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ENHANCING EDUCATION: THE IMPACT OF INTERACTIVE LEARNING IN GAMIFIED ENVIRONMENTS

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Abstract

The implementation of gamification in the educational setting has garnered significant interest as a means of augmenting student motivation, engagement, and academic achievements. Nevertheless, the influence of the aforementioned phenomenon has received little empirical attention, particularly in the sphere of educational structured instruction. The relationship between gamification and student outcomes has been insufficiently explored in terms of the mediating role of the interactive learning environment and the moderating role of perceived enjoyment. The purpose of this research was to examine how educational gamification affects students' interest, participation, and the quality of their learning experience. The study also aimed to investigate the mediating effect of an interactive learning environment and the

moderating role of perceived enjoyment. The research design used was cross-sectional. The sample size of the study was 280 Chinese students who freely participated in the study were among the participants. Self-administered questionnaires were used to gather the data, and AMOS (Analysis of Moment Structures) software was used to analyze it. To investigate the proposed connections, descriptive statistics, correlation analysis, and structural equation modeling were used. findings of the study showed that gamification has a positive impact on student engagement and motivation. furthermore, these relations are significantly mediated by an interactive learning environment. perceived enjoyment also moderated the relationship between gamification and interactive learning environment. The present study has made a significant contribution to the domain of education by furnishing empirical evidence on the interconnections among gamification in education, student motivation, student engagement, and the interactive learning environment.

Keywords: Gamification in Education, Student Motivation, Student Engagement, Interactive Learning Environment, Perceived Enjoyment.

1. INTRODUCTION

The integration of gamification strategies into instructional practices has garnered increasing attention within the field of education in recent years. The concept of gamification involves the incorporation of game elements, mechanics, and design principles into contexts that are not inherently game-like, with the aim of improving levels of engagement, motivation, and learning achievements (Thangavelu, Tan, Cant, Chua, & Liaw, 2022). Educators seek to enhance the quality of learning by utilizing the intrinsic motivational elements of games, with the objective of generating more engaging and interactive educational encounters that engross students' attention and encourage their active involvement (Douglas & Brauer, 2021).

Gamification has become a popular and innovative way to boost student engagement, performance, and excitement. This strategy mixes gaming elements including interactive elements, challenges, and rewards into academic contexts. Gamification changes students' knowledge engagement and learning perspectives (Parra-González, López-Belmonte, Segura-Robles, & Moreno-Guerrero, 2021). Gamification's ability to boost student engagement is crucial. Traditional teaching approaches sometimes dull and disengage students. Gamification solves this by including engaging elements. Gamified education uses game-like environments, interactive evaluations, and competition to encourage active learning. Gamified education reinforces student motivation with prizes and challenges (Kuo, Chu, & Tsai, 2017). Educational gamification uses games' goal-setting and achievement abilities to motivate. Achievement, incentives, and overcoming obstacles encourage students in gamified learning. Extrinsic incentive boosts intrinsic motivation, encouraging complete student participation. Gamification activities and features improve students' retention and motivation

(Feng, Tu, & Hsieh, 2020). Due to their interactivity and immersion, gamified learning experiences have greater retention rates than traditional teaching methods, according to research. Due to its sensory and emotional aspects, gamified learning improves idea recall.

Gamification also lets players use virtual skills in real life. Video games may require problem-solving, critical thinking, and decision-making. By solving problems in a gamified classroom, students strengthen their practical skills rather than merely remembering facts (Aguiar-Castillo, Hernández-López, De Saá-Pérez, & Pérez-Jiménez, 2020). This skill transfer component enhances learning in real-life settings. Gamification also reduces exam anxiety, creating a positive learning atmosphere. Gaming feedback lets students track their progress, discover areas for improvement, and improve gradually. This cyclical feedback loop fosters a supportive and positive learning environment where mistakes are seen as opportunities for growth. Understanding how gamification influences academic performance is popular (Devraj, Colyott, & Cain, 2021). Research shows that academic performance improves with challenge and reward involvement. Gamified learning environments increase academic dedication and test performance. Customized educational trajectories with game-like aspects improve academic success. Students learn more efficiently and may grasp courses better when instructional materials are tailored to their needs (Kovács, Szilágyi, & Várallyai, 2021). Gamification's applicability in numerous academic subjects and levels shows its ability to accommodate varied learning styles. Besides academic achievement, gamification in education has many other benefits. Gamified learning experiences prepare pupils for a technologically dependent future. Gamification encourages active learning, time management, and good habits (Thangavelu et al, 2022). Gamified environments use collaborative and social aspects to improve cooperation, communication, and social engagement. They help students develop skills beyond academics (Benítez et al., 2012).

The utilization of gamification in education has attracted the interest of scholars, professionals, and decision-makers due to its potential advantages. Gamification has the potential to mitigate the issues of disinterest and insufficient drive that are frequently encountered in conventional educational environments (Legaki, Xi, Hamari, Karpouzis, & Assimakopoulos, 2020). Gamified learning environments possess the potential to augment student motivation, cultivate profound engagement, and encourage meaningful learning experiences by capitalizing on students' inherent inclination towards challenge, competition, and rewards. The impact of gamification on student motivation is an essential aspect of its implementation in the field of education (Menandro & Arnab, 2020). Motivation is vital thing inside the method of studying, as it impacts the extent of endurance, effort, and educational accomplishment of college students. Through the incorporation of gamification techniques, educators strive to leverage intrinsic motivation and foster a perception of autonomy, competence, and relatedness among students (Feng et al., 2020). Nonetheless, the scholarly investigation of the correlation between gamification and student motivation remains restricted, particularly within the framework of formal educational environments. Another important component of effective learning is student engagement (Lavoué, Ju, Hallifax, & Serna, 2021). Students who are actively immersed in their studies are motivated, invested, and focused. They exhibit a higher level of involvement, effort, and enthusiasm in their academic endeavors. By offering engaging and interactive learning opportunities, gamification in education has the potential to increase student engagement (Devraj et al., 2021). However, there is still a need for more investigation into and validation of the empirical

data that supports the link between gamification and student involvement. Furthermore, a key factor in enabling efficient gamification techniques is the interactive learning environment seen in schools (Devraj et al., 2021). Group initiatives, technological assistance, and organized training are only a few of the components that make up the interactive studying environment. It is vital to investigate the role that the interactive studying environment plays in mediating the relationship between gamification and pupil consequences, given the feasible impact that the interactive mastering surroundings should have on the efficacy of gamified studying reports (Bucchiarone, 2022). In addition, the significance of ensuring that students are happy with their experiences in gamified learning settings needs to be taken into consideration. the term "perceived enjoyment" refers to the individual's own subjective assessment of how much fun they are having with those activities. Understanding how students' perceptions of fun play a part in the correlation between gamification and the flipped classroom might help educators create more engaging and satisfying learning experiences (Parra-González et al., 2021).

