



Research article

The influencing factors of game brand loyalty

Zhao Xuanze ^{a,b}, Sam Toonghai ^{b,*}, Zhang Xia ^a, Liu Yujia ^a^a Information Department, Zhejiang University of Finance and Economics Dongfang College, Yangshan Road No.2, Chang'an street, Haining, 314408, Zhejiang, China^b Faculty of Business and Communications, INTI International University, Nilai, 71800, Negeri Sembilan, Malaysia

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ABSTRACT

Our research aims to investigate the impact mechanism of brand loyalty among gamers during the gaming process within the framework of brand loyalty theory and cognitive theory. We surveyed game players from Zhejiang Province, China. The research methods include a questionnaire survey and structural equation modelling. Results show that game experience, interaction, and impression are positively correlated with game trust, while game trust is positively correlated with game brand loyalty. Game trust, as a mediator variable, plays a complete mediation role. The clustering results of player gender and age as moderating effects are not significant. Based on the analysis results, we have suggested corresponding policy recommendations and reflections. Our research contributes to the analysis of impact mechanism of brand loyalty during the gaming process through the establishment of a structural equation model and provides suggestions and reflections on the development of the gaming industry.

1. Introduction

Owing to the intense competition in the gaming industry, the sector is increasingly emphasising the construction and management of gaming brands. Game brand loyalty, as an indicator of gamers' loyalty to game brands, holds great significance for market share, profit levels, and the competitive position of the gaming industry. Studying the theory of game brand loyalty can help the gaming industry better understand gamers' needs, enhance the value of game brands, and achieve sustainable development.

Many games are primarily driven by tasks and goals, and the uncertainty throughout the gaming process increase enjoyment for gamers [1]. For gamers, the fun derived from the game directly influences their decision to continue playing. Gamers and consumers mainly consider the product content and equipment during the gaming process to enhance their overall experience and enjoyment [2]. Therefore, game fun and trust gained during the gaming process are shared among gamers, which often leads to choosing specific game brands for consumption and purchases, making brand loyalty crucial for game brands [3].

Gamers and consumers' game preferences can directly or indirectly affect their brand loyalty. Brand loyalty is a key factor for sellers and platforms as consumers frequently exhibit bias towards certain brands in their purchasing decisions. The Brand Loyalty Theory [4] posits that consumers exhibit sustained willingness and behaviour to purchase a specific brand, reflecting their preference and loyalty across multiple purchases. It can be divided into two levels: behavioural and psychological loyalty. Behavioural loyalty pertains to the number of times consumers purchase products from the same brand within a specific time frame, reflecting their purchasing behaviour. Psychological loyalty encompasses consumers' perception, attitude, and emotions towards a brand,

* Corresponding author.

E-mail address: toonghai.sam@newinti.edu.my (T. Sam).<https://doi.org/10.1016/j.heliyon.2024.e31324>

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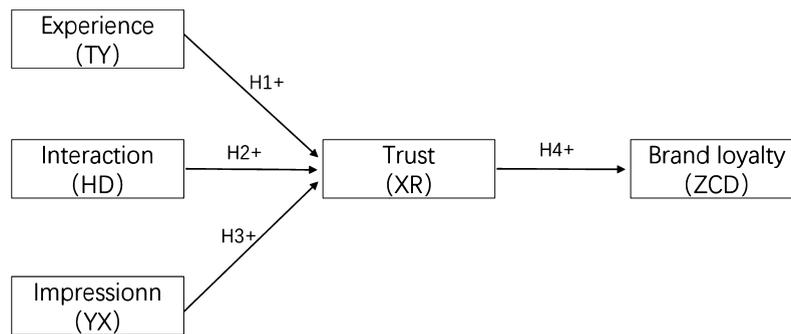


Fig. 1. Game Brand Loyalty Research Model.

reflecting their psychological state. Vries and Carlson [5] suggested that the interaction between both aspects extends to brand loyalty; Chaudhuri and Holbrook [6] proposed that brand trust and influence jointly determine purchase loyalty, which results to a larger market share, and attitude loyalty, which leads to a higher relative price for the brand. Meyvis et al. [7] proposed that consumer evaluation and extension of brand products can further strengthen brand loyalty.

Cognitive theory [8] is a psychological theory on the internal processing of organic learning, including the acquisition of information, knowledge, and experience, and the interconnection of memory, insight, and concepts. In the cognitive process of game interaction, whether consumers like or dislike the product represents the depth of the relationship between the buyer and seller [9]. Fournier and Alvarez [10] explored the negative impact, process, and state of the relationship between consumers and brands, proposing a partnership approach to achieve satisfaction for both buyers and sellers. Gamers form a psychological impression and loyalty towards a specific game product based on their usage experience, emphasising the development process of higher-level loyalty to the game brand.

After analysing brand loyalty theory and cognitive theory, and reviewing numerous references, we applied concepts from psychology, marketing, and information management to integrate ideas from different fields. We conducted a survey among game players on the factors influencing brand loyalty and established models and hypotheses affecting game brand loyalty. This research's primary objective is to understand the influencing factors and psychological changes in game consumers' brand loyalty during the gaming process and provide potential ideas for the gaming industry's development.

Drawing upon brand loyalty theory and cognitive theory, a logical research framework was constructed through literature review and analysis. First, we proposed four hypotheses based on the research framework: experience positively impacts trust, interaction positively impacts trust, impression positively impacts trust, and trust positively impacts brand loyalty. Second, we conducted reliability and validity analysis, normality tests, measurement invariance tests, common method variance tests, correlation analysis, and fitness tests on the distributed and collected questionnaires. Finally, we performed hypothesis testing analysis, mediation variable analysis, and cluster analysis. Conclusions reveal that experience, interaction, and impression positively impacts trust, while trust positively impacts brand loyalty. Trust, as a mediating variable, exhibits complete mediation. The results of clustering as regulatory effects were not significant, and corresponding policy recommendations were made based on the analysis results.

2. Research hypothesis architecture and development

In investigating the mechanisms behind consumers' loyalty towards specific gaming brands, this study closely follows the theoretical frameworks of Brand Loyalty Theory and Cognitive Theory for analysis and deductions. Brand Loyalty Theory reveals the underpinnings of consumers' continuous purchasing behaviours toward specific brands, emphasizing satisfaction, emotional connections, and habitual purchasing in forming brand loyalty. This theory further posits that loyal customers may express their allegiance through repetitive purchases and by recommending the brand to others and providing positive evaluations. The formation and reinforcement of brand loyalty necessitate crucial elements such as high-quality products and services, consistent brand messaging, superior customer service experiences, and clear, unique brand value propositions.

Simultaneously, Cognitive Theory provides a psychological foundation for understanding how consumers receive, process, and store information related to brands. This theory outlines the decision-making process, detailing how consumers actively pay attention to brand information, comprehend and evaluate it, and how their existing knowledge, beliefs, and attitudes influence purchasing decisions. Integrating perspectives from these two theories, this study constructs a specific theoretical framework model and, based on this foundation, designs a questionnaire to assess loyalty towards gaming brands. Through subsequent statistical analysis and in-depth discussions, it aims to elucidate the constituent elements and mechanisms of action behind gaming brand loyalty.

