Investigating the Impact of Peer Relationships on Student's Motivation and Attitudes Towards Mobile Gaming

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ABSTRACT

With the outbreak of COVID-19, digital learning rapidly became a crucial pillar of global education systems, and the use of mobile games has become increasingly prevalent among upper elementary school students. This study aims to explore the relationship between upper elementary school student's motivations and attitudes toward mobile gaming and their peer relationships, with particular attention to the influence of background factors such as gender, grade level, and parental attitudes. (With a focus on the impact of background variables, including gender, grade level, and parental views, this study intends to investigate the relationship between upper elementary school students' motivations and attitudes toward mobile gaming and their peer relationships.) The study employed a questionnaire survey and structural equation analysis involving 400 upper elementary school students from Kaohsiung City, Taiwan. Results showed that males scored significantly higher than females in terms of self-efficacy and flow state; fifth-grade students scored substantially higher than sixth-graders in self-efficacy; and students whose parents did not prevent them from playing mobile games scored significantly higher in stress relief, flow state, and attitudes towards mobile games. Structural equation modelling analysis further revealed that mobile game motivation strongly affects students' gaming attitudes and is highly related to flow state and sense of self-efficacy. Peer relationships were found to have a moderate positive influence on gaming motivation, while stress relief and peer and family influences were identified as key drivers.

Keywords: Mobile Gaming, Motivation towards Mobile Gaming, Attitudes towards Mobile Gaming, Peer Relationships, Upper Elementary School Students.

1. Introduction

The outbreak of COVID-19 has profoundly impacted various global sectors, with the educational field experiencing particularly significant changes. As the pandemic fluctuated, public health policies were continuously adjusted, posing unprecedented challenges to traditional teaching methods and necessitating a transformation in educational practices. In response to these challenges, digital learning rapidly emerged as a critical pillar sustaining global education systems [1][2]. During the pandemic, digital devices such as smartphones and tablets became essential tools, transitioning from mere accessories to indispensable components of education and daily life [3]. Within this context, mobile games have become increasingly prevalent, particularly among upper elementary school

students. These students utilized smartphones for learning and communication and as tools for flow state and social interaction. This shift has sparked research interest in understanding student's motivations for using mobile games and the impact of such usage on their peer relationships.

Mobile gaming has been recognized as a significant factor influencing student's peer relationships and learning outcomes. Studies have shown that mobile gaming habits can impact student's social interactions [4]. For elementary school students, interactive mobile math games with help-seeking mechanisms have been proposed to enhance learning self-efficacy, motivation, and social interactions [5]. Additionally, playing and designing location-based mobile learning games have been found to provide engaging educational experiences and foster interactions among students and with the content [6].

Moreover, research indicates that students perceive mobile games positively as enhancing engagement and motivation in subjects like social studies [7]. However, excessive mobile gaming, influenced by peer relations, self-efficacy, and self-control, can lead to prolonged gaming durations [8]. The enjoyment and ease of play in mobile gaming have been identified as predictors of students' attitudes and intentions to continue gaming, highlighting the importance of these factors in shaping students' perceptions and behaviors [9].

This study explores the intricate relationship between peer relationships and mobile game motivation among elementary school students in Kaohsiung City, Taiwan. It specifically examines how stress relief, peer influence, flow state, and self-efficacy impact students' attitudes toward mobile games. The primary contributions of this research are as follows (It especially looks at how elements including stress alleviation, peer pressure, flow state, and self-efficacy influence students' attitudes about mobile games. The following are the main contributions of this study): Firstly, this study examines the relationship between peer relationships and mobile game motivation among upper-grade elementary school students. Utilizing questionnaire surveys and structural equation modelling analysis, it explores how stress relief, peer influence, flow state, and self-efficacy impact students' attitudes toward mobile games.

Additionally, it investigates how various background variables—such as gender, grade, and parental attitudes, affect these relationships. Secondly, it reveals the impact of game time, experience level, and parental attitudes on students' gaming experiences. The study found that the longer the game time, the higher the scores in stress relief, self-efficacy, flow state, peer relationships, and overall attitude toward games. Thirdly, students with more gaming experience better use games to manage stress, enhance self-efficacy, and enjoy the experience flow. Fourthly, students whose parents do not restrict gaming scored significantly higher in stress relief, flow state, and overall attitude toward mobile games than those whose parents have conditional restrictions. Fifthly, it confirms that the flow state is the core motivation for students' engagement in mobile games. Lastly, it proposes that mobile game motivation mediates between peer relationships and game attitude.