This study examines how gamification affects student engagement, motivation, and learning environment interaction. This study examines how perceived pleasure and the interactive learning environment moderate the link between gamification and student results. The education field benefited from this study. The study found favorable correlations between gamification, student engagement, motivation, and interactive learning. The study also noted that perceived satisfaction moderates and the interactive learning environment mediates the association between gamification and student results. The above contributions help us understand gamification in education's benefits and workings. They provide educators, policymakers, and academics with useful information regarding gamification methods to improve student motivation, engagement, and learning environment reports.

2. LITERATURE REVIEW

2.1 Gamification in Education

Gamification, which integrates game principles and design into non-game environments, is a paradigm change in education that aims to promote learning, motivation, and engagement (Bergamo, Streng, de Carvalho, Rosenkranz, & Ghorbani, 2022). Gamification's ability to make learning more immersive and engaging is highlighted by its growing popularity in education (Chang, Kuo, Hou, & Koe, 2022). Gamification uses game elements like leaderboards, points, badges, and levels to motivate students and give them a sense of accomplishment and progression (Aguiar-Castillo et al., 2020). These aspects resemble games to create an ambiance that reflects game dynamics while adapting them to instructional situations. Hope, Grant, Rogers and King (2022) and Tan and Cheah (2021) found that gamification's favorable influence on student motivation and engagement increased academic attainment. An advantage of gamification is its capacity to boost intrinsic motivation. Gamification promotes freedom, competence, and intention, which corresponds with the Self-Determination Theory (SDT). According to SDT, people are more motivated when they believe their behaviors are driven by their own interests rather than external incentives (Broza, Biberman-Shalev, & Chamo, N, 2023). Gamification encourages self-directed learning, which ignites

the passion for the subject. Game mechanics can create a structured framework that simplifies learning by dividing big concepts into smaller tasks (Chang et al., 2022). Students gain strategic guidance and a sense of success by reaching each milestone in the progression system, which is divided by levels and important dates. With the game aspects, this constant feedback cycle encourages good conduct and tenacity in difficult situations. Gamification fosters cooperative learning. Leaderboards and team-based challenges promote healthy competitiveness and student collaboration, building community. Hope et al. (2022) found that social components of gamification improve its efficacy in education since students are more engaged and feel more connected when working together to achieve goals. Gamification in education has many benefits, but it must be done carefully. Gamified features should be designed to support educational goals by using game dynamics that improve learning. In addition, instructors must be sensitive to varied learning preferences by acknowledging that gamified tactics may affect pupils differently.

2.2 Student Motivation

Researchers like Kuo et al. (2017) concur that student motivation affects academic performance. Intrinsic motivation, derived from curiosity and autonomy, is crucial to learning (Li, Ma, & Xi, 2021). Gamification boosts students' motivation by using their inherent desire to achieve, learn, and push themselves (Fondo & Gómez-Rey, 2021). Gamification motivates in many ways and may help students achieve goals. Gamified elements provide pupils with clear goals, instant feedback, and a sense of success. This encourages their natural curiosity (Tatarinova, Shvetsova, Vladimirova, Gruba, & Heberlein, 2022). This strategy makes learning dynamic and interesting, making students feel engaged and accomplished throughout their academic journey. Gamification continually boosts student motivation, according to extensive studies. Gamified learning environments boost students' enthusiasm, passion, and engagement (Sadeghi, Sağlık, Mede, Samur, & Comert, 2022). Gamification and motivation are interconnected, showing how gamified education may boost academic achievement and inspire a love of learning. To use games' motivating effect, educators should include gamification in their courses as education evolves. Educational stakeholders may develop engaging and empowering learning environments for students by understanding the intricate link between gamification and intrinsic motivation. This promotes a dynamic and effective academic ecosystem.

2.3 Student Engagement

According to Choi, Lee and Kim (2019), student engagement is a critical indicator of academic success since it measures how actively students participate in the learning process. Okwuduba, Abd Rauf, Zulnaidi and Nwosu (2022) say pupils who actively seek academic goals are more focused, persistent, and academically engaged. Gamification in pedagogy creates an interactive and engaging learning environment, improving student engagement (Devraj et al., 2021). Gamification boosts student engagement. This style of teaching promotes active engagement, collaborative problem-solving, and collaboration among students, surpassing traditional methods (Alhammad & Moreno, 2018; de la Peña, Lizcano, & Martínez-Álvarez, 2021). Teachers may engage students and encourage inquiry and analysis by incorporating gamification into the learning process. Gamification regularly engages students, according to some research. Anunpattana, Khalid, Iida and Inchamnan (2021)

found that gamified learning environments' interactive elements engage students. Student engagement is boosted by game components including challenges, incentives, and interactive settings.

2.4 Interactive Learning Environment

An interactive learning environment emphasizes active learning, collaborative learning, and hands-on experiences. According to Habibi, Razak, Yusop, and Mukminin (2019), this dynamic educational approach uses technology, collaboration, and practical circumstances to create an immersive and interactive learning environment. In the contemporary educational environment, using a range of technology tools and instruments improves student engagement and learning (Catala, Gijlers, & Visser, 2022). Multimedia, virtual reality, and simulations make learning more entertaining and informative. Interactive presentations, animations, and videos may offer knowledge in different formats and suit different learning styles. Simulations help students learn complicated subjects by applying theoretical knowledge to real-world situations. Virtual reality immerses students in real-world environments, enabling exceptional student engagement and experiential education. Kang and Lee (2020) say interactive learning environments boost student success, motivation, and engagement. Technology and interactive aspects improve pupils' academic grasp and inspire astonishment and passion. Interactivity in these situations promotes active engagement, collaborative problem-solving, and critical analysis, strengthening the educational foundation.