Further, after a meticulous examination of existing literature studies related to experiences, interactions, impressions, and trust, this study, based on reasonable deductions from Brand Loyalty and Cognitive Theories, proposes the following four hypotheses as the foundation of the research (Fig. 1):

2.1. Experience

The relationship between consumer experience and brand loyalty is a multifaceted domain that draws significant interest across various sectors, including gaming, self-service technologies, political engagement through video games, and the analysis of online customer feedback. Chang et al. [11] investigate the impact of relationship maintenance and investment in self-service technologies (SST) on SST relationship performance, uncovering a positive correlation between effective relationship strategies and enhanced user satisfaction and loyalty. This finding emphasizes the role of technology in facilitating direct interactions crucial for building lasting consumer relationships. Trudel [12] provides a holistic view of consumer behaviour, from acquisition to possession and the overall consumer experience. His work illustrates the profound effect personal and emotional experiences have on developing a strong brand connection, thereby enhancing loyalty. Akbar and Kusumasari [13] explore the unconventional angle of video games as a medium for political education and engagement, arguing that positive gaming experiences can extend loyalty beyond the game to the concepts it teaches. This suggests that experiential learning through gaming can deepen brand loyalty through intellectual and emotional engagement. Son and Kim [14] focus on analyzing user experiences via online customer reviews methodically. Their work classifying UX feedback underscores the importance of understanding consumer narratives to foster a positive brand image and loyalty. Across these studies, a consistent theme emerges: the positive impact of diverse and quality consumer experiences on brand loyalty. Especially within gaming, the immersive nature of the experience not only entertains but educates and engages, creating a fertile ground for loyalty towards the brand. These insights collectively highlight the necessity of crafting meaningful, positive experiences to cultivate and sustain brand loyalty. So, we assume that:

H1: Game experience exhibits a positive correlation with game trust.

2.2. Interaction

The intersection of consumer interaction and brand loyalty, especially in digital environments and gaming, is crucial for forging stronger brand-consumer relationships. Labrecque et al. [15] examine the digital evolution of consumer power, highlighting the transformative role of interactive marketing in cultivating a participatory culture where consumers co-create value, reinforcing brand loyalty. This evolution underscores the shift towards more engaging and meaningful consumer-brand interactions. Hollebeek, Juric, and Tang [16] delve into virtual brand community engagement, proposing a model that accentuates the importance of immersive interactions in online brand communities for bolstering brand loyalty. Their work points to the effectiveness of creating vibrant, interactive online spaces to retain consumer interest and loyalty. Manjula and Srilatha [17] explore behaviour prediction in social networks, indirectly demonstrating how understanding and anticipating online user behaviour can lead to more personalized brand interactions and enhance consumer loyalty. Lowe and Haws [18] investigate the sensory impacts of acoustic pitch on product perception, suggesting broader implications for multisensory marketing strategies in crafting memorable experiences that boost brand loyalty. Spence [19] focuses on multisensory experiential marketing in wine, revealing the significant influence of engaging multiple senses on product perception and loyalty. This study advocates for holistic, sensory-rich brand experiences to deepen consumer loyalty. Altogether, these studies underscore the pivotal role of dynamic consumer interactions, whether through digital platforms, sensory marketing strategies, or engaging online communities, in fostering brand loyalty. In the gaming industry and beyond, crafting interactive and immersive experiences is critical to building a loyal consumer base. So, we assume that:

H2: Game interaction exhibits a positive correlation with game trust.

2.3. Impressions

An impression results from the sensory system's perception of external stimuli. Gamers experience psychological effects during gaming, including past or current psychological impressions related to games, which are generally influenced by the critical influence of website aesthetics, interactive experiences, emotional engagement, and social dynamics.

Hasan [20] underlines how website design characteristics can evoke irritation or satisfaction, affecting loyalty. This connection between first impressions and consumer retention highlights brands' need to prioritize website design. Similarly, Huber, Moeller, and Nuerk [21] and Lu and Lin [22] suggest that the adaptiveness and interactivity of digital platforms can significantly influence user engagement and intention, principles applicable to enhancing gaming experiences. Faraji-Rad and Pham [23] delve into the role of affect in decision-making under uncertainty, hinting at how brands that elicit positive emotional responses can solidify loyalty. Bagozzi [24] and Gross [25] extend this by illustrating how brands fulfilling emotional and cognitive needs foster deeper loyalty. Moreover, Sirola et al. [26] and Cheng and Lin [27] explore how virtual communities and sensory experiences influence consumer behaviour. Their findings suggest that fostering community and multisensory engagement can significantly enhance brand loyalty.

These studies underscore that positive initial impressions—crafted through engaging design, interactive features, emotional resonance, and social connectivity—are pivotal in building brand loyalty. In the gaming context, where experiences are inherently interactive and emotionally charged, leveraging these elements can be particularly potent for cultivating lasting loyalty among gamers, highlighting the lasting impact of first impressions on consumer-brand relationships. So, we assume that:

H3: Game impressions have a positive correlation with game trust.

2.4. Trust

Players establish trust in the game brand through their experience, interaction, and impression of the game, which translates into brand loyalty to the product. Investigating the relationship between trust and brand loyalty reveals its significant impact on

e-commerce and social media engagement, emphasizing the critical role of trust in consolidating brand loyalty and paying particular attention to its impact on the gaming industry. Pavlou and Fygenon [28], along with Salam et al. [29], highlight how trust critically underpins consumer engagement and loyalty in e-commerce settings. Trust in these digital transactions is foundational for maintaining long-term loyalty toward online brands. In the realm of social commerce and media, Braojos et al. [30] and Althuwaini [31] demonstrate that advanced digital capabilities and strategic social media interactions significantly foster brand trust, leading to enhanced brand performance and loyalty. Similarly, Haudi et al. [32] affirm that effective social media marketing elevates brand trust and loyalty, establishing a link between engaging online content and consumer attachment to brands. Lau and Lee [33], Matzler et al. [34], and Bae and Kim [35] further explored the trust-loyalty dynamic. They revealed that trust is foundational for loyalty and influences how consumers relate to brands through emotions and experiences. This multifaceted relationship suggests that trust is a crucial mediator in developing brand loyalty.

When applied to the gaming industry, these insights point to a nuanced understanding: Trust-building—through secure and engaging gaming environments—promotes stronger emotional connections and loyalty among gamers. Cultivating trust, particularly in environments rich with interactive experiences, is paramount for gaming brands aiming to achieve sustained consumer loyalty. Thus, trust is a critical strategic asset for brands looking to solidify their relationship with consumers in the digital age. So, we assume that:

H4: Game trust has a positive correlation with game brand loyalty.

