



APPLIED COGNITIVE PSYCHOLOGY DOCTORAL SCHOOL

SUMMARY OF THE PhD THESIS

SERIOUS GAMES AND GAMIFICATION IN EDUCATION: A MULTI STAKEHOLDER PERSPECTIVE ON ATTITUDES AND LEARNING OUTCOMES

PhD CANDIDATE: FLOREA LUCREȚIA SORINA

SCIENTIFIC COORDONATOR: PROF. UNIV. DR. PETRU LUCIAN CURȘEU

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I. CHAPTER I.

1.1.Introduction

The use of games for learning is a historical constant used by communities to transmit values, cultivate skills, and reinforce social norms (Landers et al., 2018). The current era is distinguished by the systematic, technology-mediated application of game logic where serious games and gamification are treated as central tools of instructional design (Michael & Chen, 2005) and professional development (Susi et al., 2007). However, despite decades of implementation, the empirical literature has not reached a consensus on effectiveness (Girard et al., 2013).

This inconsistency is driven by compounding problems of methodological fragmentation and conceptual ambiguity (Krath et al., 2021). Previous work has drawn on over 100 distinct theoretical frameworks and incompatible outcome measures, resulting in a field that lacks an agreed-upon taxonomy of game elements (Krath et al., 2021). Furthermore, the absence of a shared design protocol makes it difficult to isolate which specific elements drive learning outcomes (Deterding et al., 2011; Oliveira et al., 2023).

A critical issue in the field is the "media comparison" trap, where researchers focus on whether a technology outperforms traditional instruction rather than investigating the underlying psychological mechanisms (Landers, 2014). This focus has produced a literature that documents effects without providing a theoretical explanation for high levels of unexplained variance (Blasko et al., 2014; Lameris et al., 2017).

While taxonomies have attempted to organize gamification elements along axes of mechanics, characteristics, and dynamics (Mohamad et al., 2018), field-wide consensus remains absent (Toda et al., 2019). Consequently, studies often measure different constructs

under incompatible conditions, hindering the accumulation of knowledge and limiting the replicability of findings across educational and organizational settings.

This thesis addresses these intersecting gaps through a sequential research program designed to move the inquiry from the baseline magnitude of game effects to a mechanistic understanding of individual differences. The narrative string begins by identifying goal orientation as a critical but under-measured moderator of engagement (Elliot & McGregor, 2001; Garcia-Marquez & Bauer, 2021). This leads to a theoretical investigation of the boundary between situational and stable motivation, testing whether game-based interventions produce genuine need satisfaction or merely novelty-driven engagement (Hidi & Renninger, 2006; Ryan & Deci, 2020). By integrating Self-Determination Theory (SDT; Ryan & Deci, 2000) with Self-Regulated Learning (Zimmerman, 1990/2002), this thesis shifts the discourse toward a diagnostic perspective. It argues that the inconsistency in the literature is not a property of the interventions themselves, but a result of unmeasured variance in learner profiles, including attitudinal receptivity, gender socializations, and regulatory capacity (Gisbert-Pérez et al., 2024; Li et al., 2024).

1.2 Relevance of the Research

The primary significance of this research lies in its transition from documenting the general magnitude of game effects to mapping the specific motivational pathways that facilitate learning. Central to this relevance is the synthesis of Self-Determination Theory (SDT; Ryan & Deci, 2000), Goal Orientation Theory (Elliot & McGregor, 2001), and Self-Regulated Learning (SRL; Zimmerman, 1990/2002) into a unified explanatory architecture.

SDT provides the macro-level account of how game mechanics fulfill innate psychological needs for autonomy, competence, and relatedness (Deci & Ryan, 2000). While game elements are routinely designed to trigger these needs, they often fail to produce consistent engagement across diverse cohorts (Sailer & Homner, 2020).

By integrating Goal Orientation Theory, this research provides the individual-difference nuance required to explain why specific mechanics, such as public leaderboards, foster competence for some while inducing evaluative anxiety in others (Garris et al., 2017). This distinction is critical because social comparison can undermine the self-concept of performance-avoidance oriented learners (Müller-Kalthoff et al., 2017; Tian et al., 2017).

A further layer of relevance concerns the distinction between situational catalysts and stable dispositional shifts. Gamification is often layered onto existing structures as motivational scaffolding rather than a replacement for traditional instruction (Deterding et al., 2011).

This thesis investigates the "overjustification effect," where extrinsic game rewards risk undermining intrinsic drive if they are perceived as controlling rather than informational (Deci et al., 2001). By examining the serial mediation between topic-level interest and course-level engagement, this work identifies the proximal mechanisms through which immediate engagement either consolidates into durable interest or remains a transient novelty (Hidi & Renninger, 2006).

The durability of these effects is often limited within the span of a single session (Martin et al., 2018). This research is particularly salient for its focus on experiential learning cycles involving concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb & Kolb, 2009).

These cycles do not operate uniformly across student populations (Kolb & Kolb, 2022). Mastery-oriented students are more likely to utilize game-based failure as a prompt for reflective revision (Mayer, 2019). Conversely, those without strong regulatory skills may fail to extract transferable knowledge from the experience (Nietfeld & Hoffmann, 2024).

The relevance of this thesis extends to the development of diagnostic infrastructure. By validating an instrument to measure attitudinal receptivity and perceived utility, the research allows practitioners to identify learner readiness before an intervention begins (Davis, 1989).

Finally, the research addresses critical equity questions regarding the distribution of motivational affordances. Because gamified environments often involve non-linear progression and frequent feedback, students may need to adopt their own cognitive and behavioral strategies to cope with the course demands (Fabricatore et al., 2014).

This requirement for volitional control means that students with lower self-regulation may be disadvantaged in these settings (Zimmerman & Martinez-Pons, 1988). The investigation into how regulatory strength and gender socializations determine the translation of effort into academic self-efficacy provides a necessary framework for designing inclusive digital learning environments (Gisbert-Pérez et al., 2024).

Understanding these differences is essential because gaming familiarity and socialization vary significantly across demographics (Hartmann & Klimmt, 2006). Ultimately, this work is relevant because it transforms the unmeasured variance of learner profiles into a theoretically legible roadmap for personalized and effective instruction (Li et al., 2024).

II. CHAPTER II. RESEARCH OBJECTIVES AND GENERAL METHODOLOGY

2.1. Research Objectives

The overarching objective of this thesis is to build a theoretically grounded, empirically validated account of how and for whom serious games and gamification produce meaningful learning outcomes. Rather than asking whether gamification works, we ask through which psychological mechanisms, and contingent on which individual-differences, do gamified environments convert situational engagement into durable academic self-efficacy.

Four specific objectives operationalize this aim, each corresponding to one research phase. Study 1 establishes a quantitative baseline of serious game effectiveness and documents the role of goal orientation as an individual-difference moderator, through meta-analysis and narrative synthesis following PRISMA 2020 and SWiM guidelines. Study 2 experimentally isolates the motivational impact of gamification at both topic and course levels through a within-subjects design ($N = 220$ undergraduate students). Study 4 models the large-scale dispositional predictors of academic self-efficacy in gamified contexts through multilevel mediation modeling ($N = 3,134$ adolescents from 72 schools). Study 3 develops and psychometrically validates a standardized instrument for measuring learner attitudes toward gamification across time through the two-stage validation of the GAMA scale.

The methodological architecture of this thesis is a multi-study sequential design that advances from broad quantitative synthesis to controlled experimental manipulation, large-scale predictive modeling, and psychometric instrument validation. Each phase addresses the explanatory gap left by the previous one. The high heterogeneity documented in Study 1 ($I^2 = 82.13\%$), with no design-level moderator able to account for it, points to individual-difference variables as the missing source of variance and motivates the experimental control of Study 2.

The topic-level motivational effects found in Study 2, significant but non-generalizing to course-level engagement within a single session, demonstrate that dispositional variables must be modeled at scale, which Study 4 accomplishes across 3,134 adolescents nested within 72 schools. The absence of a validated attitudinal instrument across Studies 1 through 3 motivates the psychometric contribution of Study 3. By combining meta-analytic, experimental, multilevel, and psychometric methods, the research ensures that findings converge across designs with different strengths and limitations rather than being artifacts of any single approach.

2.2. Study Summaries

Study I: A Meta-Analysis of Learning Outcomes in Serious Games and Narrative Synthesis of Goal Orientation Effects

The effectiveness of serious games as learning environments has been consistently documented but remains variable across individuals and contexts. Study 1 investigated the effect of serious games on learning outcomes and examined the role of goal orientation as an individual-difference variable within this relationship. A systematic review following PRISMA 2020 guidelines was conducted, combining a meta-analysis of pre-post learning outcome data with a structured narrative synthesis of goal orientation findings in accordance with Synthesis Without Meta-Analysis (SWiM) guidance. The review spanned five databases (Sage, Wiley, Science Direct, ProQuest, and Google Scholar), screening 1,421 records across five stages with an inter-rater agreement of 84%, yielding 9 studies for the meta-analysis and 12 for the narrative synthesis.

The meta-analysis revealed a statistically significant, moderate-to-large overall effect size ($d = 0.637$, 95% $CI [0.483, 0.791]$, $p < .001$), indicating that participation in serious game

environments is associated with meaningful improvements in knowledge acquisition. High heterogeneity was observed ($I^2 = 82.13\%$), and no significant moderating effects were found for task type, sampling method, participant status, age, or gender. Publication bias was assessed via Fail-safe N (781 null studies required) and Kendall's tau b ($t = 0.25$, $p = .174$), with no evidence of systematic bias detected. The narrative synthesis identified a consistently positive directional relationship between mastery goal orientation and learning outcomes across all twelve studies, regardless of the theoretical framework, instrument, or timing used. This directional consistency could not be quantified, confirming goal orientation as the most theoretically coherent individual-difference mechanism through which serious game effectiveness varies, while simultaneously exposing the measurement fragmentation that has prevented the field from studying it rigorously. Findings are discussed in terms of the motivational mechanisms underlying serious game effectiveness.