2.5 Perceived Enjoyment

The concept of perceived enjoyment pertains to the personal and internalized perception of gratification and contentment that individual associates with a specific undertaking (Xu, Gonzalez-Serrano, Porreca, & Jones, 2021). Regarding education, the concept of perceived enjoyment pertains to the affirmative emotional reactions and general contentment of students towards the process of learning. According to (Choi & Tak, 2022), students are more likely to exhibit motivation, engagement, and investment in their education when they perceive the learning environment to be enjoyable. The correlation between perceived enjoyment and heightened intrinsic motivation has been established in the literature. This intrinsic motivation has been found to facilitate profound learning and superior academic performance, as evidenced by studies conducted by (Hunde, Demsash, & Walle, 2023). According to scholarly research, students who derive pleasure from the learning process are more inclined to demonstrate favorable dispositions, tenacity, and dynamic engagement in educational pursuits (Nikolopoulou, 2021).

2.6 Gamification in Education and Student Motivation

The utilization of gamification in the field of education has surfaced as a potentially effective strategy to augment student motivation. Gamification endeavors to leverage game elements and mechanics in the educational process to access students' innate motivation and furnish them with a perception of challenge, accomplishment, and advancement (Kovács et al., 2021). Academic research consistently shows that gamification increases student motivation, suggesting that gamified learning settings might boost intrinsic motivation (Arruzza & Chau, 2021). Leaderboards, badges, points, and levels may foster competition, competence, and a sense of accomplishment. This can

boost student motivation to study (Legaki et al., 2020). Gamification in academic contexts gives timely feedback, clearly stated goals, and progress tracking, which boosts college students' motivation and goal-oriented behavior (Grabner-Hagen & Kingsley, 2023). Thus, on the basis of this, we developed the following hypothesis:

Hypothesis 1: There is a positive relationship between gamification in education and student motivation.

2.7 Gamification in Education and Student Engagement

Research shows that gamification improves student involvement in schools. Gamified learning environments use game ideas and features to engage and retain students (Tavares, 2022). De la Peña et al. (2021) found that gamified environments with problem-solving, group projects, and challenges increase student engagement and social interaction. Gamification increases students' cognitive and emotional engagement and desire to complete schoolwork (Anunpattana et al., 2021). Studies show that gamification in education boosts student engagement by encouraging exploration, autonomy, and social interaction. According to academics (Alhammad & Moreno, 2018; Menandro & Arnab, 2020), these elements are essential for engaging and effective education. Thus, on the basis of this, we developed the following hypothesis:

Hypothesis 2: There is a positive relationship between gamification in education and student engagement.

2.8 Gamification in Education and Interactive Learning Environment

Gamification in education has an impact that goes beyond student motivation and engagement to influence the overall interactive learning environment of schools. Gamified knowledge of environments uses distinct eras, multimedia materials, and interactive tools to create immersive and participatory experiences (Salaberri, Gil, & Sylla, 2021). These settings foster students' cooperation, problem-solving, and critical thinking. Gamification in education promotes student-centered, participatory learning (Jeon, Lee, & Choe, 2022). Gamification can promote scholar studying, inspire lively participation, and foster significant instructor-student interactions (Fernandes, Sylla, Martins, & Gil, 2023). Thus, on the basis of this, we developed the following hypothesis:

Hypothesis 3: There is a positive relationship between gamification in education and interactive learning environments.

2.9 Interactive Learning Environment as Mediator

According to recent studies conducted by Zivan, Gashri, Habuba and Horowitz-Kraus (2022), the correlation between gamification in education and student motivation is mediated by the interactive learning environment of schools. According to Stephenson, Fleer, Fragkiadaki and Rai (2022), if an interactive learning environment promotes feelings of autonomy, competence, and relatedness, then students are more inclined to exhibit intrinsic motivation and engagement in their learning. The implementation of gamification in educational settings offers supplementary stimuli and compensations, fostering a motivational atmosphere that stimulates students' enthusiastic involvement, exertion, and pleasure (Al Hakim, Yang, Liyanawatta, Wang, & Chen, 2022). The interactive learning environment serves as an intermediary by establishing a conducive setting that amplifies the

impact of gamification on student motivation. Thus, on the basis of this, we developed the following hypothesis:

> Hypothesis 4: The interactive learning environment of schools mediates the relationship between gamification in education and student motivation.

Students are more likely to actively participate in gamified learning activities when they feel that the learning environment is safe, welcoming, and supportive (Donnermann et al., 2021). The supportive interactive learning environment that promotes active learning, collaboration, and meaningful interactions between students and teachers. Students have possibilities for autonomy, competence, and social connectivity when gamification is incorporated into an interactive learning environment (Menandro & Arnab, 2020). These are crucial elements that promote engagement (Jeon et al., 2022). By creating a situation that enhances the engagement-promoting impacts of gamification in education, the interactive learning environment serves as a mediator. Thus, on the basis of this, we developed the following hypothesis:

> Hypothesis 5: The interactive learning environment of schools mediates the relationship between gamification in education and student engagement.

2.10 Perceived Enjoyment as Moderator

The moderating effect of the perceived enjoyment of students is critical in the relationship between gamification in education and the interactive learning environment of schools. The integration of game elements and mechanics in the process of gamification is intended to produce learning experiences that are both engaging and enjoyable for students, as noted by (Gaspay, Tiglao, Tacderas, Tolentino, & Ng, 2023). The efficacy of gamification can be significantly impacted by the degree of perceived enjoyment that students experience in the interactive learning environment. According to scholarly research, students' engagement and motivation can be improved when they perceive the gamified learning environment as enjoyable (Gunawan, Santoso, Yustina, & Rahmiati, 2022). The literature suggests that there exists a correlation between perceived enjoyment and favorable affective encounters, heightened curiosity, and contentment with the educational journey. According to (Degirmenci & Breitner, 2023), the incorporation of gamified learning activities that are entertaining, immersive, and rewarding can elicit a positive emotional state among students, thereby fostering greater engagement and motivation to learn. Yen, Mulley and Meza (2023) suggest that gamification in academic institutions' interactive learning environments may affect students' enjoyment. Gamification in education boosts students' enjoyment, motivation, engagement, and academic performance (Gaspay et al., 2023). Thus, based on this, we developed the following hypothesis:

> Hypothesis 6: Perceived enjoyment moderates the relationship between gamification in education and interactive learning environments.