Through the proposition and verification of the above hypotheses, this study expects to deepen the understanding of the dynamic mechanisms behind gaming brand loyalty development and contribute unique insights and strategic recommendations for brand management practices.

3. Research method

To investigate the relationships among experience, interaction, impression, trust, and brand loyalty, a framework model for measuring game brand loyalty was developed based on an extensive review of existing literature and the specific objectives of this study. Given that our research subjects required some background knowledge in gaming, the target population included individuals involved with gaming platforms, members of gaming clubs, urban internet cafe staff, and other young individuals within Zhejiang Province, China. A combined approach of random and non-random sampling was employed, utilizing WeChat, QQ, and other online platforms to launch the survey throughout Zhejiang Province. Upon collection, questionnaires were analyzed using SPSS, Amos, and other software to assess the model's validity and reliability. Additionally, the relationships within the research framework model were tested.

3.1. Pre-text and Pilot-test

Following the initial design of the questionnaire, a pre-test was conducted to refine the content and design of the questionnaire. The sample for the pre-test consisted of five experts in the field and five doctoral students, who were invited to complete the questionnaire and provide feedback on the articulation of items, the relevance of content, understandability, clarity, and the overall layout of the questionnaire. Based on this feedback, the research team engaged in detailed discussions and made necessary modifications to address identified issues, culminating in the final questionnaire intended for testing the research model. Table 1 one lists the 20 items of the scale along with their sources of reference.

3.2. Content validity

The questionnaire has five core dimensions: experience, interaction, impression, trust, and brand loyalty. A seven-point Likert scale was employed for ratings, ranging from 1 ("strongly disagree") to 7 ("strongly agree"), to measure respondents' attitudes. To ensure the accuracy of the constructed model, the study utilized Structural Equation Modeling (SEM) as the primary statistical analysis tool. Moreover, further analyses such as correlation analysis, cluster analysis, and mediation effect analysis were conducted after completing reliability and validity tests to ensure the reliability and validity of the research conclusions. Additionally, measures were taken to control and test for measurement invariance and standard method bias.

3.3. Data collection

Considering that the research objective is to investigate game players' brand loyalty during the gaming process, the selected subjects needed a particular gaming experience. Therefore, Zhejiang Province in China was chosen as the primary survey area due to its well-developed gaming industry and rich participant pool. Hangzhou was selected as a representative city for the survey, while Jiaxing and Lishui were chosen through random sampling to ensure sample representativeness and diversity. This survey included gamers, game platform designers and service providers, professional gaming club members, internet cafe operators, and participants within Zhejiang Province.

In alignment with the distinct characteristics of the participant demographic, this investigation employed a hybrid methodology, integrating both random and non-random sampling strategies to optimize sample selection. For employees engaged in game platform design and service and members of professional gaming clubs, the survey was predominantly disseminated through two major online

Table 1
Constructs and measures of the research items.

Construct	Questionnaire items	Source
	Experience	
TY 1	Users decide to use it by watching the introduction during the live game process	
TY 2	Consumers gradually awaken their previous user experience memories during the gaming process	[11], [36]
TY 3	The game platform will arouse consumers' interest and awaken their experience in real-time	
TY 4	Game platforms will understand consumers' experience with games	
	Interaction	
HD 1	Consumers value the fun and contextual relationship of games	
HD 2	The game platform will be influenced by the game content and videos to decide whether to play the game or not	[18], [19]
HD 3	You and your consumers establish resource relationships through game content, allowing both parties to understand each other	
HD 4	You and your consumers continuously share and exchange experiences through game platform scenario simulation	
	Impression	
YX 1	Consumers often discuss the connection between game content and fun	
YX 2	Your game products or services can enhance consumers' perceived identity	[20], [26]
YX 3	You and your consumers will apply game live streaming after-sales service impression to explore games	
YX 4	You and your consumers will understand their views on game products or services	
	Trust Theory	
XR 1	Consumers communicate their trust in games through game platforms	
XR 2	Consumers will prioritize games with good reputation on gaming platforms	[10], [37]
XR 3	The platform has a long-term cooperation and trust relationship with consumers	
XR 4	Consumers will enjoy and rely on using gaming platforms and games.	
	Brand Loyalty	
ZCD1	Consumers' impression of brand value can affect their purchasing behaviour	
ZCD2	Consumers' impression of the quality and service of a certain game product can affect their subsequent purchasing behaviour	[3], [38]
ZCD3	Consumers' impression of game product content can affect their purchasing behaviour	
ZCD4	Consumers identify with the gaming product brand and make continuous purchases	

platforms: WeChat and QQ. Considering the transient nature of internet café gamers, a QR code scanning approach was utilized for this subgroup; meanwhile, a mixed methodology combining group distribution and random QR code scanning was adopted for surveying the general gaming populace. To prevent data duplication, measures were implemented to ensure that only one response could be submitted per IP address within the online survey apparatus. The online questionnaire, comprising a comprehensive survey package, explained the research objectives, pertinent terminologies, and specified queries in-depth. This study successfully amassed 486 valid questionnaire responses, reflecting the efficacy of the chosen data collection methodologies.

3.4. Data collection and responses' profiles

In the present study, five dimensions were conceptualized to assess the hypothesized model, adhering to the research design and procedures recommended by Anderson and Gerbing [39], as demonstrated in Table 4. The analysis of basic demographic information from the 486 valid questionnaires was conducted using SPSS 20.0 (refer to Table 2 for details). Predominantly, the participant demographic comprised male players, accounting for 66.26% of the sample, while females constituted 33.74%. As for the age distribution of participants, a significant majority (71.60%) fell within the 20-24 years age bracket, with a noted decrease in gaming participation correlating with increased age. Regarding occupational representation, students emerged as the primary gaming cohort, making up 74.28% of respondents, followed by service industry personnel at 12.96%. Regarding gaming frequency, 48.15% of the respondents played games less than five times per week, while 19.55% engaged 6-9 times per week, indicating that most engaged in gaming as a form of entertainment and leisure. However, a small subset (9.88%) reported gaming excessively (more than 30 times per week). The duration of gaming engagement among the participants also revealed a significant commitment to gaming, with 42.59% having played games for over six years, suggesting a considerable temporal continuity in gaming participation. Regarding monthly income, only 6.58% of the respondents reported earning more than 10,000 CNY, whereas 72.84% earned less than 4000 CNY monthly.

3.5. Common method bias

Common Method Variance (CMV) refers to the overlap in variations between two variables caused by the use of similar measurement tools, rather than accurately representing the true relationship between underlying concepts [40]. CMV can inflate correlation coefficients between concepts, leading to incorrect Type I error conclusions. Simultaneously, it can also attenuate the relationship between variables and result in Type II errors, causing significant correlation conclusions to be missed. To mitigate the potential misinterpretation of our findings due to common method variance, we employ the latent variable method [41].

4. Results

To study the structural equation model, we utilised Amos 24.0 software to analyse the overall structure and significance of the model's relationships. The structural equation method primarily investigates the connections between observed and latent variables

Table 2
Basic Information.

