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Game flow and attitude in computer-based business simulations: Implications for management education

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Abstract

This research investigates the influence of computer-based business simulations on students' perceived learning outcomes, emphasising the roles of game flow and attitude. Using structural equation modelling to analyse survey data from management undergraduates, the study finds that goal clarity, autonomy, and enjoyment significantly predict game flow, which, in turn, enhances perceived learning outcomes and promotes positive attitudes. Interestingly, attitude does not directly impact students' perceived learning outcomes, pointing to potential moderating effects of individual and contextual factors. The findings extend the game flow theory in management education, offering practical recommendations for enhancing engagement through clear goals, autonomy, and enjoyment. They also underscore the importance of further examining factors that mediate the relationship between attitudes and learning outcomes.

Introduction

According to recent data, approximately one-third of tertiary students globally discontinue their studies (Department Education, 2023), with 48% of these cases attributed to psychological factors such as boredom, unclear academic goals, and insufficient intrinsic motivation (Kocsis & Molnár, 2024; Richardson et al., 2012). Yet, students are not always detached from learning and there are certain situations where they become interested and engaged in learning (McEacharn, 2005). As younger generations increasingly rely on technology in their daily lives, computer-based gamified learning has been widely adopted to enhance student engagement and improve learning outcomes (Nair & Mathew, 2021; Pan & Ke, 2023). By providing behaviourist drill-and-practice learning and a constructivist learning environment, these games are found to improve student commitment, attitude toward learning, and problem-solving skill (Junior & Kim, 2025; Salim et al., 2023).

However, the psychological factors and mechanisms underlying learning outcomes in specific digital gaming contexts remain a topic of debate, with mixed findings reported in the literature (Kosa et al., 2020; Sweetser et al., 2020; Vanwesenbeeck et al., 2016). For example, Landers and Landers' (2014) GameFlow model identifies eight key game elements that fosters an immersive learning experience, thereby enhancing learning outcomes. In comparison, the Technology Enhanced Training Effectiveness Model (TETEM) (Landers et al., 2017) highlights two critical learner characteristics — attitude and prior experience with video games — that may influence the effectiveness of gamified experiences. Empirical testing of these models, nevertheless, suggests that the key antecedents to optimal learning are highly context-specific, depending on sample characteristics, knowledge fields, the learning environment, and the technology employed (Landers & Armstrong, 2017; Nicholson, 2012).

Regardless of the context-dependent nature of learning, most existing research focuses on students in non-management disciplines, leaving management education relatively underexplored. Traditional management education has faced criticism for its didactic approach, lack of practical activities, and excessive reliance on theoretical concepts (Rao, 2016; Sailer & Homner, 2020). While case studies have long been a cornerstone of management learning, exemplifying fundamental principles, they often fail to resonate with young students who lack industry experience, making it challenging for them to comprehend and learn effectively (Rao, 2016). Similarly, other passive learning methods, such as lectures and classroom discussions, have proven inadequate in developing critical management competencies like teamwork, communication, and problem-solving skills (IRC, 2019; National Skills Commission, 2023).

In response, there is growing consensus that contemporary management programs must incorporate more practical training, internships, and simulations to equip students with the skills needed to thrive in today's fast-changing and competitive business environments (Brammer & Clark, 2020). This need is particularly urgent as international students, who are the main revenue source for most management schools, are increasingly finding little value in passive management learning, leading to a decline in their enrolment numbers (Brammer & Clark, 2020). To address this challenge, leveraging technology to align teaching practices with students' evolving learning preferences and needs has emerged as a critical strategy (Burden & Kearney, 2017). Nevertheless, there is limited research on effectively incorporating computer-based games in management education contexts.

Drawing upon Flow Theory and the GameFlow model, this study aims to address the following research questions:

RQ1. What are the psychological antecedents of game flow in computer-based business simulations?

RQ2. How does game flow influence students' perceived learning outcomes and attitudes toward the simulation?

RQ3. Does attitude toward the simulation directly affect perceived learning outcomes?

This research endeavours to explore the above educational gap by assessing the efficacy of computer-based simulation games within management education. Specifically, it focuses on how specific psychological drivers of game flow impact perceived learning outcomes for tourism and hospitality (T&H) management students. To our knowledge, this study uniquely investigates the key determinants of game flow and its relation to effective learning within this domain. Existing simulation studies often prioritise game mechanics (e.g., badges, leaderboards, scores) over the psychological mechanisms that sustain engagement and learning. This paper addresses that gap by identifying goal clarity, autonomy, and enjoyment as core flow antecedents, offering new insights into how simulations can be designed to produce meaningful educational impact. Early findings suggest a significant link between game flow and learning results, underscoring the necessity of incorporating behavioural intentions and constraints when evaluating gamified learning methods.