Gamification in education is studied for its effects on student engagement, motivation, and performance. Gamification—the incorporation of game elements into non-game environments, such as education—is the focus of this study. This study examines how gamified tactics affect student learning complexity. The framework relies on student engagement and motivation, which demonstrate students' passion and active participation in education. The quality of the educational experience, including students' satisfaction and effectiveness, is also important. The interactive learning environment is a significant conceptual framework intermediary. Technology and education create

an exciting and ever-changing atmosphere in this setting. According to the paradigm, gamification's impact on student engagement and motivation is tightly tied to the interactive learning environment. Simply put, gamification in an interactive learning environment boosts student performance. The conceptual framework includes felt delight as a moderator. This personal experience shows how much fun and happiness game-based learning brings. According to the paradigm, students' subjective delight affects gamification and interactive learning. Gamification affects academic achievement based on student satisfaction with learning activities. Motivation, engagement, and game design underpin the conceptual framework. Self-determination theory may explain intrinsic and external incentives, while game design can help choose and apply gamified elements. Thus, on the basis of the above literature, we developed the following conceptual framework which is shown in Fig. 1.

3. METHODOLOGY

The present investigation utilized a quantitative correlational research design. The present study sought to investigate the interconnections among gamification in the educational context, student motivation, student engagement, the interactive learning environment, and perceived enjoyment. The present investigation's sample comprised pupils enrolled in educational institutions located in China. The selection of the particular schools was predicated upon their voluntary agreement to take part in the research endeavor. The sample comprised 280 students. A power analysis was conducted to determine the appropriate sample size based on the expected effect size, significance level, and desired statistical power. The power analysis results have led to the determination that a sample size of 280 would be sufficient to attain the desired level of statistical power for detecting the pertinent relationships. The study utilized a convenience sampling technique to select participants. Contact was made with schools that exhibited interest and allowed enrollment in all grades. The students' desire and availability determined participation. This study used self-administered

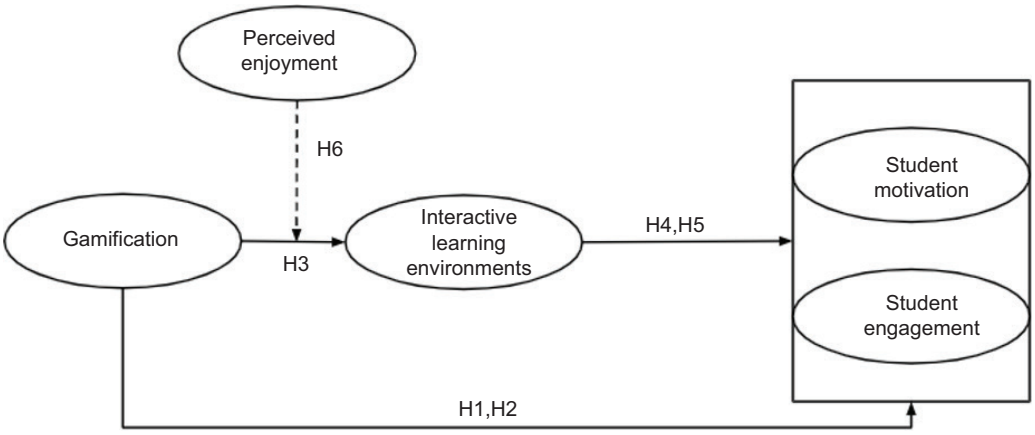

Fig. 1 Conceptual Framework.

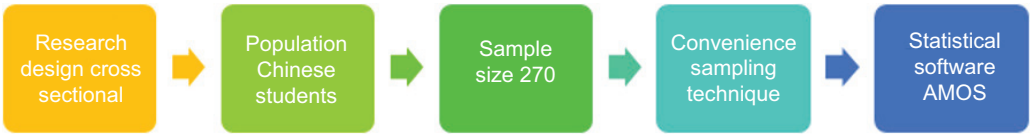

Fig. 2 Flow Diagram of Research Methodology.

questionnaires. Students received surveys and full instructions on how to complete the questionnaire during school hours. The questionnaires covered student participation, gamification, interactive learning, and enjoyment. Gamification in education was measured by using a 5-item scale which was adapted from Menandro and Arnab (2020). Student motivation was measured by using 5 items adapted from (Baber, 2020). Student engagement was measured by using 5 items adapted from (Menandro & Arnab, 2020). The interactive learning environment was measured by using 5 items adapted from (Li, 2022). Perceived enjoyment was measured by using 5 items adapted from (Gunawan et al., 2022). All items were measured by using a 5-point Likert scale.

3.1 Statistical Analysis

Analysis was done using the AMOS statistical program. AMOS is a popular structural equation modeling (SEM) software program for examining complex variable relationships (Fig. 2). Descriptive statistics, correlation analysis, structural equation modeling, and other analytic methods were used to examine the relationships between gamification, student engagement, motivation, the interactive learning environment, and perceived enjoyment.

4. RESULTS

4.1 Data Analysis

Data analysis is performed using the Statistical Package for the Social Sciences (SPSS 25) and AMOS 24 software packages. The reliability analysis in Table 1 is shown. In this research, gamification in education is the independent variable, while student motivation and student engagement are the dependent variables. Interactive learning environment is the mediating variable while perceived enjoyment is the moderating variable. Each variable has a satisfactory reliability alpha value.

The values in Table 2 and Fig. 3 show that gamification in education, student motivation, student engagement, interactive learning environment and perceived enjoyment have a mean value of 4.04, 4.48, 3.90, 4.09, and 3.94 respectively.