Study II: Gamification in Higher Education: A Study on Students' Intrinsic Motivation and Interest in Learning Content

Study 2 examines the impact of a gamified learning system on student engagement at two distinct levels: topic-specific motivation and broader course-level interest. Gamification has been shown to increase participation, motivation, and interest, yet the mechanisms through which these effects operate and the level at which they act have remained underspecified in the literature. A within-subjects experimental design was employed with 220 undergraduate students (M age = 22.13, $SD = 3.30$; 86% female) enrolled in an Organizational Psychology course. Participants attended both a gamified seminar, implemented via Quizizz with live leaderboards, accuracy- and speed-based points, and a differentiated badge system following the taxonomy of Mohamad et al. (2018), and a structurally equivalent traditional seminar across consecutive weeks. Intrinsic motivation and interest were measured at both topic and course

levels using items adapted from Kunter et al. (2007; a range .71-.86) immediately before and after each condition. Serial mediation models were tested using the MEMORE procedure (Montoya & Hayes, 2017) with bootstrapped confidence intervals.

Findings indicate that while gamification did not significantly influence students' intrinsic motivation for the overall course (indirect effect = -0.002, $SE = 0.009$, 95% $CI [-0.03, 0.01]$), it did enhance motivation for the seminar topic (indirect effect = 0.06, $SE = 0.03$, 95% $CI [0.002, 0.13]$), with a significant time x condition interaction for topic-level intrinsic motivation ($F(1, 219) = 5.69$, $p = .018$, $\eta^2 = .025$). This indicates that gamification may not shift general course perception but it can reliably boost engagement with specific content. Serial mediation was fully supported: changes in topic-level intrinsic motivation drove changes in topic-level interest ($b = .46-.56$, $p < .001$), which in turn drove changes in course-level interest ($b = .48-.49$, $p < .001$). Increased engagement also corresponded with greater fulfillment of autonomy, competence, and relatedness, key components of intrinsic motivation under SDT (Ryan & Deci, 2000). A clarification of these mechanisms offers important theoretical implications for the gamification literature, as well as specific practical implications for the design of learning environments in higher education.

Study III: Development and Validation of the GAMA Scale: Measuring Attitudes Towards Gamified Learning Across Two Studies

Attitudes toward gamification represent a theoretically central but poorly measured psychological construct. Despite the consistent relevance of evaluative cognitions toward gamified systems in predicting motivational and learning outcomes, as established in Studies 1 through 3 and identified by Krath et al. (2021), no standardized, psychometrically validated instrument for measuring these attitudes existed prior to this work. Study 3 addresses this gap through the development and two-stage validation of the Gamification Attitude Measurement

Analysis (GAMA) scale. The GAMA was constructed around nine items grounded in the key documented benefits of gamification for learning, theoretically connected to SDT (Deci & Ryan, 2000) and the Theory of Planned Behavior (Ajzen, 2006). Study 3a conducted a factorial analysis with 1,835 high school students (1,085 women; M age approximately 17 years) to establish factor structure and convergent validity. Participants also completed measures of SRL ($\alpha = .85$), subjective norms, perceived ease of use, technology readiness, and self-reported daily recreational gaming hours. Study 3b used a pre-post design with 164 participants attending a gamified training workshop, measuring GAMA, perceived utility of gamification, intrinsic motivation, and academic self-efficacy at both Time 1 and Time 2. Predictive validity was tested using the MEMORE procedure for repeated-measures mediation.

In Study 3a, the GAMA demonstrated a single dominant factor structure (eigenvalue = 6.29; 69.91% variance explained; Cronbach's $\alpha = .95$). Convergent validity was established through significant correlations with SRL ($r = .35, p < .001$), subjective norms ($r = .72, p < .001$), perceived ease of use ($r = .79, p < .001$), and technology readiness ($r = .27, p < .001$). The non-significant correlation with recreational gaming hours ($r = .02$) confirmed that attitudes toward gamified learning are structurally independent of gaming behavior.

In Study 3b, the MEMORE serial mediation model showed that gamified workshop exposure increased perceived utility ($B = .23, p < .001$), which drove positive GAMA attitude change ($B = .22, p < .001$), which in turn predicted increases in both intention to use gamification (serial indirect effect = .01, 95% *CI* [.001; .03]) and perceived learning benefits (serial indirect effect = .01, 95% *CI* [.003; .03]). GAMA scores at Time 1 correlated significantly with self-efficacy ($r = .49, p < .001$) and retained predictive validity at Time 2, establishing the scale as a theoretically grounded, psychometrically validated instrument capable of measuring stable yet experience-responsive attitudes toward gamified learning.

Study IV: Self-Regulated Learning, Gamification Attitudes, and Academic Self-Efficacy in Adolescents

Gamification is widely used in education, yet its effectiveness depends on how students perceive and engage with it. Drawing on Self-Determination Theory, Study 4 examines how self-regulated learning (SRL) relates to academic self-efficacy through attitudinal and behavioral pathways, and how these differ by gender. A cross-sectional multilevel design was employed with 3,134 Romanian adolescents nested within 72 secondary schools representing diverse school types and socioeconomic contexts. SRL was assessed using four items from the Gaumer Erickson and Noonan (2018) scale ($\alpha = .85$). Gamification attitudes were measured with an 11-item scale grounded in the key gamification functions identified by Krath et al. (2021; $\alpha = .95$). Academic self-efficacy and recreational gaming hours were also collected. Multilevel mediation modeling was implemented using the MLmed macro (Rockwood & Hayes, 2017), with gamification attitudes and recreational gaming hours modeled as parallel mediators of the SRL to self-efficacy relationship, and gender incorporated as a moderator at both the individual and school levels.

Results support a partial and asymmetric mediation model. Positive attitudes toward gamification emerged as the primary pathway linking SRL to academic self-efficacy, whereas recreational gaming played a comparatively limited and non-significant mediating role. SRL also showed a strong direct association with academic self-efficacy. Gender differences revealed decoupled attitudinal and behavioral pathways, with the indirect effects via attitudes stronger for boys than for girls. The remaining direct association between SRL and academic self-efficacy was stronger for girls at the individual level but stronger for boys at the school level. This cross-level pattern suggests a potential role of socially shared educational

engagement practices in schools that shape the association between SRL and academic self-efficacy.

III. CHAPTER III: ORIGINAL RESEARCH CONTRIBUTIONS

3.1. Study 1: A meta-analysis of learning outcomes in serious games and narrative synthesis of goal orientation effects

3.1.1. Introduction

Despite decades of research, the empirical literature on serious games has not reached a consistent verdict. Systematic reviews have documented mixed findings (Girard et al., 2013; Zuhri et al., 2025), and meta-reviews have attributed this inconsistency to methodological fragmentation and conceptual ambiguity rather than to any fundamental limitation of the interventions themselves (Krauth et al., 2021).

A primary source of this variance is inter-individual differences: the inconsistent findings cannot be entirely attributed to game design features (Lameras et al., 2017), but rather to how different learners interact with those features (Blasko et al., 2014). Serious games do not merely coexist with learner motivation they actively shape it. Their interactive, iterative structure creates a feedback loop capable of priming a learner's goal orientation during play, meaning that a game rewarding exploration and safe failure may shift a learner from a performance-avoidance stance toward mastery-oriented engagement, directly influencing the cognitive gains that follow.

This study draws on goal orientation as the individual-difference variable of interest, that being a disposition encompassing drive, cognition, feedback reactions, and achievement mentality (DeShon & Gillespie, 2005; Robins & Pals, 2002), and on experiential learning

theory (Kolb, 1984) to propose that mastery-oriented learners are more likely to engage reflectively with game-based feedback, extracting transferable knowledge from the cycle of concrete experience, observation, conceptualization, and active experimentation that serious game design embeds. Goal orientation functions not only as a stable trait but as a contextually activated motivational state that game structure can shape. Building on this, the present study employs a dual approach: a quantitative meta-analysis to establish the magnitude of learning gains, and a narrative synthesis to systematize how goal orientation moderates those outcomes. As such, we propose the following hypotheses:

H1. The use of serious games increases affective, cognitive, or achievement outcomes in the learning environment.

H2. Using serious games has a significant positive effect on learning outcomes in terms of gains and acquisition compared to prior knowledge.

H3. Goal orientation has a positive effect on cognitive, behavioral, motor, and social learning outcomes in serious game contexts.

3.1.2. Method

The study employed a dual-method approach following the updated PRISMA guidelines (Veroniki et al., 2025). Five databases were searched: Sage, Wiley, Science Direct, ProQuest, and Google Scholar. A Boolean search was conducted using the keyword sequence "serious games," "goal orientation theory/goal orientation," and "learning outcomes." Additional sources were identified through snowball sampling. Publication types included journal articles, book chapters, case studies, dissertations, and conference papers.

Screening followed five stages: identification and duplicate removal, title and abstract screening, full-text review, inclusion in the qualitative synthesis, and inclusion in the

quantitative synthesis where applicable. From an initial pool of 1,421 records, 131 proceeded to abstract screening and 52 to full-text review. The final sample comprised 12 studies for the narrative synthesis and 9 for the meta-analysis; the discrepancy arises because three studies lacked the pre-post descriptive statistics required for effect size computation. Two independent coders conducted screening with an overall agreement rate of 84%.