Literature review

As digital natives, today's students are estimated to have played over 10,000 hours of video games by the age of 21, with the gaming industry anticipated to reach $321 billion by 2026 (Ballhaus et al., 2024). Integrating computer-based simulation games into teaching not only bridges the gap between traditional pedagogical approaches and students' contemporary learning preferences but also provides a risk-free environment for the application and testing of acquired knowledge (Henderson et al., 2017). Consequently, these simulations have gained increasing traction in higher education since the 1970s (Benckendorff et al., 2015; Grijalvo et al., 2022).

Despite their rising popularity, research on the efficacy of digital simulation games in higher educational contexts remains scarce (Salim et al., 2023). Existing work has predominantly concentrated on readily applicable game elements like leaderboards, badges, and prizes, rather than the broader pedagogical potential of the computerised simulation games (Junior & Kim, 2025; Sailer & Sailer, 2021; Silva et al., 2019). This research gap may be attributed in part to implementation challenges. For instance, effective use of digital simulation games requires instructors to gain a comprehensive understanding of game mechanics and to engage in repeated gameplay. The substantial preparation often extends beyond the formal work hours allocated by institutions, leading to resistance among educators or suboptimal implementation when adequate training is not provided (Benckendorff et al., 2015).

Moreover, the use of computer-based simulation games as a primary learning tool requires a significant pedagogical shift, prompting educators to transition from traditional roles as knowledge disseminators to facilitators and coaches (Hernández-Lara et al., 2019). Institutional support and comprehensive professional training are critical for enabling this transformation; however, budgetary and workload constraints pose significant challenges to its successful implementation. As a result, the adoption of multidimensional business simulations that emulate critical operational and managerial activities across key business functions remains a relatively recent development (Benckendorff et al., 2015; Landers, 2019). Furthermore, existing research is concerned primarily with experimental practices, with limited attention given to their theoretical underpinnings (Sailer & Homner, 2020).

The limited scope of existing research is further complicated by mixed findings, underscoring the importance of contextual factors in shaping the applicability of learning frameworks in computerised simulations. For instance, Crookall et al. (1987) cautioned that not all elements of Flow Theory necessarily enhance learning because games per se are not enough for achieving the relevant learning goals. Kosa et al. (2020) echo this idea by providing evidence that, in VR games, only autonomy and satisfaction contribute to the development of flow, while attitude is less significant. This finding contrasts with earlier models, such as Landers' Technology-Enhanced Training Effectiveness Model (2017), which positioned attitude as a critical factor influencing the effectiveness of gamified experiences. Such conflicting perspectives highlight the lack of consensus on whether attitude is a driver, mediator, or a marginal factor in gamified learning — a gap this study aims to clarify by re-evaluating attitude's role in the game flow-learning outcome relationship. Accordingly, further research is needed to identify which specific game attributes (or combinations thereof) operate most effectively in various contexts and how game elements influence individual behaviours and attitudes (Landers et al., 2017; Seaborn & Fels, 2015).

Flow theory and gameflow model

This study contributes to the literature on computer-based simulations in higher education by building upon the Flow Theory and exploring three critical psychological factors — perception of a clear goal, sense of autonomy, and enjoyment, and their influence on students' perceived learning outcomes. Specifically, this study seeks to identify how computer-based simulation games facilitate effective learning within the T&H management context. The antecedents of flow: goal clarity, autonomy, and enjoyment. It is rooted in Flow Theory (Csikszentmihalyi, 1990), widely recognised as a foundational framework in computer-based learning. Flow Theory describes a state of optimal engagement in which individuals are fully immersed in an activity, experiencing focus, control, and intrinsic enjoyment (Csikszentmihalyi & LeFevre, 1989, p. 816). Widely applied in digital education, it underpins gamified learning models like GameFlow (Sweetser & Wyeth, 2005), which align game mechanics such as goal clarity, feedback, and control, with flow elements to enhance player experience and learning outcomes.

According to Csikszentmihalyi (2014), fostering a state of flow is essential for encouraging sustained engagement, wherein learners are so immersed that they "want to pursue them for their own sake" (p. 132). Educational games that enable students to solve problems and overcome challenges tend to enhance interest and foster competence (Fullagar et al., 2013). Empirical research supports the view that flow is positively correlated with motivation and engagement, both of which are linked to improved learning outcomes (Fullagar et al., 2013). While Csikszentmihalyi (1997) initially identified eight dimensions of flow, contemporary scholarship highlights goal clarity, autonomy, and enjoyment as the most relevant factors in digital game-based learning (Kiili, 2006).