4.2 Confirmatory Factor Analysis

Pooled CFA is the latest and most reliable technique. In this methodology, the AMOS 24 runs all latent variables simultaneously. Findings show that all the values are in an acceptable range. The value of RAMESA is 0.151 which is less than the threshold value (0.80). The value of CFI is 0.971 which is greater than 0.9. The value of parsimonious fit is less than 3 (Table 3).

Table 1 Reliability Analysis.

Variables	Items	Cronbach's Alpha Value
Gamification in Education	5	0.900
Student Motivation	5	0.724
Student Engagement	5	0.806
Interactive Learning Environment	5	0.842
Perceived Enjoyment	5	0.858

Table 2 Descriptive Statistics.

Variables	Mean	Std. Deviation	N
Gamification in Education	4.04	0.666	280
Student Motivation	4.48	0.511	280
Student Engagement	3.90	0.752	280
Interactive Learning Environment	4.09	0.753	280
Perceived Enjoyment	3.94	0.772	280

Table 4 and Fig. 4 show the reliability value or factor loading of every item separately. It also shows the composite reliability of a complete scale of any variable. The reliability of the measurement scales was measured with composite reliability, which is preferred to report a scale's reliability, a widely used indicator. The value of Cronbach's alpha for each variable is greater than 0.7. The values of Cronbach's alpha for gamification in education, student motivation, student engagement, interactive learning environment, and perceived enjoyment are 0.900, 0.724, 0.806, 0.842, and 0.858 respectively. The value of factor loading for each item is greater than 0.4.

4.3 Assessment of Discriminant Validity

A subtype of construct validity called convergent validity is defined as follows: The concept of "construct validity" describes the degree to which a test designed to measure a certain construct, such as IQ, actually measures that particular trait. The capacity to show that two measurements that are intended to evaluate the same notion are actually evaluating the same phenomenon is known as convergent validity. On the other side, discriminant validity shows that two metrics that are not intended to be connected are in fact not associated. Both types of validity must exist for a construct to have excellent validity. The cutoff level for severe discriminant validity was 0.850, and the cutoff threshold for liberal discriminant validity was 0.900. The HTMT analysis was performed to establish discriminant validity Henseler, Ringle, and Sarstedt (2015). The values in Table 4 and Table 5 demonstrated that the items meet the requirements for discriminant validity.

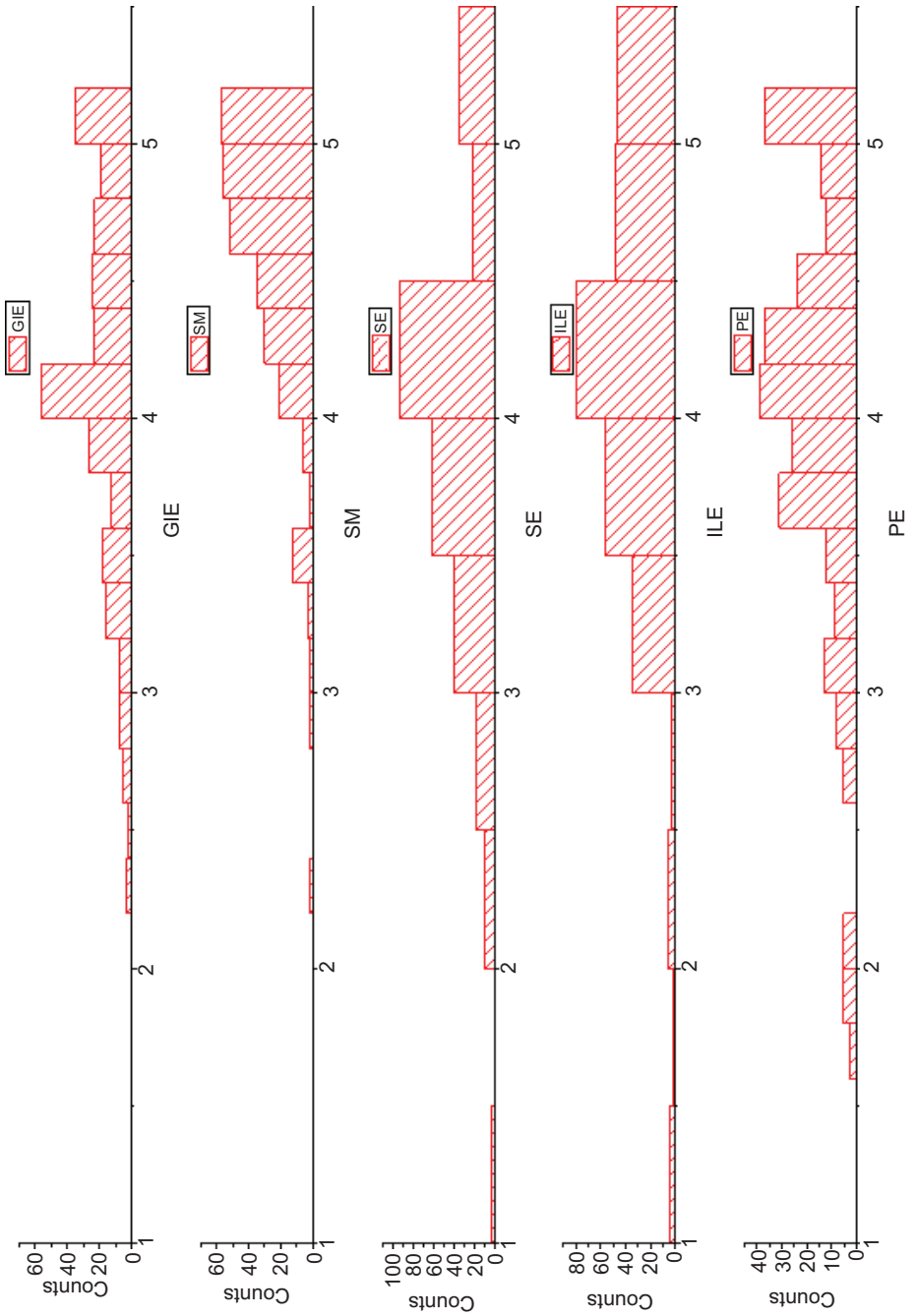

Fig. 3 Descriptive Statistics.

Table 3 Pooled CFA Model Fitness Tests.