Given the significant heterogeneity detected in the data, all meta-analytic analyses were conducted using a random-effects model, with effect sizes expressed as standardized mean differences (Cohen's *d*). Moderator analyses examined task type, sampling method, participant type, age, and gender. Publication bias was assessed using the Classic Fail-safe *N* and Begg and Mazumdar's rank correlation test.

For goal orientation outcomes, quantitative synthesis was not feasible due to three sources of methodological incompatibility: variation in measurement timing (pre-post, post-only, or in-game behavioral indicators), instrument diversity, and theoretical framework differences across studies. A structured narrative synthesis was therefore conducted in accordance with SWiM guidance.

3.1.3. Results

The heterogeneity analysis confirmed significant variance across studies ($Q(8) = 44.77$, $p < .001$, $I^2 = 82.13$), which necessitated the use of a random-effects model to account for study-level differences (Tene et al., 2025). The overall effect size was statistically significant and moderate to large ($d = 0.637$, 95%, $CI [0.483, 0.791]$, $Z = 8.11$, $p < .001$). These results support the hypothesis that serious games produce substantial learning gains across both academic and professional contexts (Sailer & Homner, 2020).

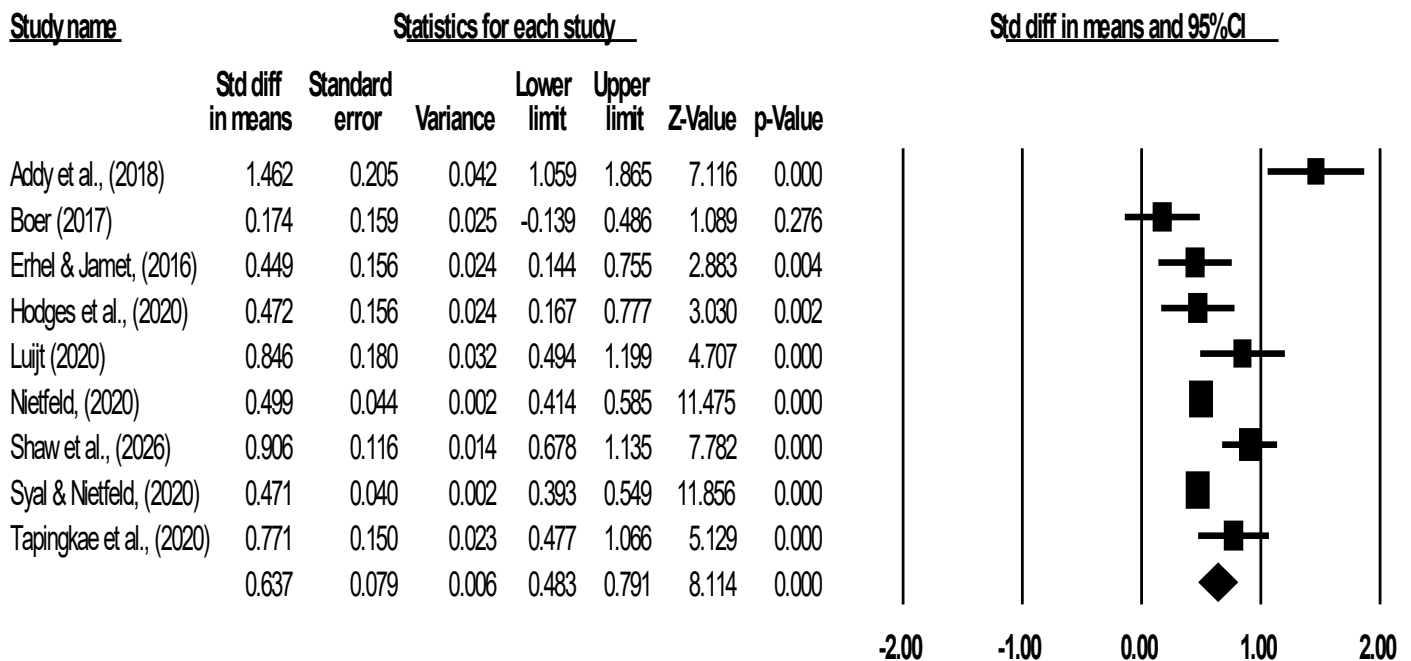
Publication bias analyses indicated that the findings are robust. The Classic Fail-safe *N* showed that 781 null studies would be required to render the effect non-significant,

representing a ratio of 87 missing studies for every observed study. Begg and Mazumdar's rank correlation test yielded a Kendall's tau b of 0.25 ($p = .174$), confirming no significant publication bias was present in the sample.

Moderator analyses revealed no significant between-group differences for task type ($Q(1) = 0.52, p = .468$), sampling method ($Q(1) = 1.65, p = .198$), or participant status ($Q(1) = 0.74, p = .691$). Furthermore, meta-regression showed that neither gender ($B = -0.007, p = .813$) nor mean age ($B = 0.008, p = .319$) significantly predicted effect size variation. This consistency confirms that the learning benefits of serious games are not confined to specific populations (Blasko et al., 2014). However, the high remaining heterogeneity indicates that sources of variance remain unmeasured at the design level (Lameras et al., 2017).

Figure 1.

Forest plot of studies included in the analysis and the overall effect size.



The overall corrected effect size is $d = 0.637$, 95% $CI = [0.483, 0.791]$ and statistically significant ($Z = 8.11$, $p < 0.001$).

Table 1

Summary of the effect size of each study included in the analysis

Study	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Addy et al. (2018)	1.462	0.205	0.042	1.059	1.865	7.116	0.000
Boer (2017)	0.174	0.159	0.025	-0.139	0.486	1.089	0.276
Erhel & Jamet (2016)	0.449	0.156	0.024	0.144	0.755	2.883	0.004
Hodges et al. (2020)	0.472	0.156	0.024	0.167	0.777	3.030	0.002
Luijt (2020)	0.846	0.180	0.032	0.494	1.199	4.707	0.00
Nietfeld (2020)	0.499	0.044	0.002	0.414	0.585	11.47	0.00
Shaw et al. (2026)	0.906	0.116	0.014	0.678	1.135	7.782	0.00
Syal & Nietfeld (2020)	0.471	0.040	0.002	0.393	0.549	11.85	0.00
Tapingkae et al. (2020)	0.771	0.150	0.023	0.477	1.066	5.129	0.00

Note. Std. diff. in means = standardized mean difference (Cohen's *d*). Lower and upper limits reflect the 95% confidence interval boundaries. Effects estimated using a random-effects model. Two-tailed *p*-values reported.

The narrative synthesis of goal orientation data identified a consistently positive directional relationship between mastery-oriented goals and learning outcomes (Robins & Pals, 2002). Studies using pre-post designs showed small but significant increases in goal orientation scores following interventions, suggesting that engagement with serious games may modestly influence motivational states (Plass et al., 2015).

Despite this directional consistency, quantitative pooling was precluded by three sources of incompatibility. Measurement timing varied substantially across the sample. Instruments ranged from the Achievement Goals Questionnaire (Elliot & McGregor, 2001) to custom priming paradigms. Finally, theoretical frameworks spanned incompatible 2x2 and three-factor models (Garcia-Marquez & Bauer, 2021). These discrepancies confirm that studies were not measuring identical constructs, establishing the empirical necessity for the standardized approach adopted in the subsequent stages of this thesis.

Table 2

Summary of studies examining goal orientation, context, and measurement instruments

Study ID	Reference	Domain	Task type	Participants	N	Goal orientation	Instrument
SYAL2020	Syal & Nietfeld (2020)	Educational	Decision-making	Middle school	775	PAP; PAV; MAP; MAV	AGQ (Elliot & McGregor, 2001)
ADDY2018	Addy et al. (2018)	Educational	Problem-solving	University students	49	Learning; Performance	Goals Inventory (Roedel et al., 1994)
BOER2017	Boer (2017)	Educational	Decision-making	University students	81	Performance; Mastery	Goal Orientation Questionnaire (Button et al., 1996)
ERHEL2016	Erhel & Jamet (2016)	Educational	Problem-solving	University students	47	Mastery; Performance	Instruction-based priming
EVANS2010	Evans (2010)	Military	Problem-solving	University students	275	Learning; Prove performance;	Survey (Yarbrough, 2007)

							Avoid performance		
HODGES2020	Hodges et al. (2020)	Educational	Decision- making	Middle school	232	Performance (fixed); Learning (growth)	Mindset quiz		
LIU2020	Liu & Liu (2020)	Educational	Problem- solving	University students	159	TAP; TAV; SAP; SAV; OAP; OAV	Goal Inventory (Elliot et al., 2011)	Orientation	
LUIJT2020	Luijt (2020)	Educational	Decision- making	Primary school	42	Performance (fun vs. perform); Mastery (test vs. learn)	Achievement reframing (Hawlotschek & Joeckel, 2017)	goal	
NIETFELD2020	Nietfeld (2020)	Educational	Decision- making	Primary school	594	Performance approach;	AGQ (Elliot & McGregor, 2001)		

						Mastery approach				
SHAW2026	Shaw et al. (2026)	Educational	Decision- making	University students	119	PAP; MAP; MAV	PAV; AGQ McGregor, 2001)	(Elliot &		
SUPER2020	Liu & Liu (2020)	Educational	Problem- solving	University students	100	Learning goal	Learning Goal Orientation (VandeWalle, 1997)			
TAPINGKAE2020	Tapingkae et al. (2020)	Educational	Decision- making	Middle school	115	Goal orientation	Science Motivation Questionnaire (Glynn & Koballa, 2005)			

Note. PAP = performance approach; PAV = performance avoidance; MAP = mastery approach; MAV = mastery avoidance; TAP = task approach; TAV = task avoidance; SAP = self approach; SAV = self avoidance; OAP = other approach; OAV = other avoidance; AGQ = Achievement Goals Questionnaire.