Csikszentmihalyi and LeFevre (1989) argued that all flow components are necessary to trigger a flow state. However, Kiili (2006) suggests a distinction between flow antecedents (e.g., goal clarity, control, playability) and flow experience elements (e.g., concentration, time distortion, loss of self-consciousness). Flow antecedents are crucial for initiating flow, while the experiential elements describe learners' psychological immersion. Others have categorised flow into three primary dimensions: arousal (activation level), valence (pleasantness), and feeling state (cognitive and physiological perception during a task) (Scherer et al., 2019).

With regard to this study, three flow elements stand out in the literature: goal clarity, autonomy, and enjoyment. Goal clarity consistently emerges as a key antecedent of flow and motivation in educational games. Clear, specific goals enhance learners' self-efficacy and academic persistence (Locke & Latham, 1990), while also improving autonomy and decision-making (Roy & Saha, 2019; Schippers et al., 2015). The GameFlow model requires goal clarity to be established early and scaled with challenge progression to sustain engagement (Sweetser & Wyeth, 2005).

Autonomy, a central concept in self-determination theory, refers to an individual's ability to make choices and control their actions, free from external rewards or pressures (Deci & Ryan, 2000). Autonomy refers to the learner's sense of control over actions and decisions, a key concept in self-determination theory (Deci & Ryan, 2000). Dynamic simulation games serve as a suitable context for this, where players develop and refine skills in complex, evolving scenarios that mimic real-world challenges. In studies on computer-based games, autonomy has emerged as a critical flow antecedent. It involves players' perception of control over their actions and choices, enhancing immersion and concentration (Kosa et al., 2020).

As a framework for evaluating usability and user experience in games, the GameFlow model is described as a model of player enjoyment, aiming to enhance the fun experience through improved game design (Sweetser et al., 2020; Sweetser et al., 2019). Enjoyment is defined as the positive feeling derived from balancing challenges and a player's capabilities during gameplay (Csikszentmihalyi, 1997; Sweetser & Wyeth, 2005). It reflects a balance between challenge and skill, encouraging students to persist with tasks and return to learning environments voluntarily. In educational games, enjoyment also compensates for limited learner autonomy and reinforces motivation when aligned with feedback and goal clarity (Kosa et al., 2020; Sweetser et al., 2019).

These three constructs were selected because they represent the most consistently identified antecedents of flow in game-based learning literature and align with the foundational principles of Flow Theory. Goal clarity reflects the requirement for clear, structured objectives, a hallmark of flow experiences as defined by Csikszentmihalyi (1990). Autonomy embodies the perception of control over actions, which is essential to sustaining intrinsic motivation within flow states. Enjoyment captures the affective dimension that signals optimal experience and immersion. Collectively, they correspond to the challenge–skill balance and intrinsic motivation core to the flow construct, making them theoretically and empirically suitable for this study. We therefore develop the following hypotheses:

> Hypothesis 1 (H1). The perception of goal clarity contributes to the development of flow experience in computer-based simulations.
>
> Hypothesis 2 (H2). The sense of autonomy contributes to the development of flow experience in computer-based simulations.
>
> Hypothesis 3 (H3). Feeling of enjoyment contributes to the development of flow experience in computer-based simulations.

Game flow and perceived learning outcomes

Learning outcomes are widely recognised as a complex construct encompassing multiple dimensions, including knowledge, understanding, engagement, confidence, self-efficacy, satisfaction, affective commitment, and the intention to pursue further learning or achievements (Baabdullah et al., 2022; Zhang et al., 2012). Building on Kirkpatrick and Craig's (1970) training evaluation framework, Kraiger et al. (1993) categorised learning outcomes into three distinct types: cognitive, skill-based, and affective. Cognitive outcomes refer not only to the acquisition of verbal knowledge but also to its organisation and the development of cognitive strategies through training. Skill-based outcomes involve mastering specific abilities and enhancing performance efficiency through processes such as proceduralisation and composition. Affective outcomes relate to changes in attitudes and motivation, including self-efficacy and motivational disposition.

The complexity and subjectivity of defining learning outcomes have led to ongoing debates about their assessment in empirical research. Erikson and Erikson (2019) note that differing interpretations between educators and students regarding what constitutes successful learning often lead to discrepancies in feedback. However, they maintain that all perspectives offer valuable insights, and challenges in defining and measuring learning outcomes should not deter their investigation or application in educational improvement. To address these challenges, Rajkumar et al. (2011) distinguish between direct and indirect assessment methods. Direct assessments involve objective evaluations of student work against programme learning objectives, whereas indirect assessments rely on students' self-reported perceptions of their abilities. The latter, often gathered through surveys and interviews, reflect perceived learning outcomes and are particularly valuable in educational research contexts.