Name of Category	Name of Index	Index Full Name	Value in Analysis	Acceptable Value	Literature
Absolute Fit	RMSEA	Root Mean Square of Error Approximation	0.151	<0.80	(Breyton, Smith, Rouquette, & Mancini, 2021)
Incremental Fit	CFI	Comparative Fit Index	0.971	>0.90	(Gundogan, 2022)
Parsimonious Fit	Chisq/ DF	Chi-Square / Degrees of Freedom	2.163	<3	(Duffy et al., 2017)

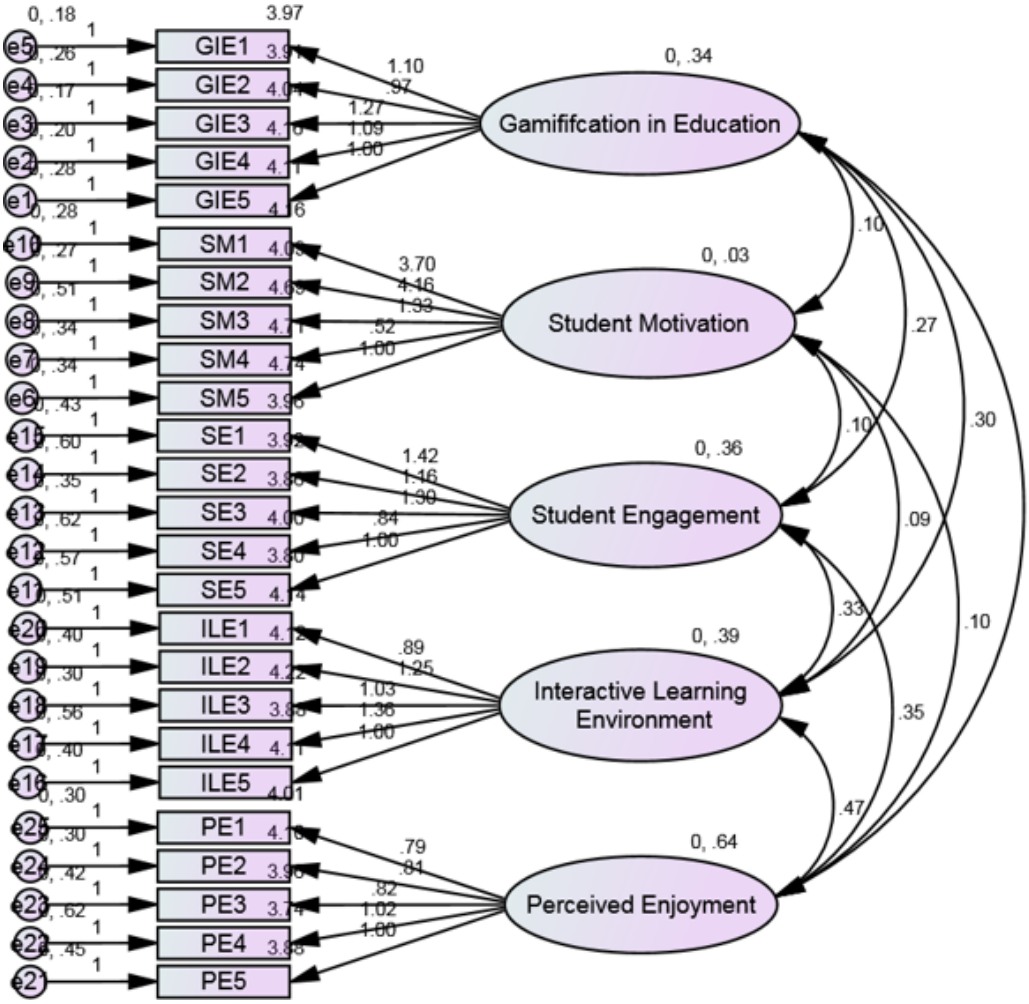

Fig. 4 Pooled Confirmatory Factor Analysis.

Table 4 Factor Loading of Items.

Scale	Items	Factor Loadings	Scale Reliability
Gamification in Education	The use of gamification techniques in my educational activities has increased my motivation to learn.	0.874	0.900
	Gamification elements such as points, badges, and leaderboards have made learning more enjoyable for me.	0.596	
	The inclusion of gamification has enhanced my engagement with the learning material.	0.830	
	Gamification strategies have helped me stay motivated and focused during my educational tasks.	0.794	
	I find that gamified learning experiences provide a sense of challenge and excitement, which positively impacts my learning outcomes.	0.716	
Student Motivation	I feel motivated to achieve academic success and perform well in my studies.	0.752	0.724
	Setting goals and having a clear understanding of what I want to achieve keeps me motivated in my educational journey.	0.763	
	I am enthusiastic about learning new concepts and acquiring knowledge in my field of study.	0.726	
	I believe that my efforts and hard work will lead to positive outcomes in my academic pursuits.	0.763	
	When faced with obstacles, I am determined to overcome them and continue striving for excellence in my education.	0.719	
Student Engagement	I actively participate in classroom discussions and contribute my thoughts and ideas.	0.835	0.806
	I seek opportunities to apply what I have learned in real-world situations or through hands-on activities.	0.525	
	I am eager to explore additional resources and materials related to the topics covered in my studies.	0.849	
	I find myself immersed and fully involved in the learning process during educational activities.	0.611	
	I feel a sense of connection and relevance between the learning material and my personal interests and goals.	0.651	
Interactive Learning Environment	My learning environment provides opportunities for collaboration and interaction with peers.	0.749	0.842
	The use of technology tools and resources enhances the interactivity and engagement in my learning environment.	0.725	
	I have access to diverse learning materials and resources that support interactive learning experiences.	0.769	
	The classroom setup and arrangement encourage active participation and engagement among students.	0.743	
	The learning environment promotes a sense of autonomy and ownership in my educational journey.	0.710	

(*continues*)

Table 4 Continued.

Scale	Items	Factor Loadings	Scale Reliability
Perceived Enjoyment	I find the learning activities and tasks enjoyable and engaging.	0.624	0.858
	The use of gamification elements adds a fun and exciting element to my learning experiences.	0.687	
	I look forward to participating in gamified learning activities because they bring a sense of enjoyment.	0.628	
	The use of gamification strategies makes learning more interesting and appealing to me.	0.715	
	I feel a sense of satisfaction and pleasure when engaging with gamified learning materials and tasks.	0.741	

Table 5 HTMT Analysis.