Dimension	Demographic profile	Number of firms	Percentage
Gender	Male	322	66.26%
	Female	164	33.74%
Age	Under 19 years old	5	11.11%
	20-24 years old	348	71.60%
	25-29 years old	69	14.20%
	30-34 years old	41	8.44%
	35-39 years old	17	3.50%
	40-44 years old	5	1.03%
	45-49 years old	2	0.41%
	Above 50	4	0.82%
Career	Student	361	74.28%
	Service personnel	63	12.96%
	Retirement personnel	2	0.41%
	Unemployed individuals	46	9.47%
	Others	14	2.88%
Average monthly income (RMB)	Below 4000 yuan	354	72.84%
	RMB 4,001- RMB 7,000	43	8.85%
	RMB 7,001-RMB 10,000	57	11.73%
	RMB 10,001-RMB 12,000	23	4.73%
	More than RMB 13,000	9	1.85%
The latest frequency of watching the live broadcast is in a week	Less than 5 times	234	48.15%
	6-9 times	95	19.55%
	10-15 times	52	10.70%
	16-19 times	44	9.05%
	20-25 times	7	1.44%
How many years of experience have you used a gaming platform	26-29 times	6	1.23%
	More than 30 times	48	9.88%
	Less than six months	65	13.37%
	6-12 months	23	4.73%
	1-less than 3 years	74	15.23%
3-less than 6 years	117	24.07%	
More than 6 years	207	42.59%	

Table 3
Reliability Analysis of the Game Product Loyalty Scale.

Variables	Cronbach coefficient	Number of items
Question 1	0.924	4
Question 2	0.895	4
Question 3	0.917	4
Question 4	0.886	4
Question 5	0.867	4
Total	0.957	20

while constructing one or more structural factors for analysis. Observed variables are those we can directly measure, while latent variables are those inferred from the data of observed variables. The two types of structural equation models are measurement models and structural models [39]. Measurement models, also known as confirmatory factor analysis, describe the relationships between observed variables and latent variables. The structural model, also referred to as the causal model, depicts the causal relationships between latent variables.

4.1. Assessment of the measurement model

4.1.1. Reliability analysis

The main factors of the structural equation model were measured using scales. Therefore, verifying the measurement results' data is an important prerequisite to ensure the significance of subsequent analysis. We utilised the Cronbach coefficient to conduct reliability tests on the internal consistency of various dimensions. The Cronbach coefficient ranges from 0 to 1, with higher values indicating greater reliability. Generally, a Cronbach coefficient below 0.6 is considered unreliable and necessitates questionnaire redesign or the collection of new data for further testing and analysis. A reliability coefficient between 0.6 and 0.7 is considered of basic reliability, between 0.7 and 0.8 is considered reliable, between 0.8 and 0.9 is considered to be of general reliability, and between 0.9 and 1 is considered very reliable. In this analysis, the results of the reliability analysis are presented in Table 3. The overall reliability coefficients of the game brand loyalty scale and various secondary dimensions fall within the range of 0.86 to 1. Therefore, it indicates that the scales exhibit good internal consistency and high reliability.

Table 4
Model Adaptability Test.

Index	CMIN/DF	RMSEA	IFI ¹	TLI ²	CFI ³	NFI ⁴
Result	1.873	0.042	0.982	0.979	0.982	0.973

¹ The closer the value of IFI is to 1, the better, IFI ≥ 0.9 Good.
² The closer the value of TLI is to 1, the better, TLI ≥ 0.9 Good.
³ The closer the value of CFI is to 1, the better, CFI ≥ 0.9 Good.
⁴ The closer the value of NFI is to 1, the better, NFI ≥ 0.9 Good.

Table 5
Convergence Validity and Combined Reliability Testing of the Game Product Loyalty Scale.

Path Relationship	Estimate	AVE	CR		
TY1	←	TY	0.859		
TY2	←	TY	0.887	0.753	0.924
TY3	←	TY	0.863		
TY4	←	TY	0.861		
HD1	←	HD	0.764		
HD2	←	HD	0.883	0.682	0.896
HD3	←	HD	0.832		
HD4	←	HD	0.821		
YX1	←	YX	0.862		
YX2	←	YX	0.86	0.7377	0.918
YX3	←	YX	0.863		
YX4	←	YX	0.848		
XR1	←	XR	0.87		
XR2	←	XR	0.773	0.659	0.885
XR3	←	XR	0.861		
XR4	←	XR	0.734		
ZCD1	←	ZCD	0.726		
ZCD2	←	ZCD	0.823	0.626	0.870
ZCD3	←	ZCD	0.814		
ZCD4	←	ZCD	0.797		

4.1.2. Validity analysis

According to the results of the model adaptation test shown in Table 4, the CMIN/DF (chi-square degree of freedom ratio) is 1.873, which falls within the excellent range of 1-3. Additionally, the RMSEA (root mean square error) is 0.042, which is less than 0.05, indicating excellent performance. The results for other fitness indicators, such as the Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Tucker Lewis Index (TLI), all exceed a satisfactory level of 0.9, with a TLI/CFI value of 0.993. Therefore, after a comprehensive analysis of the data, it can be concluded that the confirmatory factor analysis of this scale demonstrates good model adaptability.

Considering that the confirmatory factor analysis of the scale demonstrates good adaptability, the convergent validity (AVE) and composite reliability (CR) of each dimension of the scale will be further assessed. First, we calculate the standardised factor loadings of each measurement item in the respective dimensions using the established CFA model. Then, we compute the convergence validity and composite reliability values for each dimension using the AVE and CR calculation formulas. According to the established standards, the minimum requirement for the AVE value is 0.5, and the minimum requirement for the CR value is 0.7. These criteria indicate that the model exhibits good convergent validity and composite reliability.

Finally, based on the analysis results presented in Table 5, it can be concluded that in the validity test of the scale, the AVE values for each dimension were all above 0.5, and the CR values were all above 0.7. This indicates that all dimensions of the scale possess good convergent validity and composite reliability.

Moreover, the analysis results in Table 6 reveal that in the discriminant validity test, the standardised correlation coefficients between each dimension are lower than the square root of the corresponding AVE values for each dimension. This finding suggests that each dimension exhibits good discriminant validity.

4.1.3. Descriptive statistics and normality testing

The statistical analysis results described in Table 7 show that the average score of each variable falls within the range of 4-6, with a scale scoring method of 1-7 for positive scoring. Therefore, the research sample’s understanding and behaviour level concerning game product loyalty is above average. Normality tests were conducted for each measurement dimension using skewness and kurtosis. According to the standards proposed by Kline [42] and analysed using SPSS 20.0 software, the absolute values of skewness coefficients for each measurement dimension ranged from 0.006 to 0.179, with a skewness standard error of 0.111. The quotient between the

Table 6
Discriminant validity.