There are two main schools of thought regarding the mechanism through which flow influences learning outcomes of any kind. On one hand, several studies advocate for a direct and positive relationship between game flow and performance, including models such as GameFlow and its extensions, like Pervasive GameFlow, EGameFlow, and MIU-GameFlow (Csikszentmihalyi, 2014; Fullagar et al., 2013; Zain et al., 2016). The flow state is widely regarded as a driving force behind subsequent behaviours and outcomes across various fields, including market research, cognitive neuroscience, and computer-based learning (Ghani & Deshpande, 1994; Sweetser et al., 2020). Flow Theory researchers similarly argue that students progressively develop their knowledge and skills as problem-solving becomes intrinsically interesting (Fullagar et al., 2013; Oliveira et al., 2021; Özhan & Kocadere, 2020). These ideas lead to our hypothesis:

> Hypothesis 4 (H4). Flow has a positive impact on perceived learning outcomes.

On the other hand, other frameworks, such as Landers and Landers' (2014) theory of gamified learning, emphasize the mediating role of attitude in the relationship between game flow and performance. Attitude research views education as a form of persuasive communication aimed at modifying individuals' attitudes and behaviours (Lavidge & Steiner, 1961). This learning process progresses through three sequential stages: a cognitive phase, where individuals develop awareness and understanding of the learning material; an affective phase, where an attitude toward the learning is formed; and a conative phase, where conviction and action take place (Lavidge & Steiner, 1961). They argue that the use of game elements alters learners' attitudes toward learning, which in turn induces behavioural outcomes. Recent research confirms that enjoyment during flow predicts learning outcomes via positive attitude (Kosa et al., 2020), and that flow and attitude together account for 66% of the intention to play digital games (Krogstie et al., 2016). Thereby, we posit the following hypotheses:

> Hypothesis 5 (H5). Flow has a positive impact on attitude toward the simulation game.
>
> Hypothesis 6 (H6). Attitude toward the simulation game has a positive impact on perceived learning outcomes.

The proposed relationships between the key factors are presented in the following research model (see Figure 1).

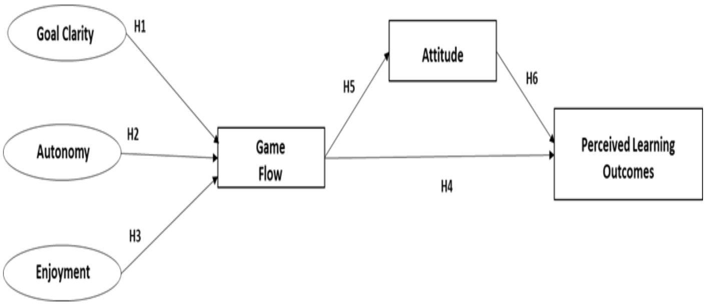


Figure 1. The research model.

Methodology

Simulation background

This study utilised two computer-based business simulation platforms: *RevSIM* (developed by ExperiencePoint Inc.) and *GoVenture* (by MediaSpark Inc.). Both simulations replicate real-world decision-making environments to facilitate experiential learning in business-related units. The two units involved in the study enrol students from across all disciplines within the institute, typically aged between 15 and 24, with a substantial proportion of international students. This diverse and youthful cohort is reflective of the broader composition of management students across Australia (ABS, 2024). The simulation GoVenture Entrepreneur Basic was used in the subject centred on management principles to develop soft skills essential for T&H businesses, while RevSIM was employed in the other subject for its alignment with the subject's focus on hotel revenue management.

Both simulations ran over a six-week period and served as the core assessment tasks for the respective subjects. Assessments comprised three components: simulation performance, a performance evaluation report, and a reflective report on the learning experience. Students participated in teams of three and were tasked with launching and managing a business within the T&H sector. They oversaw functions such as daily operations, marketing, financial performance, human resources, customer service, and supply chain management. As teams met predefined performance thresholds, they were allowed to "level up" and manage multiple, more complex businesses under increasingly demanding conditions.

Prior to the formal simulation, students were given a three-week preparatory period during which they could explore the game's mechanics through unlimited practice. During this phase, they were encouraged to perform simple management tasks or restart the simulation as needed. This process was designed to ensure a solid understanding of the game rules and objectives. The official simulation began in Week 6 with unique and dynamic scenarios to test their applied skills in a more realistic and challenging environment.