3.1.4. Discussion

The meta-analytic results provide clear evidence that serious games are effective learning tools. The moderate-to-large pooled effect, the absence of publication bias, and the robustness of effects across population and design characteristics all point in the same direction. The contribution of the study, however, lies not only in quantifying this effect but in situating it within a motivational account. By mapping learning gains onto a theoretical framework that foregrounds goal orientation as an individual-difference moderator, the study offers a more precise explanation of why games work for some learners and not others.

3.1.4.1. Theoretical implications

The narrative synthesis findings extend this account. The consistent positive directional relationship between mastery goal orientation and learning outcomes across twelve studies supports the view that the learner's motivational mindset functions as a boundary condition on game effectiveness. Mastery-oriented learners are more likely to interpret game-based failure as corrective feedback, to persist through challenging tasks, and to engage with the reflective stages of the experiential learning cycle embedded in serious game design. Equally important is what the narrative synthesis could not do: the inability to conduct a quantitative synthesis is not merely a study limitation but a field-level diagnosis. The absence of a shared measurement standard and a common theoretical framework constrained what could be concluded, and this constraint is itself a substantive finding. The goal orientation literature in game-based learning is not yet ready for cumulative quantitative synthesis.

3.1.4.2. Practical implications

From a design standpoint, the robustness of effects across age, gender, task type, and sampling method is encouraging for practitioners serious games can be deployed broadly without being restricted to narrow profiles. However, a uniform approach to game mechanics may be counterproductive for individual learners. Designers should consider building in features that support mastery-approach orientations, such as environments that reward exploration, tolerate failure, and provide constructive feedback, rather than relying solely on competitive ranking structures that may activate performance-avoidance in some learners. Educators and organizational trainers should prioritize the quality of feedback loops over the surface properties of the game, as feedback is the primary driver of the engagement and reflective processing through which learning gains accumulate.

3.1.4.3. Limitations and future research directions

Several limitations qualify these conclusions. The relatively small number of studies in the meta-analysis reduces the precision of the overall estimate and limits the power of moderator analyses. Many included studies employed pre-post designs without control groups, which constrains causal inference.

The high heterogeneity indicates that substantial variance in effect sizes remains unexplained by the moderators tested. Learning outcomes were operationalized differently across studies, making it difficult to determine whether observed differences reflect intervention effects or measurement inconsistencies.

The inability to quantitatively synthesize goal orientation data is a direct reflection of the field's current state and points to the standardization work that future research must undertake. Finally, although no evidence of publication bias was detected, the small number of studies reduces

the sensitivity of these tests. Future research should prioritize more rigorous experimental designs, including randomized controlled trials with active control conditions. With respect to goal orientation specifically, the adoption of a common theoretical framework ideally the 2x2 model (Elliot & McGregor, 2001) and standardized measurement applied consistently across pre-game, in-game, and post-game time points would enable the meta-analytic synthesis that the current literature cannot yet support.

The development of standardized learning outcome measures would further improve comparability across studies and the accumulation of comparable evidence in this field.

3.2. Study 2: Gamification in higher education: A study on students' intrinsic motivation and interest in learning content

3.2.1. Introduction

Gamification broadly defined as the application of game design elements in non-game contexts (Deterding et al., 2011) has become an increasingly prominent approach in higher education. Its theoretical appeal is grounded in Self-Determination Theory (SDT; Ryan & Deci, 2000), which proposes that sustained intrinsic motivation depends on the satisfaction of three fundamental psychological needs: autonomy, competence, and relatedness. When thoughtfully designed, gamification can address all three simultaneously offering learners agency through choice, a sense of mastery through performance feedback, and social connection through collaborative and competitive mechanics (Proulx et al., 2017).

Complementing this, Goal-Setting Theory (Locke & Latham, 2002) suggests that explicit performance targets embedded in badge criteria and leaderboard positions function as

motivationally effective proximal goals that channel student effort within a learning session. Despite this theoretical promise, the empirical literature is mixed. Positive findings have been reported for student participation (Xiao & Hew, 2024), quality of work (Metwally et al., 2021), and willingness to engage with challenging tasks (Tan & Hew, 2016), but null and negative effects have also been documented (Koivisto & Hamari, 2019), with variability widely attributed to methodological limitations, short intervention durations, and insufficient attention to the mechanisms through which gamification operates (Hamari et al., 2014; Oliveira et al., 2023).

A central unresolved question in this literature is whether gamification operates differently at the level of specific topic engagement versus broader course-level motivation a distinction that most prior research collapses into a single construct (Krath et al., 2021). This distinction is particularly underexamined outside STEM contexts, where the assumption that gamification simultaneously makes specific content more engaging and fosters a broader positive orientation toward the subject has rarely been tested directly.

The present study addresses this gap by comparing a gamified and a traditional seminar condition in an undergraduate Organizational Psychology course, using a within-subjects design with pre- and post-measurement across both conditions. Drawing on SDT (Ryan & Deci, 2000), Self-Efficacy Theory (Bandura, 1982), and Goal-Setting Theory (Locke & Latham, 2002), the study tests a serial mediation model in which topic-level intrinsic motivation and topic-level interest mediate the relationship between seminar condition and course-level outcomes. As such, we propose the following hypotheses:

H1. Students will report higher (a) intrinsic motivation for the seminar topic, (b) intrinsic motivation for the course, and (c) interest in the course in the gamified condition than in the traditional condition.

H2. There is a significant time x condition interaction on (a) intrinsic motivation for topic, (b) intrinsic motivation for course, and (c) interest in course, such that the increase from pre- to post-seminar will be higher in the gamified condition.

H3. The pre-post increase in interest in course is serially mediated through the change in intrinsic motivation for topic and the change in interest in topic.

H4. The pre-post change in intrinsic motivation for course is serially mediated through the change in intrinsic motivation for topic and the change in interest in topic.

3.2.2. Method

The sample consisted of 220 undergraduate students (189 women, mean age 22.13 years, range 20-55) enrolled in an Organizational Psychology course, who participated in two consecutive seminars and fully completed all four questionnaires. Informed consent was obtained from all participants and the study received formal ethical approval from the university's ethics committee.

The study employed a within-subjects design, with each participant attending both a traditional and a gamified seminar across two consecutive weeks. Both seminars addressed content from the same module communication and learning in organizational contexts and followed an identical three-phase structure: a review section consolidating prior material, a teaching section

introducing new concepts, and a group case study in which students collaboratively proposed organizational interventions. This structural equivalence was maintained to ensure procedural comparability across conditions.

The gamified condition was delivered via Quizizz (currently rebranded as Wayground), an interactive platform supporting avatar creation, a live leaderboard, and interactive question formats. Points were allocated based on both accuracy and response speed during the first two phases. The badge system was designed in line with the recommendations of McDaniel and Fanfarelli (2016) to recognize distinct behavioral dimensions across all three seminar phases: placement badges for the top three leaderboard positions, a "Megamind" badge for full accuracy across phases one and two regardless of speed, a "Godspeed" badge for the first group to submit a case study solution, a "Dream Team" badge for the peer-voted best solution, and a "Leader of the Pack" badge for students earning recognition in both individual and group phases.

Intrinsic motivation for the seminar topic and for the course was measured with 16 items adapted from Kunter et al. (2007), assessing autonomy, competence, and relatedness on a 4-point Likert scale (α range .71-.86 across conditions and time points). Interest in topic and course was measured with 4 items from the same source on a 5-point scale (α range .73-.83). Serial mediation was tested using the MEMORE 3.0 macro (Montoya & Hayes, 2017) for repeated-measures designs in SPSS v31, with within-person change scores calculated as the difference between post- and pre-seminar evaluations.

3.2.3. Results

Repeated-measures ANOVAs were conducted for each outcome variable. For intrinsic motivation for topic, both the main effect of time, $F(1, 219) = 56.03, p < .001, \eta p^2 = .204$, and the main effect of condition, $F(1, 219) = 27.39, p < .001, \eta p^2 = .111$, were significant. The time x condition interaction was also significant, $F(1, 219) = 5.69, p = .018, \eta p^2 = .025$, with pairwise comparisons confirming that post-seminar intrinsic motivation for the topic was significantly higher in the gamified ($M = 2.97, SD = .46$) than in the traditional condition ($M = 2.81, SD = .48$), $p < .001$. H1a and H2a were supported.

Neither intrinsic motivation for the course nor interest in the course showed significant main effects of time or condition, and neither yielded a significant interaction. H1b, H1c, H2b, and H2c were not supported. The gamification effect was confined to the topic level and did not generalize to course-level outcomes within the span of the study.