2. Literature review

Peer Relationships

Peer relationships play a significant role in mobile gaming, influencing various aspects of gameplay and user behaviour. Wang [10] highlights the importance of peer recommendations in

mobile social games, emphasizing the impact of needs-supplies fit and game identification. This suggests that peer interactions can shape players' choices and experiences in mobile gaming environments. Additionally, Bunz et al. [11] found that friends who already play a game can strongly influence both younger and older adults, indicating that offline relationships substantially affect digital gaming behaviours. Moreover, the study by Lin et al. [12] reveals that social influence and enjoyment significantly affect mobile game users' behavioural intentions, underscoring the role of peer interactions in shaping individuals' decisions to engage with mobile games. Peer relationships also impact online gaming behaviours, with poor peer relationships potentially leading to problematic online gaming [13].

Peer relationships play a significant role in influencing motivation towards mobile gaming. Studies have shown that peer influence can impact gamers' satisfaction, purchasing behaviour, and even addiction levels [14][15]. Furthermore, Silaban et al. [16] emphasize that users' sense of belonging while playing online mobile games can lead to addictive behaviours such as repetitive and prolonged play, highlighting the impact of peer relationships on gaming addiction. In mobile gaming, peer relationships extend beyond mere gameplay interactions. Lee et al. [17] discuss how games like Pokémon GO promote physical activity and enhance social interaction among players, fostering camaraderie and competition among friends.

Similarly, Rauschnabel et al. [18] suggest that playing mobile AR games with friends can strengthen relationships, indicating that shared gaming experiences contribute to social bonding. Overall, peer relationships play a multifaceted role in mobile gaming, influencing game choices, user behaviours, addiction tendencies, physical activity, and social interactions. Understanding the dynamics of peer influence in mobile gaming environments is crucial for developers and researchers aiming to enhance user experiences and promote healthy gaming behaviours.

Attitudes towards Mobile Gaming

Mobile games have become increasingly popular, influencing individuals' motivations and attitudes towards playing them. Research has shown that social norms play a significant role in the adoption of mobile games, affecting users' attitudes towards these games [19]. Furthermore, the gratifications derived from mobile games, such as socialization and relationship maintenance, are significant predictors of users' intention to engage with these games [20]. Furthermore, the enjoyment derived from playing mobile games has been found to impact attitudes towards the games [9] positively. Interest in playing games has also been shown to positively affect attitudes towards playing games [21].

Motivations towards Mobile Gaming

Mobile gaming has become a prevalent form of flow state, offering individuals enjoyment and motivation [22]. Studies have shown that individuals who engage in mobile gaming for extended periods exhibit high motivation levels akin to addiction tendencies [23]. The motives behind mobile gaming vary, encompassing aspects such as self-realization, social interaction, rivalry, addiction, and escapism [24]. Additionally, the perceived value of information disclosure is crucial in influencing gaming motives and gameplay [25].

Mobile gaming has been identified as a potential tool for stress relief and mood improvement. Research suggests that individuals may turn to mobile gaming to alleviate psychological pressure and feelings of constraint, finding freedom and enjoyment in the virtual world of games [26]. Studies have shown that engaging in video games, including mobile games, can lead to a reduction in stress levels and an improvement in mood states, with the potential to impact psychological well-being positively[27]. Furthermore, mobile gaming has been compared to other activities like horticultural tasks, indicating that it can have similar stress-reducing effects on mental well-being [28].

Moreover, the impact of mobile gaming on peer relationships within families has been studied. Lande et al. [29] suggested a potential link between playing mobile games and improving family communication and closeness, indicating a positive influence of mobile gaming on familial interactions.