Measurement dimension	YX	HD	TY	XR	ZCD
YX	0.753				
HD	0.748	0.737			
TY	0.862	0.716	0.682		
XR	0.73	0.839	0.69	0.659	
ZCD	0.566	0.719	0.522	0.709	0.626
Square Root of AVE	0.868	0.858	0.826	0.813	0.791

Table 7
Statistical analysis and normality test for the current status of various measurement factors.

Md ¹	Qi ²	Mean	Sd ³	skewness	kurtosis	Pm ⁴	Psd ⁵
TY	TY1	5.10	1.211	-.179	.238	5.131	1.109
	TY2	5.12	1.187	-.031	-.020		
	TY3	5.13	1.217	-.157	.116		
	TY4	5.17	1.168	-.110	.057		
HD	HD1	5.15	1.350	-.085	-.368	5.108	1.164
	HD2	5.16	1.258	-.149	-.167		
	HD3	4.98	1.328	-.098	.232		
	HD4	5.14	1.253	-.180	-.002		
YX	YX1	5.02	1.199	-.049	-.271	5.045	1.028
	YX2	5.07	1.199	.018	-.023		
	YX3	5.01	1.161	.081	-.088		
	YX4	5.08	1.066	.122	.130		
XR	XR1	5.07	1.170	-.062	.157	5.038	1.109
	XR2	5.01	1.124	.132	.025		
	XR3	5.06	1.140	.057	-.096		
	XR4	5.01	1.107	.172	-.121		
ZCD	ZCD1	4.54	1.000	-.006	.370	4.602	.086
	ZCD2	4.62	.895	.091	.195		
	ZCD3	4.64	.906	-.149	.323		
	ZCD4	4.60	.874	-.165	.301		

¹ Measurement dimension.
² Question items.
³ standard deviation.
⁴ population mean.
⁵ population standard deviation.

absolute values of skewness coefficients and the skewness standard error ranged from 0.054 to 1.618. Additionally, the absolute value of the kurtosis coefficient ranges from 0.020 to 0.370, with a standard error of 0.221. The quotient between the absolute value of the kurtosis coefficient and the standard error of kurtosis is between 0.011 and 1.674. At the test level of $\alpha = 0.05$, both skewness Z-score and kurtosis Z-score fall within the standard range of 1.96, indicating that the data for each measurement dimension follows an approximate normal distribution.

4.1.4. Related analysis

The Pearson method [43] was utilised to analyse the correlation among multiple variables in this correlation analysis. Results presented in Table 8 show that each variable exhibits a significant correlation at a 99% confidence level. Examining the Pearson correlation coefficient results reveals that the correlation coefficients between each variable are greater than 0. Impression and trust exhibit the highest correlation coefficient of 0.844, while interaction and brand loyalty have the lowest correlation coefficient of 0.463. This implies that the positive correlation among all variables is statistically significant.

4.1.5. Common variation method testing

Usually, we employ two models, with the baseline model fixing the factor loadings of all common factors at 0. We assume there is no common variation, and the factor loadings that govern the model’s common factors are set at a constant, denoted as ‘a’, regardless of its specific magnitude, which can also be represented as ‘b’. We then compare the differences in chi-square values between the baseline model and the control model to determine their significance. If there is a significant difference in chi-square values between the two models, it suggests the presence of common variation; otherwise, no significant difference is observed. The difference in chi-squared values between 468.313 ($df = 163$) and 471.753 ($df = 162$), obtained using the Common Latent Factor [41], is 3.440 ($df = 1$). However, this difference does not reach a significant level ($p > 0.05$), indicating the absence of common variation and requiring further analysis.

Table 8
Pearson correlation analysis between various dimensions.

Dimension	YX	HD	TY	XR	ZCD
YX	1				
HD	0.811**	1			
TY	0.688**	0.645**	1		
XR	0.658**	0.608**	0.844**	1	
ZCD	0.505**	0.463**	0.642**	0.625**	1

** Significantly correlated at 0.01 level (bilateral).

Table 9
Assuming model Unconstrained to be correct.

Model	DF	CMIN	p	NFI ¹	IFI ²	RFI ³	TLI ⁴
Measurement intercepts	20	31.561	.175	.003	.003	-.002	-.002

¹ IFI Delta-1.

² IFI Delta-2.

³ RFI rho-1.

⁴ RFI rho-2.

Table 10
Model Adaptation Test for Structural Equation Modeling.

Index	CMIN/DF	RMSEA	IFI ¹	TLI ²	CFI ³	NFI ⁴
Result	1.882	0.043	0.982	0.982	0.979	0.982

¹ The closer the value of IFI is to 1, the better, IFI ≥ 0.9 Good.

² The closer the value of TLI is to 1, the better, TLI ≥ 0.9 Good.

³ The closer the value of CFI is to 1, the better, CFI ≥ 0.9 Good.

⁴ The closer the value of NFI is to 1, the better, NFI ≥ 0.9 Good.

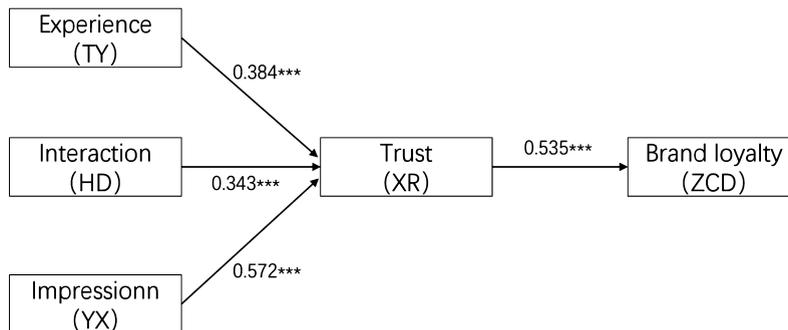


Fig. 2. A Structural Equation Model of Game Brand Loyalty.

4.1.6. Measurement invariance

Measurement invariance is the observation and study of the same phenomenon under different conditions, and whether it yields consistent attribute results. To assess the presence of this consistency, we divided the male and female samples into two groups and compared the measurement results of these two groups to determine if there is indeed uniformity. We found that the p-value in the group test results was 0.175, which exceeded the significance level of 0.05, indicating a lack of consistency or measurement invariance (see Table 9).

4.2. Assessment of the structural model

The model adaptation test results presented in Table 10 show that the CMIN/DF (chi-square degree of freedom ratio) is 1.882, which falls within the excellent range of 1-3 for data results. Additionally, the RMSEA (root mean square error) is 0.043, less than 0.05, which is also within the excellent range for data results. The test results for other fitness indicators such as the Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Tucker Lewis Index (TLI) all achieved a high level of 0.9 or higher, closely approaching 1. The TLI/CFI value was 0.994, indicating that the structural equation model exhibits excellent model fitness.

By studying this theoretical model (refer to Fig. 2), we discovered that game experience has a notably positive influence on game trust. Additionally, game interaction, impression, and trust during the gaming process foster game brand loyalty. Therefore, game developers and game platforms should acknowledge the significance of these factors in the game industry’s development.