Weekly tutorials enabled students to reflect on team progress and benchmark their performance against peers. Each game generated performance summaries at the end of each business cycle, and students had access to real-time feedback via business summary reports. This structured format supported the transition from guided practice to strategic decision-making and execution. Weekly tutorial discussions provided an opportunity for students to review their team's progress and compare their simulation performance with their peers. Each game generated a performance summary at the conclusion of each business period, and students were able to access real-time feedback on their progress by reviewing business summary reports at any point. The following chart summarises the implementation of the simulations.

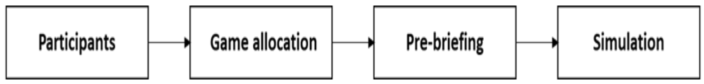


Figure 2. Flowchart of the project.

The researchers, who also served as subject lecturers, established varying levels of goals within the simulations, enabling students to advance by overcoming progressively challenging tasks. Lecturers delivered face-to-face explanations of the game goals and rules, complemented by detailed step-by-step instructions on how to navigate the simulations. Furthermore, students had access to online learning modules available through the Learning Management System throughout the semester. These modules included short videos on critical management strategies and concepts, as well as written manuals for the simulations. To reduce bias in the evaluation of the learning experience, the post-simulation survey was administered by academic staff who had no involvement in the delivery of the subjects. The survey was distributed only after the completion of all teaching activities. The survey instruments and procedures were reviewed and approved by the Human Research Ethics Committee of William Angliss Institute (Approval No: 2023-03-21-04). All responses were anonymised to ensure confidentiality and maintain research integrity.

Instruments and data collection

All items measuring the antecedents of flow were adapted from validated instruments in prior studies by Fu et al. (2009) and Silva et al. (2019). To assess attitude toward the simulation, three items were drawn from Landers and Armstrong (2017) (e.g., "If I had the choice, I would choose to complete classroom training in which such a simulation game was used"). Perceived learning outcomes were assessed using both cognitive and affective indicators, following the approach of Paechter et al. (2010) and Wei et al. (2023). Cognitive outcomes pertain to the extent to which students feel they have mastered the knowledge imparted by the game (e.g., "The game has enhanced my management knowledge"), while affective outcomes reflect students' satisfaction with their learning experience (e.g., "I'm satisfied with the learning experience").

The items were assessed on a 5-point Likert scale with endpoints of 1 = *strongly disagree* to 5 = *strongly agree*. To ensure content validity, a pilot test of the questionnaire was conducted with three faculty members in higher education prior to data collection. Based on insights from preliminary and pilot tests, item wording was adjusted to better align with the study's context, culminating in the finalised survey questions.

Following the popular methodology in this field (Silva et al., 2019; Vanwesenbeeck et al., 2016), we employed retrospective self-reported measures to approximate the factors of interest. This approach is suitable for evaluating subjective constructs such as perceived learning outcomes, enjoyment, and attitude, which are best captured through personal reflection following a complete learning experience. Retrospective self-reports enable learners to assess their experience holistically, particularly in the absence of objective behavioural tracking during simulation gameplay. Students were invited to complete an anonymous online survey at the end of the semester regarding their learning experiences using the simulation. Submission of the completed questionnaire indicated their consent to participate in the project. A total of 154 responses were submitted. Following the exclusion of outliers and incomplete responses, the final dataset comprised 123 responses. The gender distribution reveals that a majority were male, comprising 58.5% of the total, while females accounted for 41.5%. Most respondents were aged between 18-24 (Mean=23.4 years, Standard Deviation=4.9), representing 97.6% of the sample, and there was a higher proportion of international students (57.7%) compared to domestic students (42.3%). Additionally, 65.9% of participants used the GoVenture simulation, whereas 34.1% used RevSIM.

Data analysis

This study examined a model using structural equation modelling (SEM) via AMOS 26.0. Although the final sample size (n = 123) is slightly below the general recommendation of 150–200 for covariance-based SEM (Hair et al., 2014), it is considered acceptable due to the model's relative simplicity, the strength of factor loadings, and the overall robustness of the model fit indices. Comparable sample sizes have been reported in published studies applying similar analytical frameworks in educational contexts (Wolf et al., 2013). Two steps are included in SEM. First, evaluating and refining the measurement model using confirmatory factor analysis (CFA) and, secondly, testing the estimation of the structural model and hypotheses (Byrne, 2016). This two-step approach ensures that adequate processes have been undertaken to learn about the theoretical constructs and their interrelations (Anderson & Gerbing, 1988). Covariance-based SEM is a method used to test complex relationships between variables simultaneously and is particularly employed for testing theoretical causal relationships, with causal inferences primarily drawn from the observational nature of the data (Kosa et al., 2020).