The relationship between Self-Efficacy and mobile gaming is multifaceted and influenced by various factors. Research has shown that mobile games offer behavioural possibilities that allow users to engage in activities leading to self-efficacy, socialization, and immersion [30]. Players can achieve things beyond reality through attributes like role-playing and character abilities, stimulating imagination and leading to Self-Efficacy [31]. The need for gratification and experiential motives fulfilled by online games mainly focus on providing a flow state and filling time through interactions with others, catering to participants' flow state needs [32]

3. Methodology

The methodology of this study adopts a survey research method and employs quantitative analysis. Through systematic questionnaire design, objective data is collected to test hypotheses or understand the differences in participants' attitudes and thoughts, thereby minimizing the influence of subjective factors. The questionnaire uses a 5-point Likert scale and is distributed via Google Sheets. Participants can complete the survey at their convenience in terms of time and location, free from temporal and spatial constraints, which increases participation and response rates. Anonymity is ensured, making participants more willing to provide honest responses, thus enhancing the reliability of the data. The questions in the questionnaire are typically standardized, maintaining consistent meaning and context, which aids in comparing responses among different participants and improves data accuracy and comparability. Since the questionnaire can cover multiple topics and aspects, the issues explored are relatively broad, resulting in more comprehensive research findings.

The primary focus of this study is to investigate the relationship between upper elementary school students' motivations and attitudes towards mobile gaming and their peer relationships. By employing a questionnaire survey and statistical analysis, the research aims to understand whether students' motivations and attitudes towards mobile gaming, under various background factors, affect their peer interactions and whether there are differences and correlations among the variables[33]. The research framework is illustrated in Figure 1.

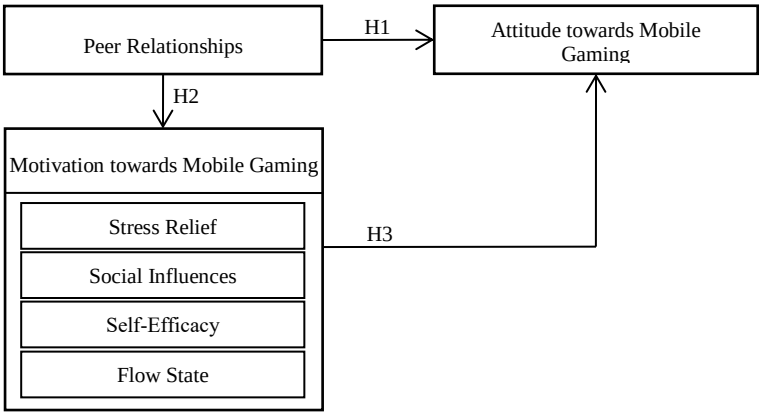


Figure 1. The integrated research framework.

Peer relationships among upper elementary school students significantly influence their attitudes towards mobile gaming. Research indicates that positive peer interactions can enhance students' engagement with digital games, fostering a more favourable attitude towards gaming as a social activity. A moderate positive relationship between peer relationships and learning attitudes suggests that strong peer connections can enhance students' overall gaming experiences [34]. Mobile games designed for social inclusion can improve peer interactions, promoting empathy and teamwork among students, which positively affects their gaming attitudes[35]. Hence, the following is hypothesized.

H1: Peer relationships among upper elementary school students significantly impact their attitude toward mobile gaming.

Peer relationships among upper elementary school students significantly influence their motivation for mobile gaming. The social dynamics within peer groups can enhance engagement and motivation, particularly in educational contexts where mobile games are utilized as learning tools. Research indicates that game-based learning activities often incorporate peer interactions and can lead to increased motivation and deeper engagement among students. For instance, Yang et al. highlight that peer interaction in small groups is crucial for enhancing students' engagement during learning activities, which suggests that cooperative learning strategies, such as peer tutoring, can effectively promote motivation and performance in educational settings [36]. Hence, the following is hypothesized.

H2: Peer relationships among upper elementary school students significantly impact their motivation for mobile gaming.

The motivation for mobile gaming usage among upper elementary school students significantly shapes their attitudes toward gaming. Research highlights that factors such as perceived enjoyment and ease of play are crucial in developing positive attitudes, influencing students' intentions to continue playing mobile games [9]. Moreover, social interaction and entertainment motivations contribute to this demographic's widespread acceptance of mobile gaming [37]. Hence, the following is hypothesized.

H3: The motivation for mobile gaming usage among upper elementary school students significantly impacts their attitude towards mobile gaming.