Table 11
Convergence Validity and Combined Reliability Testing of the Game Product Loyalty Scale.

Path relationship			Estimate	S.E.	C.R.	P
XR	←	TY	0.384	0.087	3.658	***
XR	←	HD	0.343	0.054	1.797	***
XR	←	YX	0.572	0.093	4.391	***
ZCD	←	XR	0.535	0.121	3.208	***
ZCD	←	TY	0.216	0.105	1.114	0.256
ZCD	←	HD	0.216	0.065	2.373	0.132
ZCD	←	YX	0.031	0.137	0.171	0.895
TY4	←	TY	0.889	—	—	***
TY3	←	TY	0.915	0.040	26.235	***
TY2	←	TY	0.898	0.041	24.425	***
TY1	←	TY	0.907	0.042	24.873	***
HD4	←	HD	0.891	—	—	***
HD3	←	HD	0.866	0.044	23.135	***
HD2	←	HD	0.901	0.043	25.439	***
HD1	←	HD	0.824	0.046	20.41	***
YX4	←	YX	0.899	—	—	***
YX3	←	YX	0.887	0.043	24.564	***
YX2	←	YX	0.896	0.042	25.857	***
YX1	←	YX	0.882	0.043	24.744	***
XR1	←	XR	0.891	—	—	***
XR2	←	XR	0.886	0.037	25.034	***
XR3	←	XR	0.898	0.037	25.576	***
XR4	←	XR	0.883	0.037	24.573	***
ZCD4	←	ZCD	0.885	—	—	***
ZCD3	←	ZCD	0.857	0.049	21.336	***
ZCD2	←	ZCD	0.851	0.049	21.218	***
ZCD1	←	ZCD	0.832	0.053	20.402	***

*, **, and *** denote significance at $\alpha = 0.05$, $\alpha = 0.01$, and $\alpha = 0.001$, “—”no effect, respectively.

4.2.1. Results of hypothesis 1-3

The weights of the influencing factors on trust (XR), such as experience (TY), interaction (HD), and impression (YX), are 0.384, 0.343, and 0.572, respectively, with highly significant p-values less than 0.001. These results suggest that consumer experience, interaction, and impression during the gaming process The standardised path coefficients for experience (TY) from TY1 to TY4 are 0.889, 0.915, 0.898, and 0.907, respectively, indicating a substantial positive impact of introduction, awakening game memory experience, arousing interest, and active platform participation during live gaming on trust. Similarly, the standardised path coefficients for interaction (HD) from HD1 to HD4 are 0.891, 0.866, 0.901, and 0.824, respectively, demonstrating that HD1 to HD4 have a significant positive influence on interaction. Likewise, the standardised path coefficients for Impression (YX) from YX1 to YX4 are 0.899, 0.887, 0.896, and 0.882, respectively, indicating that YX1 to YX4 also have a significant positive impact.

In conclusion, consumer experience, interaction, and impression during the gaming process foster trust in gaming products. Thus, H1, H2, and H3 are all confirmed as valid.

4.2.2. Results of hypothesis 4

The weight of the trust factor (XR) on loyalty (ZCD) is 0.535, ranking second only to impression, with a significance p-value less than 0.001. This result indicates that game trust has a significant positive impact on game brand loyalty. Additionally, the standardised path coefficients for trust (XR) from XR1 to XR4 are 0.891, 0.886, 0.898, and 0.879, respectively, signifying a significant positive impact of XR1 to XR4 on trust (XR). Therefore, trust in game products has a significant positive influence on the brand loyalty of game products and validates H4.

4.3. Test of mediating effects

To test the existence of the mediating effect in our structural equation model, we used Bootstrap technology in AMOS software. In Table 11, the paths $TY \leftarrow XR$, $HD \leftarrow XR$, $YX \leftarrow XR$, $XR \leftarrow ZCD$ correspond to $W16$, $W17$, $W18$, and $W19$ in Fig. 3, respectively, and they have a significantly positive impact relationship. However, the paths $TY \leftarrow ZCD$, $HD \leftarrow ZCD$, and $YX \leftarrow ZCD$ correspond to $T2 = W20$, $H2 = W21$, and $G2 = W22$ in Table 12, respectively, do not have significant p-value results. In Table 12, $T1 = W16 * W19$, $T = T1 + T2$; $H1 = W17 * W19$, $H = H1 + H2$; $G1 = W18 * W19$, $G = G1 + G2$. The lower and upper limits of $T1$, $H1$, and $G1$ in the 95% confidence interval are all positive, and $P < 0.05$, which is significant. This indicates that $T1$, $H1$, and $G1$ have indirect mediating effects and belong to complete mediation. However, the lower and upper limits of the 95% confidence intervals for $T2$ and T , H and $H2$, G and $G2$ are located on both sides of 0, and $P > 0.05$. The 3 total effects and 3 direct effects are not significant, and the pathway relationships $W20$, $W21$, and $W22$ are not significant in the table. Therefore, all three effects belong to complete mediation.

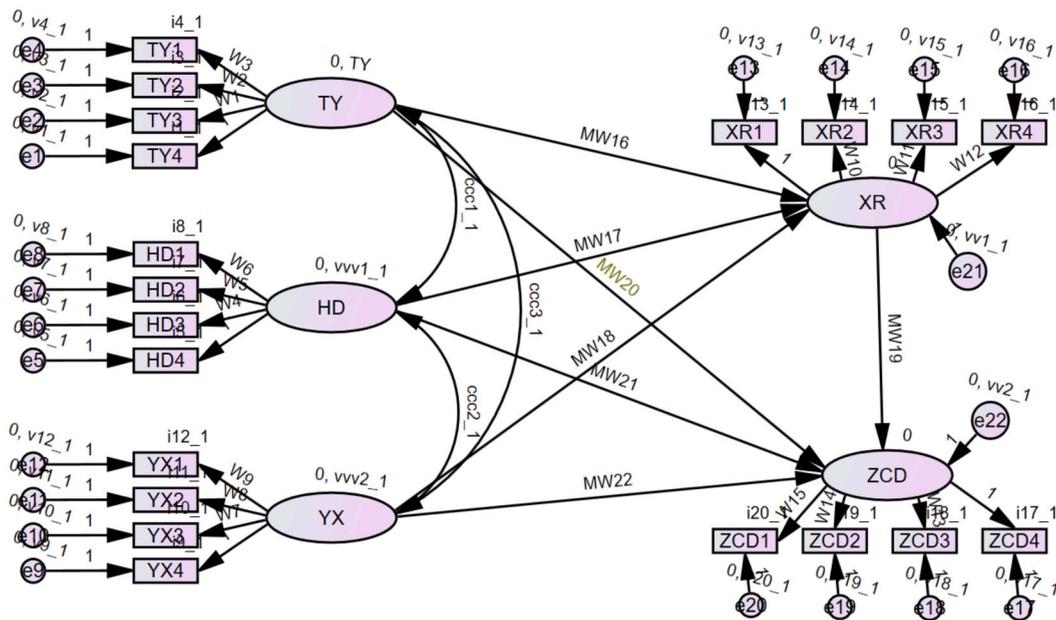


Fig. 3. Mediation Effect Test Path Relationship Diagram.