Results

Measurement model: First-order CFA

A CFA was performed on the sample dataset to evaluate the measurement model. All first-order constructs including *goal clarity, autonomy*, and *enjoyment* were treated as correlated factors, utilising the maximum likelihood estimation method. Factor loadings for the 8 indicators, ranging from .70 to .92 and surpassing the recommended threshold of .70 (Hair et al., 2014), were significant ($p < 0.01$) on their respective constructs, with critical ratios exceeding 2.57 (Netemeyer et al., 2003) as shown in Table 1, thereby affirming strong convergent validity.

Table 1. Results of confirmatory factor analysis.

Constructs and Items	*M*	*SD*	SFL	Critical Ratio	CR	AVE	Cronbach's alpha
Goal clarity	3.93	1.14			.83	.62	.81
The rules of the game were clearly presented.			.71	7.76			
Overall, game goals were presented clearly.			.91	N/A			
I understood the learning objectives through the game.			.76	8.78			
Autonomy	3.95	1.10			.76	.61	.74
I felt a sense of control over the game.			.70	5.69			
I knew what the next step was in the game.			.85	N/A			
Enjoyment	3.86	1.12			.81	.60	.80
I enjoyed this simulation game.			.70	N/A			
Learning through this simulation game is fun.			.92	6.96			
The game stimulated my curiosity for learning management knowledge.			.73	6.74			

Note: M=mean; SD = standard deviation; SFL = standardised factor loading, CR = composite reliability; AVE = average variance extracted.

The values for both composite reliability (between .76 and .83) and Cronbach's α (between .74 and .81) averaged above .70, suggesting that latent variables showed adequate internal consistency. Furthermore, the average variance extracted (AVE) for all constructs exceeded the .50 threshold (Fornell & Larcker, 1981), supporting the construct reliability of the measurement scales, as presented in Table 1. Although autonomy was measured using only two items, this approach has been adopted in prior SEM studies when items show strong factor loadings and internal consistency (Hair et al., 2014). Given the acceptable AVE, CR, and α values, the construct was retained as reliable for model estimation. Additionally, Table 2 reveals that the square roots of AVE for constructs, highlighted in bold on the diagonal, are greater than the intercorrelation among all pairs of constructs, confirming the constructs as valid measurements that represent distinct concepts. The results of the analysis indicate that the proposed conceptual model had a good fit, with $\chi2$ = 30.490, *df* = 17, $\chi2/df$ = 1.79, $p < .001$, GFI = .94, CFI = .97, RMSEA = .08, and SRMR = .04.

Table 2. Results of discriminant validity analysis.

	Goals	Attitudes	Learning Outcomes	Enjoyment	Autonomy
Goal Clarity	**.79**				
Attitudes	.38**	**.78**			
Learning Outcomes	.22*	.20*	**.83**		
Enjoyment	.47***	.54***	.26*	**.77**	
Autonomy	.61***	.36**	.27*	.46**	**.78**

Note. The bold diagonal elements are the square roots of the variance shared between the constructs and their measures. Off-diagonal elements are correlations between the constructs.

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

Measurement model: Second-order CFA

The CFA was employed to verify the suitability of modelling *Game Flow* as a second-order hierarchical latent construct involving three dimensions before including it in the structural model. The CFA results reveal that the proposed second-order construct has an adequate goodness-of-fit based on the cut-off points in the existing literature, with $\chi2$ = 30.490, *df* = 17, $\chi2/df$ = 1.79, $p < .001$; GFI = .94, CFI = .97, RMSEA = .08, and SRMR = .05. The lower-order constructs all loaded significantly on *Game Flow*, with alpha levels at .001 ranging from .60 to .79. The second-order model explains between 35% and 63% of the variance in the underlying factors. Consequently, the construct of *Game Flow* encompasses all three dimensions: goal clarity, autonomy, and enjoyment.

Structural model

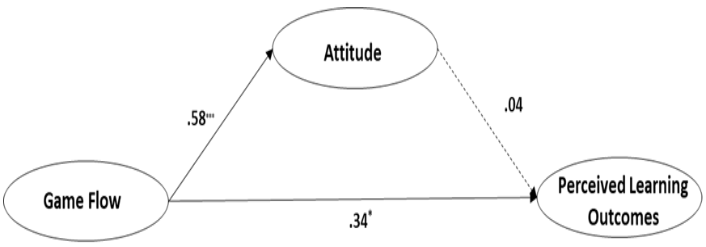
The overall structural model had a tolerable goodness of fit with $\chi2$ = 112.606, *df* = 72, $\chi2/df$ = 1.56, $p < .001$, GFI = .90, CFI = .95, RMSEA = .06, and SRMR = .08. The results of the structural path coefficients examination suggests that two paths were supported, but one path (i.e., attitude → learning outcomes) was not supported. The results indicate that game flow significantly predicts students' perceived

Table 3. Results of the second-order measurement model.