Means, standard deviations, and correlations by condition (N=220)

Variable	Mea	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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	Mean	SD	1.	2.	3.	4.	5.
1. Gender	.86	.35	-				
2. Age	22.13	3.30	.01	-			
Traditional							
3. Motivation for Topic T1	2.73	.42	-.05	.05	-		
4. Motivation for Topic T2	2.81	.48	-.08	.10	.70** *	-	
5. Motivation for Course T1	2.80	.45	-.08	.13	.65** *	.65** *	-

6. Motivation for Course T2	2.82	.48	-.12	.16*	.61** *	.78** *	.79** *	-					
7. Interest in Topic T1	3.16	.84	.04	-.03	.08	.04	.02	.04	-				
8. Interest in Topic T2	3.24	.91	-.01	- .001	-.02	.08	.05	.08	.70** *	-			
9. Interest in Course T1	2.99	.87	-.09	-.01	.04	.07	.07	.13	.76** *	.59** *	-		
10. Interest in Course T2	3.02	.89	-.10	.01	.05	.12	.11	.18**	.66** *	.76** *	.75** *	-	
Gamified													
11. Motivation for Topic T1	2.81	.45	-.07	.14*	.57** *	.72** *	.58** *	.69** *	.13	.14*	.13	.16*	-
12. Motivation for Topic T2	2.97	.46	-.12	.08	.44** *	.62** *	.56** *	.60** *	.14*	.20**	.12	.18**	.74** * -

13. Motivation for Course T1	2.82	.48	-.13*	.16*	.49** *	.60** *	.66** *	.78** *	.12	.18**	.14*	.22**	.78** *	.66**	-			
14. Motivation for Course T2	2.85	.48	-.15*	.14*	.48** *	.60** *	.66** *	.76** *	.09	.16*	.12	.23**	.74** *	.74** *	.86** *	-		
15. Interest in Topic T1	3.13	.88	-.05	-.09	.15*	.18**	.09	.16*	.52** *	.58** *	.48** *	.52** *	.24** *	.17**	.25** *	.22**	-	
16. Interest in Topic T2	3.24	.88	-.04	-.03	.14*	.18**	.13	.16*	.55** *	.63** *	.52** *	.59** *	.18**	.26** *	.195**	.19**	.67** *	-
17. Interest in Course T1	3.06	.91	-.13	-.06	.16*	.18**	.13	.21**	.49** *	.50** *	.57** *	.59** *	.16*	.14*	.23**	.23**	.80** *	.58** *
18. Interest in Course T2	3.06	.91	-.08	.01	.16*	.14*	.12	.19**	.55** *	.58** *	.61** *	.68** *	.18**	.17*	.27** *	.28** *	.69** *	.76** *

Notes. Gender is coded as a dummy variable (1 = women, 0 = men). * $p < .05$; ** $p < .01$; *** $p < .001$

Serial mediation analyses were conducted across four models. In both conditions, the change in intrinsic motivation for topic was positive and significant for the traditional condition, $b = .09$, $SE = .02$, $t(219) = 3.65$, $p < .001$; for the gamified condition, $b = .16$, $SE = .02$, $t(219) = 7.34$, $p < .001$. Change in intrinsic motivation for topic significantly predicted change in interest in topic in both conditions, which in turn significantly predicted change in interest in course.

Table 5*Results of the MEMORE serial mediation analyses*

Variables	Δ Motivation for Topic		Δ Interest in Topic		Δ Interest in Course		Δ Motivation for Course	
	Effect (SE)	95%CI	Effect (SE)	95%CI	Effect (SE)	95%CI	Effect (SE)	95%CI
<u>Traditional condition</u>								
constant (Δ)	.09 (.02)	[.04; .13]	.04 (.05)	[-.05; .13]	.002 (.04)	[-.07; .08]	-.01 (.02)	[-.05; .03]
Δ Motivation for Topic			.46 (.13)	[.21; .72]	-.10 (.11)	[-.32; .11]	.31 (.06)	[.20; .43]
Δ Interest in Topic					.48 (.06)	[.37; .59]	-.02 (.03)	[-.08; .03]
Average Motivation for Topic			-.11 (.11)	[-.32; .11]	.11 (.09)	[-.07; .28]	.07 (.05)	[-.03; .16]
Average Interest in Topic					.01 (.05)	[-.08; .10]	.01 (.02)	[-.04; .06]
<u>Gamified condition</u>								
constant (Δ)	.16 (.02)	[.12; .21]	.02 (.05)	[-.08; .12]	-.03 (.04)	[-.11; .06]	-.01 (.02)	[-.04; .03]
Δ Motivation for Topic			.56 (.14)	[.28; .84]	-.22 (.13)	[-.47; .03]	.23 (.05)	[.13; .34]
Δ Interest in Topic					.49 (.06)	[.38; .61]	-.003 (.02)	[-.05; .04]
Average Motivation for Topic			.02 (.11)	[-.20; .23]	.02 (.10)	[-.17; .21]	.03 (.04)	[-.05; .11]
Average Interest in Topic					.03 (.05)	[-.07; .13]	-.01 (.02)	[-.06; .03]

Notes. Δ - reflects the absolute difference between the scores recorded before and after the seminar for each of the target variables.

The indirect serial effect was significant across both conditions (indirect effect = .05, $SE = .02$, 95% CI [.02; .08]), with full mediation indicated by non-significant direct effects in both the traditional ($b = .002$, $SE = .04$, $p = .96$) and gamified conditions ($b = -.03$, $SE = .04$, $p = .56$). H3 was supported. For intrinsic motivation for course, the indirect effect through change in intrinsic

motivation for topic was significant for both conditions, but the full serial mediation through topic interest was not, and H4 was not supported.

3.2.4. Discussion and conclusion

The results offer a theoretically meaningful dissociation: gamification boosted topic-level intrinsic motivation significantly relative to the traditional condition, but this effect did not extend to course-level motivation or interest within a single session. This pattern is consistent with SDT's distinction between situational and dispositional forms of motivation (Ryan & Deci, 2000). A single gamified session may be sufficient to create conditions for competence feedback and social recognition that heighten engagement with specific learning content, but insufficient to alter the more stable evaluative structures that underlie students' broader orientation toward the course.

3.2.4.1 Theoretical implications

The serial mediation findings add important nuance. The motivational chain from topic-level intrinsic motivation through topic-level interest to course-level outcomes was significant and fully mediated in both conditions not only in the gamified one. This indicates that this cascade is a stable motivational process independent of condition. What the gamified condition contributed was a stronger initial impulse along that chain: the larger pre-post increase in topic-level intrinsic motivation under gamification may amplify downstream effects over time, even though within a single session the cascade reaches course-level outcomes only weakly. Repeated gamified exposure across a full module, with consistent design, may be necessary to produce stable course-level shifts.

3.2.4.2 Theoretical implications

From a practical standpoint, the differentiated badge system recognizing accuracy, speed, collaborative achievement, and sustained performance likely contributed to the topic-level effects observed by simultaneously supporting competence, relatedness, and a degree of autonomy in how achievement could be expressed. Educators should not, however, expect a single gamified session to shift students' overall course motivation; the effects appear temporally bounded and content-specific. Gamification is best positioned as a sustained pedagogical strategy rather than an occasional intervention.

3.2.4.3. Limitations and future research directions

The single-session design limits conclusions about sustained motivational effects. The fixed ordering of conditions traditional always preceding gamified introduces potential order and contrast effects that cannot be ruled out. The predominantly female, single-institution sample limits generalizability. The absence of measures assessing students' subjective experience of the gamification system perceived fairness, competitiveness, or fun constrains the mechanistic interpretation of results.

Future research should examine the cumulative motivational effects of repeated gamification across a full semester, use counterbalanced or between-subjects designs to address ordering confounds, and incorporate validated measures of gamification experience alongside motivational outcomes. Understanding the role of individual difference variables including prior familiarity with gamified systems and goal orientation as moderators of the effects observed here would further sharpen the account of for whom gamification works and under what conditions.

3.3. Study 3: Development and validation of the GAMA Scale: Measuring attitudes towards gamified learning across two studies

3.3.1. Introduction

The gamification literature has long recognized that individual attitudes toward game-like systems moderate the effectiveness of gamified interventions (Krath et al., 2021; van Roy & Zaman, 2017), yet no validated, theoretically grounded instrument specifically designed to measure attitudes toward gamified learning existed prior to this study. Existing approaches have relied on adapted general attitude scales, single-item measures, or instruments developed for different technological contexts, none of which capture the specific evaluative cognitions that learners hold about the core functional benefits of gamification in educational settings.

This measurement gap is not merely a technical inconvenience it is a structural constraint on the field's ability to diagnose learner readiness before an intervention begins, explain variability in outcomes, or design targeted support for students less receptive to gamified instruction.

The present study develops and validates the GAMA scale (Gamification Attitudes Measurement for Academics), a nine-item unidimensional instrument grounded in SDT (Ryan & Deci, 2000), the Theory of Planned Behavior (Ajzen, 1991), and the Technology Acceptance Model (Davis, 1989), assessing evaluative cognitions across nine key functional benefits of gamification consistently identified in the literature (Krath et al., 2021). Validation proceeds across two studies: Study 1 (N = 1,835 high school students) establishes the factorial structure and convergent validity of the scale, while Study 2 (N = 158 undergraduate students, measured at two time points) tests predictive validity by examining whether GAMA scores at Time 1 predict

changes in gamification-related outcomes following a gamified learning intervention, through a serial mediation model involving perceived utility and attitude change. As such, we propose the following hypotheses:

H1. The GAMA scale has a single dominant factor structure with good convergent validity, correlating positively with self-regulated learning, technology readiness, ease of use, and subjective norms.

H2. Exposure to a gamified learning intervention leads to an increase in perceived utility of gamified learning, which in turn increases positive attitudes toward gamification.

H3. The change in attitudes toward gamification and perceived utility serially mediates the relationship between the gamified intervention and (a) intention to use gamification and (b) perceived learning benefits.

3.3.2. Method

Study 3a

The first study tests for factorial structure and convergent validity of the GAMA scale. A representative, yet large sample of 1,835 high school students (1,085 women, *Age* $\approx$ 17 years) was used to completed the nine-item GAMA scale alongside measures of self-regulated learning (four items adapted from Gaumer Erickson & Noonan, 2018; $\alpha = .85$), technology readiness (two items from the Technology Readiness Index; Parasuraman, 2000; $\alpha = .63$), ease of use (single item from the TAM model; Davis, 1989), subjective norms (single item; Ajzen, 2006), and self-reported weekly video gaming hours. The nine GAMA items assess the degree to which participants believe

gamification communicates learning goals clearly, supports goal-setting, provides direct performance feedback, rewards and communicates progress, enables social comparison, supports communication and collaboration, adapts to user needs, provides clear steps toward goals, and offers flexibility in achieving those goals, rated on a 1-5 Likert scale.