The questionnaire for this study was developed after reviewing relevant literature and data organization. The content of the questionnaire is divided into four sections: “Basic Information”, “Motivation towards Mobile Gaming Scale”, “Attitude towards Mobile Gaming Scale” and “Peer Relationships Scale.” Each section is detailed as follows:

Demographic Information

This section aims to gather background data about the participants, including gender, grade level, parental attitude, average daily time spent on mobile games, average holiday time spent on mobile games, and the years of mobile gaming experience.

Mobile Gaming Motivation Scale

To understand the motivations of upper elementary school students for mobile gaming, this scale is divided into four sections: Stress Relief, Peer Influence, Flow State, and Self-Efficacy.

- Stress Relief: To assess whether students use mobile games to alleviate stress, this section includes five items (SR1–SR3).
- Social Influences: To determine if students are influenced by their peers and family in mobile gaming, this section consists of seven items (SI1–SI3).
- Self-Efficacy: To explore if self-efficacy influences a student’s mobile gaming, this section includes seven items (SE1–SE4).
- Flow State: To examine whether the flow state of mobile games affects students, this section contains eight items (FS1–FS3).

Attitude towards Mobile Gaming Scale

To understand the attitudes of upper elementary school students towards mobile gaming, this scale examines the psychological perceptions and behavioural manifestations. This section includes eight items (AMG1–AMG3).

Peer Relationships Scale

Peer Relationships scale focuses on the student’s interactions with peers at school, after-school programs, or online. It includes eight items (PR1–PR4). These sections are designed to capture the breadth of student’s peer interactions in different contexts.

4. Data Analysis

Descriptive statistics were employed to analyze the distribution of student’s motivations and attitudes towards mobile Gaming and their peer relationships, focusing on background variables such as gender, grade level, Parents’ attitudes, average daily and holiday time spent on mobile games, and Years of mobile gaming experience. The questionnaire for this study was administered to fifth and sixth-grade students from four elementary schools in Kaohsiung City using convenience sampling. A total of 415 responses were collected, with 400 valid questionnaires retained after excluding incomplete responses and those with extreme or patterned answers. The effective response rate was 96.38%. Among them, 206 were male (51.50%) and 194 were female (48.50%). The grade distribution was 120 fifth graders (30%) and 280 sixth graders (70%). In terms of parental attitudes towards mobile gaming, 87 students (21.75%) reported that their parents rarely restrict their gaming time, while 313 students (78.25%) indicated that their parents impose conditional time limits.

Regarding average daily time spent on mobile games, 165 students (41.3%) played for 60 minutes or less, 63 students (15.8%) played between 61 and 120 minutes, 112 students (28%) played between 121 and 240 minutes, and 60 students (15%) played for more than 240 minutes. On holidays, 77 students (19.3%) spent 1 hour or less on mobile games, 97 students (24.3%) spent between 1 and 2 hours, 97 students (24.3%) spent between 2 and 4 hours, and 129 students (32.3%) spent more than 4 hours. Concerning the duration of exposure to mobile gaming, 29 students (7.3%) had been playing for less than 6 months, 42 students (10.5%) for 6 months to 1 year, 53 students (13.3%) for 1 to 2 years, and 276 students (69%) for more than 2 years. These findings are summarized in Table 1.

Table 1. Demographic information for respondents

Variables	Values	Frequency	Percentage
Gender	Male	206	51.50%
	Female	194	48.50%
Grade	Fifth grade	120	30.00%
	Sixth grade	280	70.00%
Parents' attitudes towards children playing mobile games	Not preventing	87	21.75%
	Conditionally allowing	313	78.25%
Average daily time spent on mobile gaming	≤ 1 hour	165	41.25%
	1 hour to 2 hours	63	15.75%
	2 hours to 2 hours	112	28.00%
	> 4 hours	60	15.00%
Average time spent on mobile gaming during holiday	≤ 1 hour	77	19.25%
	1 hour to 2 hours	97	24.25%
	2 hours to 4 hours	97	24.25%
	> 4 hours	129	32.25%
Years of mobile gaming experience	≤ 6 months	29	7.25%
	6 months to 1 year	42	10.50%
	1 year to 2 years	53	13.25%
	> 2 years	276	69.00%

N=400

This study's data analysis was conducted in two main steps: data reduction process and structural relationship analysis. The data reduction process aimed to decrease the number of variables and parameters in the research model to achieve a reasonable ratio between sample size and estimated parameters in the Structural Equation Model (SEM). The structural relationship analysis was used to examine the relationships between peer relationships, motivations for using mobile games, and attitudes and evaluate the relationships among these three performance variables.