Table 12
Significance of the measurement model based on gender clusters of male.

Parameter	Estimate	Lower	Upper	P
T1	0.130	0.015	0.362	0.017
T2	0.111	-0.151	0.383	0.387
T	0.241	-0.018	0.49	0.167
H1	0.04	0.009	0.15	0.018
H2	0.15	-0.005	0.288	0.142
H	0.19	-0.031	0.345	0.055
G1	0.223	0.043	0.605	0.015
G2	0.02	-0.387	0.309	0.971
G	0.243	-0.012	0.487	0.138

4.4. Multi group analysis

This study preliminarily examined the impact of gender-based clustering on the path coefficients of model moderating effects (see relevant Tables 13 for details). Observations indicate that within the male sample group, the path coefficient from experience to trust was -0.116 , whereas, within the female sample group, this path coefficient was 0.414 , resulting in a difference of 0.53 . The corresponding significance levels exceeded 0.05 for one group while being significant (< 0.001) for the other, suggesting that the moderating effect under this clustering strategy is not significant. Similarly, clustering analysis based on gaming age also failed to reveal significant moderating effects.

Subsequently, the study constructed and compared two restricted and unrestricted models (refer to relevant Tables 14). In the restricted models, constraints were set to equalize the moderating path coefficients; in the unrestricted models, no such constraints were applied to the path coefficients. By comparing the chi-square values and degrees of freedom of the two types of models, a chi-square difference test was employed to assess the significance of the moderating effects. The comparative results revealed that the chi-square difference values for the restricted and unrestricted models were 60.487 and 37.234 , respectively, indicating significant discrepancies. However, these differences still needed to substantiate the significance of the clustering strategy's impact on moderating effects.

5. Discussion theoretical and practical significance

5.1. Summary of research results

Based on the model we constructed, this research presents five variables: experience, interactivity, impression, trust, and brand loyalty. Within the entire research framework, game experience, interactivity, and impression are positively correlated with game

Table 13
Significance of the measurement model based on gender clusters of male.

Gender	Path Relationship	Estimate	S.E.	C.R.	P
Male	XR ← TY	-0.116	0.193	-0.728	0.467
	XR ← HD	0.106	0.104	1.043	0.297
	XR ← YX	0.906	0.188	5.835	***
	ZCD ← XR	0.299	0.143	1.36	0.174
Female	XR ← TY	0.414	0.111	3.828	***
	XR ← HD	0.051	0.07	0.697	0.486
	XR ← YX	0.529	0.119	4.769	***
	ZCD ← XR	1.086	0.275	2.894	0.004
Less than three years	XR ← TY	-0.069	0.269	-0.304	0.761
	XR ← HD	0.056	0.111	0.522	0.602
	XR ← YX	0.902	0.295	3.844	***
	ZCD ← XR	-0.456	0.394	-0.761	0.447
More than three years	XR ← TY	0.287	0.113	2.673	**
	XR ← HD	0.080	0.068	1.103	0.27
	XR ← YX	0.610	0.111	5.911	***
	ZCD ← XR	0.800	0.146	3.974	***

*, **, and *** denote significance at $\alpha = 0.05$, $\alpha = 0.01$, and $\alpha = 0.001$, respectively.

Table 14
Comparison between Restricted and Unrestricted Models.

Model	DF	CMIN	P	NFI	IFI	RFI	TLI
Structural weights	27	60.487	0	0.007	0.007	-0.001	-0.001
Structural weights	27	37.234	0.091	0.0074	0.004	-0.004	-0.004

trust, and game trust is positively correlated with game brand loyalty. This finding is consistent with previous related studies [44]. Gamers are influenced by their interest, impression, and understanding of the game content and products and the interaction between the platform and player consumers. These influences evolve into trust in game products and subsequently foster loyalty to game brands. We have incorporated concepts from psychology, consumer behaviour, and marketing, expanding from traditional game research and conducting a series of model design and analysis research. Our discovery enhances the application of brand loyalty theory and cognitive theory in the gaming field, which can further promote the development of the gaming industry.

5.2. Explanation and analysis of results

This study’s theoretical contributions are manifested in three main aspects: First, by integrating Brand Loyalty Theory and Cognitive Theory, this research theoretically expands our understanding of the mechanism behind brand loyalty formation within the gaming industry. Specifically, in a gaming context, this study intricately analyzes how dimensions such as gaming experience, gaming interaction, and game impressions influence the formation of brand loyalty through the mediating variable of game trust, offering a composite perspective to comprehend how players establish profound connections with game brands.

Secondly, the empirical analysis of this research, based on a survey of gamers in Zhejiang Province, China, and the application of structural equation modelling, confirms the positive correlations between game interaction, game experience, game impression, and game trust, as well as the positive impact of game trust on game brand loyalty. These findings not only statistically support the research hypotheses but also provide an empirical basis for gaming enterprises to formulate strategies more effectively to enhance players’ brand loyalty. The finding that game trust acts as a complete mediator further underscores the importance for gaming companies to focus on improving the quality of player experiences, interaction, and positive impressions in order to build player trust.

Lastly, the policy recommendations and considerations proposed by this study offer specific and practical strategy suggestions for stakeholders in the gaming industry. These suggestions not only aid game developers and marketers in better understanding and meeting player needs but also promote the long-term sustainable development of game brands. Especially in the current context of increasingly fierce competition in the game market, how to maintain and enhance brand loyalty represents a significant challenge for gaming enterprises. By deeply analyzing the mechanism of game player brand loyalty formation, this study provides new perspectives and strategies, contributing theoretical and practical guidance for the healthy development of the gaming industry.

In summary, this research not only contributes theoretically to the field of game brand loyalty research but also provides strategy suggestions based on player psychology and behaviour for gaming enterprises, holding significant theoretical and practical value. Through a deep analysis of how gaming experiences, interactions, and impressions affect brand loyalty, this study lays an important theoretical foundation and empirical support for further exploration and optimization of game brand management strategies.

5.3. Discussion of relationship with previous research

We developed a new research model to examine the relationship between game experience, interaction, impression, trust, and brand loyalty during the gaming process. We aimed to explore the factors influencing game brand loyalty and determine whether they are influenced by intermediary factors. Our contributions are as follows: First, this research contribute to understanding the connection between consumer psychological factors and brand loyalty. Second, we have applied the concept of trust as a mediating factor from a cognitive theory perspective to assess its direct effect on final brand loyalty. Thus, trust has a positive impact on brand loyalty. Findings both support and expand upon previous research on brand loyalty and aligns with earlier studies that focus on the psychological factors and cognition of game consumers during their gaming experiences. Furthermore, we have investigated the mediating role of trust as proposed in cognitive theory [31] and have determined that this mediating effect significantly enhances brand loyalty. This is an improvement to prior research.