Study 3b

Participants completed a battery of measures. Attitudes toward gamified learning were assessed with the 9-item GAMA scale (Krath & Von Korfflesch, 2021), alongside two items measuring attitudes toward gamification (Martí-Parreño et al., 2018), three items for preference to use and four for perceived usefulness (both adapted from Bourgonjon et al., 2010), and three items for intention to use (Adukaite et al., 2017). Perceived learning opportunities were measured with a seven-item scale (Bourgonjon et al., 2010) and perceived self-efficacy with a six-item scale (Pintrich & De Groot, 1990). Individual difference variables included self-regulated learning (four items; Gaumer Erickson & Noonan, 2018), technology readiness (two items; Parasuraman, 2000), subjective norms (one item; Ajzen, 2006), ease of use (one item; Davis, 1989), and skeptical optimism (nine items across three subscales; Oțoiu et al., 2025). Participants also self-reported their daily video gaming hours. Unless otherwise noted, all items were rated on a five-point Likert scale ranging from 1 (fully disagree) to 5 (fully agree).

The second study, Study 3b, tests the predictive validity of the GAMA scale, using a sample of 158 undergraduate students ($M_{age} = 21.47$ years, 92% women) who completed the a battery of questionnaires and additional measures at two time points surrounding a gamified workshop. At T1 and T2 participants completed the GAMA scale (nine items; $\alpha = .80$ at T1, $.87$ at T2), a two-item attitudes toward gamification scale, measures of perceived utility, intention to use

gamification, perceived learning benefits, and self-efficacy. The serial mediation model in which participation in the gamified workshop predicts change in perceived utility, which predicts change in GAMA attitudes, which predicts change in intention to use and perceived learning benefits was tested using the MEMORE procedure for repeated-measures mediation in SPSS.

3.3.3. Results

Exploratory factor analysis revealed a single dominant factor structure for the GAMA scale, with an eigenvalue of 6.29 explaining 69.91% of the variance. Item loadings ranged from .77 to .86, and Cronbach's alpha was .95, indicating excellent internal consistency. Convergent validity was supported: GAMA scores correlated positively and significantly with self-regulated learning ($r = .35, p < .001$), technology readiness ($r = .27, p < .001$), ease of use ($r = .79, p < .001$), and subjective norms ($r = .72, p < .001$). The number of recreational gaming hours was not significantly associated with GAMA scores ($r = .02, p > .05$), distinguishing attitudinal receptivity to educational gamification from recreational gaming engagement. These results support H1.

Table 6

GAMA scale psychometric properties

GAMA 9 Items	Study 3a	Study 3b	
		T1	T2
1. Through gamification, learning goals and their relevance are clearly communicated to users.	.80	.53	.67
2. Gamification allows users to set their own learning goals.	.85	.62	.76

3. Through gamification, users receive feedback directly and immediately on their performance.	.84	.56	.62
4. Gamification clearly rewards performance and communicates the progress towards the established learning goal	.86	.68	.78
5. Gamification allows users to compare their results and progress between each other.	.83	.57	.66
6. Learning through game allows users to communicate with each other and learn together.	.77	.62	.72
7. Gamification allows adapting tasks according to user needs.	.86	.62	.65
8. Gamification offers clear steps and describes the necessary actions towards goal achievement.	.86	.69	.78
9. Learning through gamification allows users the flexibility to choose between multiple options to achieve their goals.	.86	.73	.75
<i>N</i>	1835	158	158
Eigenvalue dominant factor	6.29	3.55	4.57
Percentage of variance explained	69.91%	39.42%	50.78%
Cronbach's alpha	.95	.80	.87

GAMA scores showed a significant increase from T1 ($M = 4.01$, $SD = .52$) to T2 ($M = 4.21$, $SD = .62$), and significant positive correlations at both time points with intention to use ($r = .47$ at T1, $r = .69$ at T2), perceived utility ($r = .52$ at T1, $r = .66$ at T2), perceived learning

opportunities ($r = .58$ at T1, $r = .76$ at T2), and attitudes ($r = .49$ at T1, $r = .69$ at T2), supporting the concurrent validity of the scale.

Table 7

Correlations between the variables for Study 3a

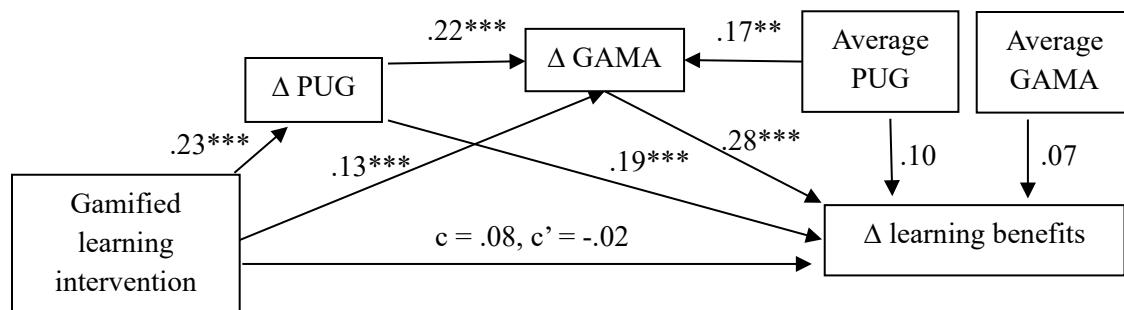
	Mean	SD	1	2	3	4	5	6	7
1. Gender	.41	.49	1						
2. Age	16.88	.81	.03	1					
3. GAMA	3.32	.89	.001	.01	1				
4. Self-regulated learning	3.25	.97	-.13***	.004	.35***	1			
5. Technology readiness	4.27	1.50	.21***	.01	.27***	.15***	1		
6. Easiness of use	3.43	1.06	.01	.04	.79***	.27***	.28***	1	
7. Subjective norms	3.26	1.06	.02	.03	.72***	.22***	.26***	.69***	1
8. Number of hours playing video games	1.79	2.01	.24***	-.03	.02	-.15***	.10*	.02	.04

For the serial mediation models, all indirect effects on intention to use gamification were significant. The mediation via perceived utility alone was significant (indirect effect = .09, $SE = .03$, 95% CI [.04; .14]), via gamification attitudes alone was significant (indirect effect = .03, $SE = .02$, 95% CI [.001; .07]), and the serial mediation through both was also significant (indirect effect = .01, $SE = .01$, 95% CI [.001; .03]). The same pattern held for perceived learning benefits: the indirect effect via perceived utility (indirect effect = .04, $SE = .02$, 95% CI [.01; .08]), via

attitudes (indirect effect = .03, $SE = .02$, 95% $CI [.01; .07]$), and the serial mediation (indirect effect = .01, $SE = .01$, 95% $CI [.003; .03]$) were all significant, supporting H2 and H3. GAMA scores at T1 also significantly predicted self-efficacy and intrinsic motivation at T2, establishing the scale as a diagnostic tool with genuine predictive capacity beyond concurrent validity.

Figure 2

The overall serial mediation model for change in perceived learning benefits through gamification due to change in gamification attitudes and perceived utility of gamification

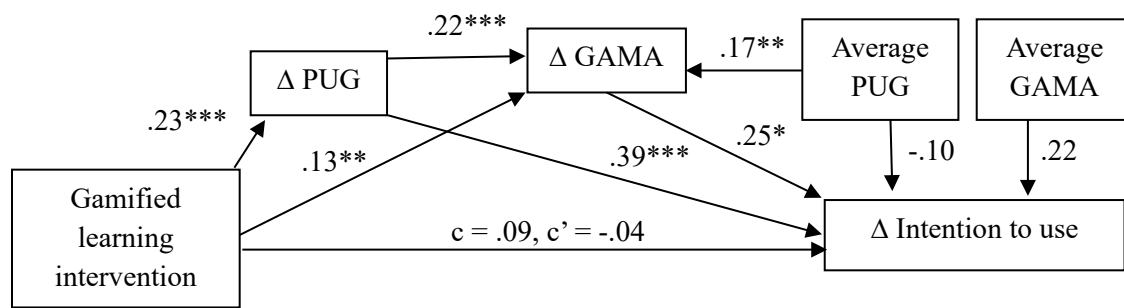


Note. PUG = perceived utility of gamification; GAMA = positive attitudes towards gamification; $\Delta PUG = PUG_T2 - PUG_T1$ (reflecting an improvement of perceived utility as a consequence of the gamified learning intervention), $\Delta GAMA = GAMA_T2 - GAMA_T1$ (reflecting a positive change in attitudes towards gamification as a consequence of gamified intervention); Δ learning benefits reflects an increase in perceived learning benefits through gamification from T1 to T2; Unstandardized regression coefficients are reported.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 3

The overall serial mediation model for change in intention to use gamification due to change in gamification attitudes and perceived utility of gamification



Note. PUG = perceived utility of gamification; GAMA = positive attitudes towards gamification; Δ PUG = PUG_T2-PUG_T1 (reflecting an improvement of perceived utility as a consequence of the gamified learning intervention), Δ GAMA = GAMA_T2-GAMA_T1 (reflecting a positive change in attitudes towards gamification as a consequence of gamified intervention); Δ intention to use reflects an increase in intention to use from T1 to T2; Unstandardized regression coefficients are reported.

* $p < .05$; ** $p < .01$; *** $p < .001$.

3.3.4. Discussion

The GAMA scale demonstrates strong psychometric properties: a single dominant factor structure, excellent internal consistency, robust convergent validity across theoretically related constructs, and predictive validity that extends across time. The distinction between GAMA scores and recreational gaming hours the two being essentially uncorrelated is particularly important. It confirms that attitudinal receptivity to gamified learning is a distinct psychological construct, not a proxy for gaming familiarity or enthusiasm, and that it can be measured and acted upon independently.