Hypothesis	Path	Standardized Factor Loadings	Critical Ratio	R^2	Result
H1	Goal Clarity ← Game Flow	.79	N/A	.59	Supported
H2	Autonomy ← Game Flow	.77	3.52***	.63	Supported
H3	Enjoyment ← Game Flow	.60	3.51***	.35	Supported

***$p < .001$.

learning outcomes (β = .34, $p < .05$) and attitude (β = .58, $p < .001$). The p-values reflect the probability that the observed relationships occurred by chance, with $p < .05$ indicating less than a 5% likelihood and $p < .001$ indicating less than a 0.1% likelihood of the effect being due to random variation, thus providing strong empirical support for the proposed relationships between game flow and both learning outcomes and attitude.



*$p < .05$. *** $p < .001$.

Figure 3. Results of structural model analysis.

Discussion and implications

This theory-driven study aims to enrich our understanding of the relationship between game flow and learning outcomes by empirically testing hypothesised relationships using structural equation modelling. While the GameFlow Model focuses on sets of game features and criteria that lead to a flow state, this research proposes that the presence of three psychological features in particular – goal clarity, a sense of autonomy, and enjoyment – predicts the flow experience and contributes to learning outcomes.

The results of this study establish a robust foundation for understanding the multi-dimensional constructs of goal clarity, autonomy, and enjoyment in relation to game flow (H1-H3). This confirmation not only reinforces the reliability of the game flow measurement used but also underscores the significance of these psychological factors as key antecedents of game flow in educational simulations. The findings reveal that students are likely to develop flow experiences in computer-based simulations through clear learning goals from a goal-oriented approach (Schippers et al., 2015), a perceived sense of control over actions and choices informed by self-determination theory (Deci & Ryan, 2000), and positive feelings from the user experience aspect of games (Sweetser et al., 2020). By validating this measure, the analysis establishes a credible basis for exploring the intricate relationships among these psychological factors and their impact on learning outcomes, paving the way for further structural model analysis.

The confirmed hypotheses (H4 and H5) reveal a significant, positive relationship between game flow and learning outcomes, as well as game flow and attitude towards the game. These findings are consistent with prior research indicating that flow can significantly enhance both the learning experience and the disposition towards learning activities (Csikszentmihalyi, 2014; Kosa et al., 2020). Specifically, the substantial path coefficient from game flow to attitude suggests that engaging students in a state of flow can notably improve their perception and receptiveness towards the learning tool, in this case, simulation games.

However, the hypothesis that attitude towards the simulation game would positively impact learning outcomes (H6) was not supported. This unexpected result implies that while flow can directly enhance learning outcomes and positively affect students' attitudes, the attitude itself might not translate directly into learning effectiveness. This aligns with the work of Oliveira et al. (2021) and Özhan and Kocadere (2020), who suggest that while positive attitudes towards gamified learning environments are critical, they do not automatically guarantee enhanced learning outcomes. Kosa et al. (2020) also explored how flow elements and attitudes influence learning effectiveness in computer-based environments, concluding that attitudes were relatively insignificant. They reasoned that the similarity between the constructs of attitude and intention to play diminished the relevance of attitudes in their study context. Building on this premise, our research eliminated the intention construct to further examine the role of attitudes in a virtual simulation environment. Our findings align with Kosa et al.'s results, confirming that attitudes do not directly impact learning outcomes in such settings.

This outcome also redirects attention towards the intricate process of information processing and the multifaceted nature of attitude formation, suggesting a nuanced interaction between situational factors, temporal connections to stimuli, and subsequent behavioural outcomes (Calanchini & Sherman, 2013; Oswald et al., 2015). Attitude is conventionally defined to contain a behavioural component (e,g., behavioural intention), dissonance between attitude and behaviour is not uncommon due to the influence of external constraints, the social context, attitudinal attributes (e.g., accessibility, stability), and the reciprocal relationship between the two constructs (Glasman et al., 2006; Kroesen et al., 2017). Bechler et al. (2021) further demonstrated that the attitude-behaviour relationship might follow a nonlinear pattern. Specifically, as attitudes shift from extremely negative to extremely positive, the corresponding behavioural change initially remains flat (when attitudes progress from extremely to moderately negative), becomes steep as attitudes transition from negative to positive, and tapers off once attitudes move from moderately to extremely positive.