5.4. Emphasis on the importance of results

Results hold both practical and theoretical significance. We have acquired a profound understanding of the potential role of psychological and cognitive factors in enhancing brand loyalty within the gaming process and have provided suggestions for addressing challenges. These findings contribute to the integration of existing theories on brand loyalty and cognitive theories, providing valuable insights for the gaming industry's development, policy formulation, and future research directions. This research underscores the direct positive impact of experience, interaction, and impression in the process of cultivating brand loyalty in gaming, as well as the complete mediating role of trust in building brand loyalty. We aim to optimise both theory and practice to achieve more effective industrial development.

5.4.1. Experience

Consumer experience during the gaming process can have a positive, trust-building effect on game products. According to the model validation results, for gaming platforms, allowing consumer gamers to watch the live gaming process, gain real-time understanding of their gaming experience, and stimulate interest through evoking memories help establish trust in gaming products. Live streaming on gaming platforms can rekindle gamers and consumers' past gaming experiences, generate interest or affinity with the game product, an ultimately solidify consumer trust.

5.4.2. Interactivity

Interaction within the gaming community during the gaming process have a positive effect on promoting trust in game products. According to the validation results of the model, gamers and consumers are influenced by game content and video when deciding whether to play the game. They also value the fun and situational aspects of the game. Meanwhile, game platforms hope to establish resource relationships with gamers, allowing both parties to understand each other and continuously share and exchange experiences through interaction, thereby building trust in game products. Therefore, game platforms should make efforts to establish interaction and communication with game players at different levels, create consumption incentives, and help players gradually build trust.

5.4.3. Impression

Positive impressions during gaming experience can positively influence the establishment of trust in game products. According to the model validation results, gamers are influenced by various factors such as game live streaming and after-sales service, which help them better understand and become attracted to game products. Ultimately, these products and services contribute to the formation of consumer impressions. Gaming platforms also aim to engage with gamers on interesting game-related topics and share and exchange experiences to build trust in their game products. Therefore, game platforms should make efforts to interact and communicate with players at different levels, enabling them to form brand impressions and fostering consumer trust in the later stages of the gaming experience.

5.4.4. Trust

Trust during the gaming process can have a positive impact on building loyalty towards game products. According to the model validation results, gamers and consumers convey their trust in the game through the platform, prioritise games with high ratings and credibility on the platform, and consequently develop a dependence on the platform and the game, forming brand loyalty. Meanwhile, gaming platforms must expand trust and communication with game players to establish complete trust in game products. Therefore, game platforms should also promote various levels of trust interaction with game players and extensively assist gamers and consumers in forming brand trust, which will enable players to establish brand loyalty later on.

5.4.5. Brand loyalty

Players exchange experiences on gaming products with others who share common interests, thereby forming brand loyalty towards the product. According to model validation results, brand loyalty is fostered by gamers but requires active participation and contribution from game platforms. Factors such as game product content, brand value, product quality, and services influence gamers' purchasing behaviour. Many game products consider consumer preferences before game release and continuously engage and assist consumers during gameplay. In today's rapidly evolving landscape, the lifecycle of game products is becoming increasingly shorter. Thus, it is crucial to determine whether the product's content and storyline can captivate consumers and swiftly establish brand loyalty to ensure continued dependence on the product.

5.5. Limitations and future research directions

We have developed a new research model to examine the relationship between game experience, game interaction, game impression, game trust, and game brand loyalty throughout the gaming process. We aim to investigate the factors influencing game brand loyalty and whether they are influenced by intermediary factors. Our contributions are as follows: Firstly, this study helps us comprehend the connection between consumer psychological factors and brand loyalty. Secondly, we have incorporated the concept of intermediary factors from trust theory to observe whether they have a direct influence on the ultimate brand loyalty. It is evident that they do indeed impact brand loyalty.

5.5.1. Limit

It is important to acknowledge the limitations of this research. The research was conducted with a specific sample and in a particular context, which may restrict the generalisability of the research findings.

Our research is constrained by human, material, and financial resources, and the scope of the survey is primarily within Zhejiang Province, China. The sample may lack a broader diversity, and future research can extend the geographical scope of sample collection. Similarly, subjects lack diversity and range in selected attributes such as age. Most participants are young, with relatively fewer elderly participants. While those who have played games continuously, whether single-player or online, may develop experiences, impressions, interactions, and loyalty toward the games, further investigation on game types and categories' specific impact on game brand loyalty is necessary. Furthermore, specific surveys can be conducted for different games, technical tools, or platforms. Finally, further investigation is necessary to develop strategies that address challenges and promote responsible use of these research conclusions in the gaming industry's development.

The research is restricted owing to the paper's length and sole focus on the specific issue under study, potentially overlooking other relevant factors. However, although it may contain potentially missing necessary information, it simplifies the research question and increases the research's clarity. Additionally, the research is influenced by various factors, including the researcher's experience, knowledge background, methods used, adequacy of data acquisition, methods, and models for data analysis, which could impact the research results.

5.5.2. Future research

Although we established models of brand loyalty in gaming from various disciplinary backgrounds and drawn significant conclusions, the question of whether excessive trust from players during the gaming process leads to obsession and blindness must be considered in future research. Teenagers and elderly people's irrational consumption behaviour due to excessive temptation from platforms and game content can also be further explored. Additionally, future researchers should consider different consumption concepts based on various cultural backgrounds. This can be extended to compare game consumers in other countries such as the United States, India, Japan, Israel, and Saudi Arabia. It will greatly increase research value and contribution. Combining different fields can also contribute to the research.

In summary, this research expands the application of brand loyalty theory and cognitive theory in the gaming industry. It posits that game experience, interaction, impression, and trust of game consumers have a positive promoting effect on brand loyalty during the gaming process. Trust, as a mediating variable, plays a key role in complete mediation. It also provides suggestions and reflections for the development, policy formulation, and future research of the gaming industry. These findings enrich existing literature and emphasise the importance of psychological and cognitive factors in the gaming process. Through understanding these factors and their impacts, game platforms and developers can create more enjoyable and interactive games. Furthermore, industry managers and policymakers can make wiser decisions to enhance the gaming consumer experience.

Ethics approval

This study was reviewed and approved by Academic Committee of Zhejiang University of Finance and Economics Dongfang College (No. 132[2022]).

Consent to participate

Informed consent was obtained from all the participants.

Consent for publication

All the participants consented to submit findings for publishing purposes.

CRedit authorship contribution statement

Zhao Xuanze: Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Sam Toong-hai:** Supervision. **Zhang Xia:** Conceptualization. **Liu Yujia:** Investigation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Zhao Xuanze reports financial support was provided by Zhejiang Cultural and Creative Industry Association.

Data availability

<https://pan.baidu.com/s/1NaFfVw6k56Bf5J7BdHzJPA?pwd=zirf>

Extract code: zirf

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