3.3.4.1 Theoretical implication

The serial mediation results from Study 3b establish a theoretically coherent pathway through which exposure to gamified learning shapes subsequent motivational outcomes: the gamified intervention increases perceived utility of gamified learning, which in turn increases positive attitudes toward gamification, which then drives increases in intention to use gamification in the future and in perceived learning benefits. This chain suggests that brief, well-designed gamified experiences can shift attitudinal dispositions that go on to influence how students orient toward future gamified instruction. The predictive relationship between T1 GAMA scores and T2 intrinsic motivation and self-efficacy, established independently of the mediation model, further supports the diagnostic value of the scale as a pre-intervention screening tool.

3.3.4.2. Practical implication

Practically, the GAMA scale provides practitioners and researchers with a validated, brief instrument for assessing learner readiness before gamification is implemented. Given that gamification effectiveness is substantially filtered through attitudinal receptivity, identifying students with low GAMA scores prior to an intervention allows for targeted support or adapted design, rather than uniform deployment that risks disengaging the students least likely to benefit. The scale's brevity and strong psychometric properties make it suitable for use across both research and applied educational contexts.

3.3.4.3. Limits and Future Directions

The predominantly female samples in both studies, and the restriction to Romanian high school and university contexts, limit the generalizability of the psychometric findings. Future research should extend validation to more demographically diverse and culturally varied samples, including male-majority and non-European contexts. Discriminant validity testing against related but distinct constructs such as general technology attitudes or gaming motivation would strengthen the conceptual boundaries of the scale. Longitudinal research examining whether pre-intervention GAMA scores predict actual learning gains, rather than attitudinal and motivational outcomes alone, would establish the scale's practical utility for educational decision-making.

3.4. Study 4: Different paths to confidence: Gendered and cross-level dynamics linking self-regulation to academic self-efficacy

3.4.1. Introduction

Although gamification is often framed as a design problem, the critical question has shifted in recent years: not whether gamification works, but under what conditions it supports or undermines motivation, and how individual student characteristics determine whether those conditions are met (Krath et al., 2021). The field remains predominantly design-centric, concentrating on the presence of game elements rather than the psychological processes they are intended to trigger (Deterding et al., 2011; van Roy & Zaman, 2017).

A gap that has received particularly little systematic attention is the simultaneous influence of recreational gaming and attitudes toward gamification on learning-related outcomes. Students who are receptive to gamified instruction may also spend substantial hours on recreational gaming

two distinct relationships with game-like systems that carry different motivational implications, yet have rarely been studied in parallel.

The present study addresses this gap by employing a Self-Determination Theory framework (SDT; Deci & Ryan, 1985) to test a parallel mediation model in which the positive association between self-regulated learning (SRL) and academic self-efficacy is explained by two opposing pathways: positively through positive attitudes toward gamification, and negatively through hours spent on recreational gaming.

Beyond establishing these pathways, the study investigates the moderating role of gender across both mediators and across levels of analysis, given well-documented differences in gaming socialization, familiarity with game-like systems, and academic self-efficacy between male and female students (Gisbert-Pérez et al., 2024; Hartmann & Klimmt, 2006; Huang, 2013). Data were collected from 3,134 adolescents nested within 72 Romanian schools, enabling multilevel mediation modeling that separates within-school from between-school effects. As such, we propose the following hypotheses:

- H1. Self-regulated learning is positively associated with attitudes toward gamification.
- H2. Self-regulated learning is negatively associated with the number of recreational gaming hours.
- H3. The association between SRL and academic self-efficacy is partially mediated by (a) gaming hours and (b) attitudes toward gamification.
- H4. Gender moderates the association between SRL and positive attitudes toward gamification, such that the relation is more positive for men than for women.

H5. Gender moderates the association between SRL and gaming hours, such that the relation is less negative for men than for women.

H6. Gender moderates the indirect association between SRL and academic self-efficacy, such that the indirect associations via gamification attitudes and recreational gaming time are stronger for men than for women.

H7. The remaining positive association between SRL and academic self-efficacy is stronger for women than for men.

3.4.2. Method

The sample included 3,134 adolescents (1,900 women, $M_{age} = 16.92$ years) from 72 Romanian schools, recruited as part of a larger project on school attitudes and educational adaptation. Participation was voluntary, students could withdraw at any time, and the project received ethical approval from the UBB review board.

Self-regulated learning was assessed with four items adapted from Erickson and Noonan (2017; e.g., "I carefully plan my homework and all the school projects"), rated on a 1-5 Likert scale ($\alpha = .84$). Gamification attitudes were evaluated with 11 items grounded in the key functions of gamification in learning as described by Krath et al. (2021; e.g., "Gamification allows users to set their own learning goals"), rated on a 1-5 scale ($\alpha = .95$). Recreational gaming hours were assessed as a self-estimated average of weekly hours spent playing video games. Academic self-efficacy was evaluated with a single adapted item asking students to rate their confidence in future academic success on a scale from 1 to 10.

Given that participants were nested within 72 schools, and because gaming behavior and gamification attitudes were expected to vary across schools (students often play with classmates

and schoolmates), multilevel modeling was used to test the hypotheses. The MLmed macro Beta 2 for SPSS (Rockwood & Hayes, 2017) was applied, estimating mediation effects both within and between schools. Indirect association analyses used Monte Carlo confidence intervals.

3.4.3. Results

At both the within-school and between-school levels, SRL showed a significant positive association with gamification attitudes within schools: $B = .33$, $SE = .03$, $p < .001$; between schools: $B = .42$, $SE = .18$, $p = .02$ fully supporting H1. SRL was negatively and significantly associated with recreational gaming hours at both levels within schools: $B = -.32$, $SE = .06$, $p < .001$; between schools: $B = -1.37$, $SE = .47$, $p < .001$ supporting H2.

The indirect association between SRL and academic self-efficacy via gamification attitudes was significant at the within-school level (effect = .08, $SE = .02$, 95% CI [.05; .11]) and at the between-school level (effect = .26, $SE = .16$, 95% CI [.01; .65]). The indirect pathway via recreational gaming hours was also significant at both levels, though smaller in magnitude. H3 was supported, with gamification attitudes emerging as the stronger of the two mediating pathways.

Table 14

Results of the within-between multilevel analysis

Variable	Gamification attitudes		Gaming hours		Academic self-efficacy	
	Within	Between	Within	Between	Within	Between
Constant	-.003 (.12)		.26 (.19)		7.53***(.23)	
Gender	-.08* (.03)	-.02 (.18)	-1.08*** (.08)	-.53 [†] (.29)	-.19* (.08)	-.74* (.35)

Age	-.002 (.01)	.07 (.05)	-.05* (.03)	.18 [†] (.10)	-.01 (.03)	-.09 (.11)
Self-regulated learning (SRL)	.33*** (.03)	.42* (.18)	-.32*** (.06)	-1.37*** (.34)	.99*** (.06)	.40 (.43)
Gaming hours					-.06** (.02)	-.27* (.13)
Gamification attitudes					.24*** (.04)	.63* (.25)
SRL x Gender	-.09** (.03)	.06 (.24)	.14 [†] (.07)	.79 [†] (.46)	.08 (.08)	.53 (.52)

Notes. Unstandardized coefficients are presented with SE in parentheses; gender is coded as a dummy variable (1 = women, 0 = men); SRL = self-regulated learning.

The interaction between gender and SRL was significant within schools for gamification attitudes ($B = -.09$, $SE = .03$, $p = .005$), with the association being more positive for male than for female students, supporting H4. The interaction was only marginally significant for gaming hours (within schools: $B = .14$, $SE = .07$, $p = .06$), providing only partial support for H5. Separate multilevel mediation analyses for male and female subsamples revealed that the indirect association via gamification attitudes was stronger for male (within schools: effect = .06, $SE = .01$, 95% CI [.04; .08]) than for female students (within schools: effect = .01, $SE = .006$, 95% CI [.001; .02]), supporting H6. The remaining direct association between SRL and academic self-efficacy was stronger for female students at the within-school level (effect = .48, $SE = .02$, 95% CI [.44; .52]) but stronger for male students at the between-school level (effect = .49, $SE = .12$, 95% CI [.25; .73]), supporting H7 and revealing an unexpected cross-level reversal.

Table 15

Results of the multilevel mediation models presenting the indirect association paths as well as the remaining direct association between SRL and academic self-efficacy, with Monte Carlo confidence intervals

Model/Mediator	Within Schools indirect effect		Between Schools indirect effect	
	Effect (SE)	95% MCCI	Effect (SE)	95% MCCI
SRL→AG→ASE	.08 (.02)	[.05;.11]	.26 (.16)	[.01;.65]
SRL→RGH→ASE	.02 (.007)	[.007;.03]	.38 (.21)	[.02;.83]
Women (standardized scores)				
SRL→AG→ASE	.01 (.006)	[.001;.02]	.11 (.06)	[.02;.23]
SRL→RGH→ASE	.01 (.002)	[.001;.01]	.05 (.04)	[-.01;.13]
SRL→ASE	.48 (.02)	[.44;.52]	.35 (.10)	[.15;.54]
Men (standardized scores)				
SRL→AG→ASE	.06 (.01)	[.04;.08]	.10 (.05)	[.01;.21]
SRL→RGH→ASE	.01 (.004)	[.001;.02]	.01 (.05)	[-.09;.12]
SRL→ASE	.39 (.03)	[.34;.45]	.49 (.12)	[.25;.73]

Notes. SRL = self-regulated learning, AG= positive attitudes towards gamification, ASE = academic self-efficacy; RGH = recreational gaming hours; MCCI = Monte Carlo confidence intervals; values marked in bold are all deemed significant as the confidence intervals do not include zero

3.4.4. Discussion and conclusion

The results support a partial and asymmetric mediation model in which SRL translates into academic self-efficacy through two distinct pathways that operate differently across genders. Positive attitudes toward gamification emerged as the primary mediating mechanism: students who regulate their learning effectively are better positioned to recognize gamified environments as aligned with their motivational goals, and this receptivity consolidates into stronger academic self-efficacy. This is consistent with SDT, which treats need-supportive environments as proximal catalysts for intrinsic motivation and self-efficacy development (Deci & Ryan, 1985), and with recent meta-analytic evidence linking SRL to intrinsic motivation and autonomous regulation (Fong et al., 2024).