	GIE	SM	SE	ILE	PE
Gamification in Education	x				
Student Motivation	0.424	x			
Student Engagement	0.534	0.633	x		
Interactive Learning Environment	0.256	0.532	0.632	x	
Perceived Enjoyment	0.246	0.533	0.426	0.625	x

4.4 Path Analysis in Structural Equation Modelling

Structural equation modeling (SEM) is used in this study to evaluate the hypothesized correlations. Exogenous variables are used in this analysis to make it easier to examine endogenous variables using AMOS 24. You can see that the independent and dependent variables are related to one another linearly in this situation. Observed facts served as the foundation around which the fundamental design was built. For analysis, all observations were tabulated and associated with data on their mean values. The model fit indices for the structural model are shown in Table 6 and demonstrate that they satisfy the requirements for approval. The value of RAMESA is 0.660 which is less than 0.8. The value of CFI is 0.993 which is greater than 0.9 and the value of parsimonious fit is 1.423 which is less than 3.

The following table illustrates the results of direct effects. All of the hypotheses have P-values lower than 0.05, indicating a 95% confidence interval (Table 7). Fig. 5 depicts a structural equation modeling path analysis. The first hypothesis of the study stated that gamification in education has a significant impact on student motivation. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$). The second hypothesis of the study stated that gamification in education has a significant impact on student engagement. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$). The third

Table 6 SEM, Model Fitness Tests.

Name of Category	Name of Index	Index Full Name	Value in Analysis	Acceptable Value	Literature
Absolute Fit	RMSEA	Root Mean Square of Error Approximation	0.660	< 0.80	(Breyton et al., 2021)
Incremental Fit	CFI	Comparative Fit Index	0.993	> 0.90	(Gundogan, 2023)
Parsimonious Fit	Chisq/DF	Chi-Square / Degrees of Freedom	1.432	< 3	(Duffy et al., 2017)

Table 7 Results of Direct Effects.

Hypothesis	Causal Path	Lower Bound	Upper Bound	P-Value	Standardized Estimated
H1	Gamification in Education → Student Motivation	0.045	0.154	0.001	0.383
H2	Gamification in Education → Student Engagement	0.024	0.145	0.001	0.310
H3	Gamification in Education → Interactive Learning Environment	0.045	0.157	0.024	0.066

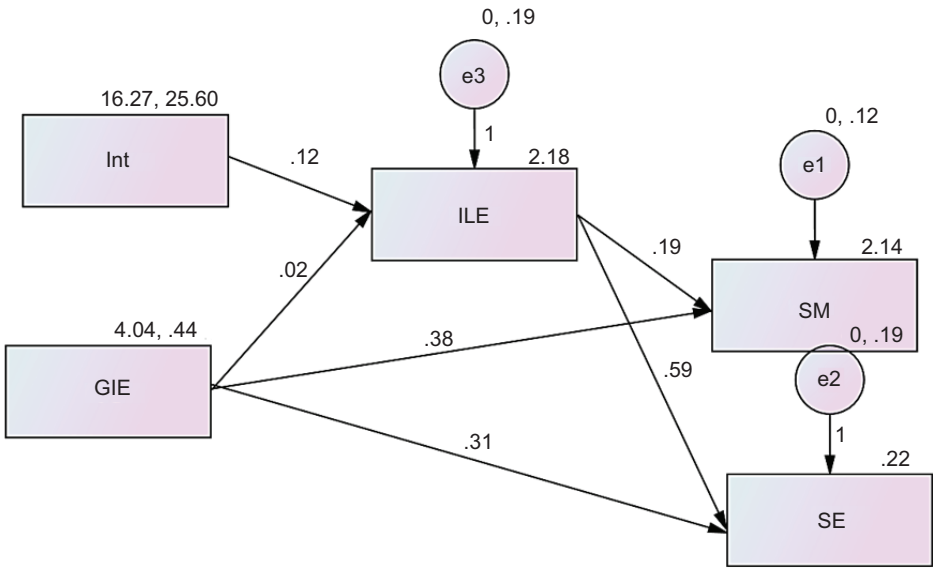

Fig. 5 Structural Model.

Table 8 Results of Mediation.

Hypothesis	Original Sample	T Values	P Values
GIE → ILE → SM	0.383	8.333	0.001
GIE → ILE → SE	0.310	5.391	0.001

Table 9 Results of Moderation.

Hypothesis	Original Sample	T Values	P Values
GIE × PE → ILE	0.103	2.734	0.006

hypothesis of the study stated that gamification in education has a significant impact on interactive learning environments. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$).

All hypotheses are statistically significant, and Table 8 classifies the observed mediation for these hypotheses as partial mediation. Full mediation suggests that the mediating variable explains the entire relationship between the independent and dependent variables, whereas partial mediation suggests that the mediating variable only partially explains the relationship. The fourth hypothesis of the study stated that an interactive learning environment mediates the relationship between gamification in education and student motivation. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$). The fifth hypothesis of the study stated that an interactive learning environment mediates the relationship between gamification in education and student engagement. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$).

Table 9 shows partial moderation for all statistically significant hypotheses. The sixth hypothesis of the study stated that perceived enjoyment moderates the relationship between gamification in education and interactive learning environments. The findings also confirm this hypothesis ($t > 0.164$, $p < 0.05$).

5. DISCUSSION

The aim of the study was to investigate the impact of gamification in education on student motivation and student engagement with the mediating role of the interactive learning environment and the moderating role of perceived enjoyment. Data was collected from 280 Chinese students. Collected data was analyzed by using AMOS software.

Hypothesis 1 states that there is a positive relationship between gamification in education and student motivation. Numerous academic studies have emphasized the beneficial effects of gamification on student motivation. Gamified learning environments are classrooms that incorporate game elements like leaderboards, missions, and badges to motivate and recognize students. According

to (Sobrino-Duque et al., 2022), using this strategy raises students' enthusiasm and engagement. According to scholarly research conducted by (Aguiar-Castillo et al., 2020), gamified activities are frequently perceived by students as enjoyable, stimulating, and personally meaningful, which in turn fosters their intrinsic motivation to participate in such activities. According to Arruzza and Chau, (2021) self-determination theory, the incorporation of gamification in education has been found to boost students' motivation by fostering autonomy, competence, and relatedness. This has been supported by research. Consequently, it is plausible to anticipate a favorable correlation between the implementation of gamification in the educational setting and the level of motivation displayed by students. Hence H1 is supported.