This study makes three key contributions to the literature on computer-based learning and gamification in education. First, this research pioneers the exploration of psychological drivers of flow and their direct and indirect effects on learning outcomes within the context of T&H management education. While existing studies have primarily focused on disciplines such as science, accounting, and marketing, this study extends the scope to the tourism and hospitality domain, addressing a critical gap. Specifically, the findings identify goal clarity, a sense of autonomy, and enjoyment as essential antecedents of game flow among management undergraduates. These insights align with and extend Sweetser et al.'s (2019) proposition that flow can occur even without all eight flow elements, with certain elements playing a more prominent role in driving the experience.

Second, this research contributes to the game flow literature by highlighting the nuanced relationship between flow, attitudes toward learning tools, and learning outcomes. The findings demonstrate that while flow positively influences attitudes toward simulation games, the conversion of positive attitudes into tangible learning outcomes may be impeded by personal and situational constraints. This adds depth to the understanding of the limitations of attitudes as predictors of learning effectiveness, encouraging further investigation into the mediating variables that shape this relationship.

Finally, this study provides actionable insights for educators and instructional designers aiming to enhance engagement and learning through computer-based simulations. Educators should prioritise clearly defined and progressively challenging goals by using structured milestones, rubrics, and scenario-based missions that guide students through complex decisions. To enhance autonomy, instructors can allow students to choose among different roles, decision paths, or business scenarios within the simulation. For instance, giving students the option to manage marketing versus operations functions lets them shape their learning based on interest or career goals. Enjoyment can be increased by embedding time-based challenges, team competitions, or feedback badges that reflect student performance in real time. These design and implementation strategies, grounded in goal clarity, autonomy, and enjoyment, help foster game flow and improve educational effectiveness.

This study offers practical guidance for educators and instructional designers seeking to improve student engagement and learning through computer-based simulations. Clearly defined, progressively challenging goals should be emphasised, supported by ample orientation and practice before gameplay begins. To promote autonomy, students should be given meaningful choices—such as selecting strategies or roles—enhancing their sense of control and motivation. Enjoyment can be fostered through timely feedback and elements of playful competition aligned with learning objectives. Grounded in goal clarity, autonomy, and enjoyment, these design strategies can help cultivate game flow and boost educational effectiveness.

Although this study focuses on T&H management education, the findings have broader relevance to other disciplines that employ experiential or simulation-based learning.

The core drivers of game flow are transferable to contexts such as business, healthcare, and engineering, where learner autonomy and intrinsic engagement are equally important. Future research could further test the model's applicability across varied educational settings to assess its generalisability. These findings also align with constructivist learning principles, where knowledge is actively constructed through immersive, goal-directed experiences. Similarly, the emphasis on autonomy and enjoyment reflects key elements of engagement theory, which posits that meaningful learning emerges from interactive, learner-driven tasks supported by technology. Together, these frameworks reinforce the value of simulation-based flow in supporting deep, student-centred learning.

Conclusion

Through a review of the drivers of game flow and the mechanism by which the flow state promotes learning outcomes, this research aims to provide valuable insights into the relationship between these elements. Our findings advance computer-based learning research by highlighting three psychological factors — goal clarity, a sense of autonomy, and enjoyment — as key contributors to fostering a game flow experience and improving learning outcomes in hospitality education. Given the unique features of the tourism and hospitality industry compared to other industries, these findings emphasise the importance of the learning context in understanding the effectiveness of a particular game design. Notably, the results underscore the need to account for constraints in translating attitude into relevant behaviour, which presents an opportunity for future research. Future studies may also test the proposed relationships in different contexts (e.g., education in other fields or non-Western countries) or use more longitudinal data to examine the findings over time.

Limitations and future research

While this study provides valuable insights into the psychological drivers of game flow and their influence on learning outcomes, several limitations must be acknowledged. First, the reliance on retrospective self-report measures may introduce recall or social desirability bias. Future research could incorporate behavioural tracking or longitudinal designs to complement self-reported perceptions. Second, the final sample size (n = 123) was slightly below CB-SEM recommendations (Hair et al., 2014), although model fit and reliability metrics were robust. Third, autonomy was measured using only two items. While factor loadings and internal consistency were acceptable, future studies should use additional items to capture the construct more comprehensively.

Finally, the context was limited to tourism and hospitality management students at a single institution. Replication across diverse educational contexts would help generalise the findings. While this study focuses on learning outcomes as the key dependent variable, constructs such as behavioural intention were excluded to maintain model parsimony and reduce survey fatigue. However, this may limit direct comparability with studies that frame intention as a key mediator between flow and learning behaviours. Future research could incorporate intention measures to align with established frameworks such as the Technology Acceptance Model (TAM) or Theory of Planned Behaviour, enabling cross-study benchmarking.

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