3.4.4.1. Theoretical implications

The gender moderation findings were the most theoretically striking. The stronger indirect pathway through gamification attitudes for male students reflects well-documented differences in gaming socialization: male students' greater baseline familiarity with game-like systems makes the structure of gamified instruction feel like a more natural extension of their existing interests, amplifying the link between self-regulation and positive attitudinal receptivity. For female students, strong SRL translated into academic self-efficacy more directly independently of gamification attitudes or gaming behavior at the individual level, suggesting that self-regulation is a particularly potent and direct academic resource for female students in this sample. The reversal of this pattern at the school level, where the SRL-self-efficacy association was stronger for male students between schools, points to a potential role for socially shared educational and gaming

engagement practices at the school level in shaping how self-regulation converts into academic confidence for male students.

3.4.4.2. Practical implications

Practically, these findings reinforce the necessity of moving beyond a design-centric view of gamification. The critical mechanism was not the presence of game elements but students' attitudes toward them a disposition shaped by self-regulation which means that gamification is likely most effective as a catalyst for students who already possess strong SRL. Implementing gamified systems without attending to learner characteristics and motivational profiles risks producing surface-level engagement without lasting benefit.

3.4.4.3. Limitations and future research directions

The cross-sectional design precludes causal inference. The measure of recreational gaming captured only weekly hours, omitting qualitative dimensions such as game type, social context, and motivation for gaming that may be critical moderators. The generalizability of findings to higher education settings requires further investigation.

Future research should use longitudinal or experimental designs and incorporate more nuanced measures of gaming behavior. Differentiating between self-efficacy domains, rather than relying on generalized academic self-efficacy, would allow more precise mapping of the pathways identified here. Examining the role of peer gaming dynamics and socially shared engagement practices at the school level would help account for the between-school gender effects that this study can only interpret speculatively.

IV. CHAPTER IV. CHAPTER IV. CONCLUSIONS AND GENERAL DISCUSSIONS

4.1. Theoretical implications

One of the central contributions of this thesis is the empirical confirmation that goal orientation functions as a relevant and consistent moderator of serious game effectiveness, alongside the simultaneous documentation that the field has not agreed on how to measure it. The narrative synthesis identified a positive directional relationship between mastery orientation and learning outcomes across all twelve included studies, regardless of the theoretical framework, instrument, or timing used. Mastery-oriented learners persist through failure states inherent in game-based environments (DeShon & Gillespie, 2005), attribute outcomes to effort and strategy rather than luck (Robins & Pals, 2002), and extract transferable knowledge from experiential challenges (Garris et al., 2017; Kolb & Kolb, 2009). Yet this relationship could not be quantified because studies employed incompatible frameworks, ranging from the dichotomous mastery-performance distinction (Dweck, 1986) to the 2x2 model (Elliot & McGregor, 2001) to the three-factor taxonomy (Garcia-Marquez & Bauer, 2021).

The present research makes this gap explicit and, by grounding the GAMA scale items in identified key functions of gamification (Krath et al., 2021), begins to provide the standardized infrastructure that future research requires.

A related contribution is the reframing of the heterogeneity problem. The meta-analysis produced a significant, moderate-to-large pooled effect size ($d = 0.637$, 95% $CI [0.483, 0.791]$, $p < .001$), confirming that participation in serious game environments produces meaningful learning gains. Yet high unexplained heterogeneity accompanied it ($I^2 = 82.13\%$), with no design-level or demographic moderator accounting for the variance. Factors such as task type, sampling

method, gender, and age all failed to explain why some learners benefit greatly while others do not (Blasko et al., 2014; Lameris et al., 2017). This finding reorients the theoretical question from one about technology to one about individual psychology. Goal orientation, self-regulated learning (SRL), and attitudes toward gamification are the individual-level constructs that filter how learners receive and process game-based instruction.

A distinct theoretical contribution concerns the boundary between situational and stable motivation, a boundary that prior gamification research has rarely tested directly. The experimental evidence showed that a well-designed gamified condition significantly increased topic-level intrinsic motivation relative to a traditional condition ($F(1, 219) = 5.69, p = .018, \eta_p^2 = .025$), yet left course-level motivation and interest entirely unchanged. This dissociation is a theoretically meaningful specification of gamification's scope, mapping directly onto the model of interest development (Hidi & Renninger, 2006).

Gamification reliably triggers situational interest, but a single session is not sufficient to alter the stable evaluative structures that constitute a learner's orientation toward a discipline. Most prior studies have collapsed these two levels into a single construct (Krath et al., 2021; Mursalin et al., 2024), and the null course-level effects here would be invisible to such designs.

The serial mediation analyses further show how the motivational structure transfers across levels. Changes in topic-level intrinsic motivation drive topic-level interest ($b = .46-.56, p < .001$), which in turn predicts course-level interest and motivation ($b = .48-.49, p < .001$). This cascade operates identically in both conditions, establishing it as a general motivational mechanism (Ryan & Deci, 2020). The large-scale modeling extends this logic to the structural level, where positive attitudes toward gamification emerged as the primary pathway linking SRL to self-efficacy.

Students who regulate their learning proactively develop more favorable evaluative cognitions about gamified systems, perceiving them as need-supportive and goal-congruent. This attitudinal orientation is the proximate mechanism through which regulatory strength translates into academic confidence (Li et al., 2024; Nguyen-Viet & Doan Ngoc Minh, 2025).

Finally, this research provides the first empirical evidence that attitudes toward gamified learning and engaging in recreational gaming are structurally distinct constructs. Despite a significant negative association between SRL and recreational gaming hours, gaming hours did not constitute a significant mediating pathway to self-efficacy. The quantity of time spent in leisure gaming is motivationally inert for academic self-efficacy (Howard et al., 2025), while attitudes toward gamified instruction are not (Martinez et al., 2022). Recreational gaming operates through extrinsic reward loops and hedonic engagement (van Roy & Zaman, 2017), whereas gamification attitudes reflect an evaluative judgment about whether game-based structures support learning goals (Rigby & Ryan, 2016).

4.2. Practical implications

The practical implications of this research are best read against what the field has lacked: an agreed design framework and a diagnostic tool. The positive learning effect of serious games is robust to variation in task type, demographics, and sampling context, allowing practitioners to deploy these tools with reasonable confidence (Sailer & Homner, 2020; Tene et al., 2025). What cannot be assumed is equitable benefit. The high unexplained heterogeneity is a direct signal that individual-level variables determine outcomes. Diagnostic tools must accompany good game design rather than be treated as optional add-ons.

For educators, a theoretically grounded design combining individual performance mechanics, social recognition, and a multi-dimensional badge system is demonstrably sufficient to produce topic-level motivational effects (Mohamad et al., 2018; McDaniel & Fanfarelli, 2016). However, gamification should not be expected to shift broader academic orientation within a single session. Implementations embedded within a sustained, module-level motivational strategy that varies mechanics across sessions are more likely to produce the cascading interest development that the serial mediation model shows is achievable (Tan & Hew, 2016; Hellin et al., 2023).

The equity implications of the large-scale findings are direct. Students with low SRL are less likely to develop a positive attitude toward gamification through which self-regulation translates into academic confidence.

Universal implementations without accompanying scaffolding risk compounding existing motivational inequalities (Gini et al., 2025; Backlund & Hendrix, 2013). The practical response is to pair gamified instruction with explicit SRL development (Li et al., 2022). Furthermore, given the stronger direct SRL-to-self-efficacy pathway for female students, this scaffolding is a meaningful lever for closing confidence gaps.

The GAMA scale provides the diagnostic infrastructure that has been missing. Administered before an intervention, it is a useful tool to support the identification of learners whose attitudinal profile warrants additional help. Because gaming hours predict neither attitudes nor self-efficacy independently, diagnostic instruments should target attitudes and self-regulation, not behavioral proxies like gaming time. Students with limited gaming histories but strong SRL and positive attitudinal profiles may benefit from these learning contexts more than the design-centric literature would predict.

4.3. Limitations and future direction

Several boundaries define the conclusions of this thesis. The cross-sectional design of the large-scale study prevents causal inference about the direction of the SRL-attitudes-self-efficacy pathway. Longitudinal designs tracking these variables across an academic year are needed to establish directional causality. The experimental sample was predominantly female and drawn from a single psychology course, limiting generalizability across disciplines and gender distributions.

Both the experimental and correlational studies relied on self-report, leaving open whether the motivational effects translate into observable performance gains. Behavioral indicators of engagement should complement self-report in future designs. Furthermore, the GAMA scale, validated with student populations in Romanian educational contexts, has not yet been tested in organizational training settings or cross-cultural samples. Given the positioning of this thesis at the intersection of educational and Industrial-Organizational Psychology, validation in corporate onboarding (Davis, 1989) and leadership simulation environments (Kalana & Junaini, 2025) is a priority. These limitations mark the boundaries of what has been established and define the agenda for what comes next.

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