Hypothesis 2 states that there is a positive relationship between gamification in education and student engagement. The concept of gamification has demonstrated a consistent correlation with heightened levels of student engagement. Devraj et al. (2021) posit that the incorporation of game elements, such as leaderboards, points, and levels, can effectively engage students and maintain their interest throughout the learning process. According to Murillo-Zamorano, López-Sánchez, López-Rey and Bueno-Muñoz (2023), gamified learning experiences enhance student engagement through interactive and immersive activities. Ownership and proactive involvement result from this approach. Gamification can also provide timely feedback and clear objectives, which have been shown to boost student engagement by boosting their perception of progress and achievement (Kowitlawakul et al., 2022). Gamification integration in the classroom should boost student engagement. So, H2 is supported.

Hypothesis 3 suggests that gamification in education will foster an interactive learning environment. Gamification is essential to creating a dynamic learning environment in education. According to Landis and Cieslowski (2022), some technologies and activities can encourage student, teacher, and educational resource participation, creating a dynamic and interactive learning environment. Bakhanova, Garcia, Raffe, and Voinov (2020) claim that gamification can boost student involvement, encourage discussion and cooperation, and make learning more interesting and dynamic. Thus, it is a justifiable expectation that the integration of gamification within educational contexts will yield a positive correlation with the establishment of an interactive learning milieu. Hence H3 is supported.

Hypothesis 4 states that the interactive learning environment of schools mediates the relationship between gamification in education and student motivation. The infrastructure, tools, and assistance required for the use of gamification approaches are supplied via interactive getting-to-know surroundings (Lavoué et al., 2021). Gamification can increase scholar motivation while it's miles included in interactive studying surroundings since it allows for energetic engagement, collaboration, and personalization (Bennani, Maalel, & Ghezala, 2020). Higher levels of student motivation result from the gamification's motivational benefits being amplified by the interactive learning environment. Hence H4 is supported. Hypothesis 5 states that the interactive learning environment of schools mediates the relationship between gamification in education and student engagement. The context for implementing gamification tactics and fostering student involvement is provided by the interactive learning environment (Lavoué et al., 2021). Gamification can increase student engagement by fostering interactive and collaborative learning opportunities in an interactive learning environment (Alsofyani, 2023). The association between gamification and student engagement is strengthened because of the facilitative role played by the interactive learning environment. Hence H5 is supported.

Gamification in education and the interactive learning environment are linked by perceived enjoyment, according to Hypothesis 6. According to Degirmenci and Breitner (2023), gamified learning sessions may boost students' motivation and engagement by making them feel good. Gamification's benefits are amplified by an engaging educational atmosphere and enjoyment. According to Gaspay et al. (2023), interactive learners are more likely to participate in gamified activities. Perceived joy links gamification, interactive learning, and student results. H6 is confirmed.

6. CONCLUSION

Gamification in education was tested for its benefits on student engagement, motivation, and learning environment interaction. The study examined how the interactive learning environment mediates and how joy moderates. The findings supported the assumptions and shed light on the relationships between gamification, student academic progress, and environmental variables. Student motivation and gamification in schools are linked. Gamification may boost students' learning motivation. Gamified learning environments stimulate active involvement and student engagement, as shown by a positive link. The research also stressed the importance of the interactive learning environment, which supported gamification and student motivation and engagement. An interactive learning environment encouraged gamification and student interaction. The research also highlighted the moderating effect of perceived joy, demonstrating that students' subjective experiences and attitudes toward gamified learning activities may affect the interactive learning environment. Positive views about gamified activities had a big influence on student motivation and engagement. Results have practical implications for educators and academic institutions. Gamification, interactive learning environments, and student enjoyment can help instructors create dynamic and meaningful learning experiences. The study advances learning theory, contextual factors, and subjective enjoyment in educational gamification. Gamification as a didactic method to motivate and engage students is better understood after this research.

7. IMPLICATIONS

The study's practical consequences emphasize the need for gamification in academia. Many instructors believe that adding games, prizes, and challenges to lessons can motivate students. Through digital platforms and interactive technologies, educational institutions may create dynamic learning environments with gamified activities. Effective education implementation requires infrastructure and teacher training. Collaboration and support among educators may also help education gamification techniques last.

The study advances motivation and learning theories in educational gamification. The results confirm the importance of intrinsic motivation and how gamification tactics affect students' psychological needs for relatedness, competence, and autonomy in education. The research also highlights the interactive educational environment's intermediate role in student engagement. This emphasizes the importance of contextual aspects, such as cooperation and individualized learning, in increasing

student engagement. The research also emphasizes the importance of perceived enjoyment as a moderating factor, emphasizing the need for gamified educational assignments that are fun and student-friendly.

8. LIMITATIONS AND FUTURE DIRECTIONS

This study is fascinating, but its limitations require additional exploration. The research started with self-report tools, which are prone to response bias and social desirability. To acquire more objective data, further studies may use qualitative and quantitative methods like interviews and observations. The research was limited to a single age group or education level, limiting its application to education. To study the effects of gamification in multiple educational environments, future studies should include people of all ages, cultures, and academic levels. Uninvestigated confounding factors are another issue. Gamified learning results may be affected by past experience with comparable learning approaches, individual learning patterns, and instructor-student relationships. Future studies may include control groups and the above criteria to improve findings validity. The study focused on the short-term effects of gamification on student engagement, motivation, and instructional interaction. Academic research has neglected gamification tactics' long-term impacts. The long-term durability of the findings and the variables that sustain student enthusiasm and involvement in education should be investigated. The research focused on perceived pleasure and the interactive learning environment as moderators, rather than other educational mediators and moderators. Self-efficacy, social interaction, and instructional design components may be studied to better understand the complex relationships involved in education gamification.

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