This study's data reduction process involved six constructs, each containing three to four items. Four of these constructs (stress relief, peer and family influence, flow state, and self-efficacy) constitute the latent variable of motivations for using mobile games. These six constructs underwent validity and reliability tests before calculating a single score to represent each construct. Confirmatory

Factor Analysis (CFA) was performed using Amos to examine the construct validity of each scale by evaluating how well the items measured each construct. Following Kelloway's [38] recommendation, each construct's Goodness of Fit Index (GFI) exceeded the standard of 0.9, thus establishing construct validity. Reliability analysis was conducted by calculating Cronbach's alpha for each scale. Cronbach's alpha (α) is a measurement that calculates the internal consistency of an assessment instrument. The value of Cronbach's alpha between 0.6 and 0.8 is deemed acceptable [39]. In this study, Cronbach's alpha of the intuitive scale scored above 0.6 (0.670–0.859) and had acceptable overall internal consistency. The final results of construct validity and reliability tests are shown in Table 2.

Table 2. Construct reliability and the values for composite measures

Constructs	No of items	Means	Standard deviation	Cronbach's alpha
Stress relief	3	4.146	0.681	0.760
Social Influences	3	3.962	0.724	0.670
Self-Efficacy	4	3.606	0.741	0.806
Flow state	3	3.985	0.680	0.713
Peer Relationships	4	4.241	0.748	0.859
Attitude towards Mobile Gaming	3	3.727	0.744	0.733

Independent Samples t-test

To explore whether there are significant differences in "motivations towards mobile gaming," "attitudes towards mobile gaming," and "peer relationships" based on background variables such as "gender," "grade," and "parents' attitudes towards student's mobile Gaming," independent samples t-tests (two-tailed tests) were utilized. This analysis examined whether there were significant differences in the six sub-constructs: "stress relief," "peer and family influence," "flow state," "self-efficacy," "attitudes towards mobile Gaming," and "peer relationships." When conducting a two-tailed t-test, it is necessary to set two rejection regions, considering test results under two extreme situations to consider differences comprehensively.

T-test for Parents' attitudes towards children playing mobile games

Independent samples t-tests were conducted on the scores obtained for each sub-construct. In terms of gender, as shown in Table 3, males scored significantly higher than females in both self-efficacy ($t = 2.323$, $p = 0.018$) and flow state ($t = 2.374$, $p = 0.026$). This indicates that males may be more inclined to derive self-efficacy and flow state from mobile games. This finding is consistent with Wang et al. [40], who found that male players are more focused on competition and challenges in games compared to female players. Males are more easily attracted to the competitive elements and progression systems in games, leading to stronger self-efficacy during gameplay. No significant differences were observed between males and females in aspects such as stress relief, peer and family influence, peer relationships, and overall attitudes towards mobile games. This suggests that, despite motivational differences, both genders may have similar tendencies to use mobile games to relieve stress or maintain social relationships.

Table 3. T-test for gender

Constructs	Male (N=206)	Female (N=194)	t value	Significant *p*
Stress relief	4.154	4.138	0.238	0.812
Social Influences	3.969	3.954	0.214	0.831
Self-Efficacy	3.691	3.516	2.323	0.018
Flow state	4.058	3.907	2.374	0.026
Peer Relationships	4.177	4.308	-1.751	0.081
Attitude towards Mobile Gaming	3.968	3.878	1.523	0.129

For the study on the motivations and attitudes of students across different grades regarding mobile gaming, an independent samples t-test was conducted on the scores of each sub-dimension. The results showed that In terms of grade level, fifth-grade students scored significantly higher than sixth-grade students in the self-efficacy dimension ($t = 2.680$, $p = 0.008$). This may reflect a change in student's attitudes and motivations towards mobile games as they age. Teng [41] also found that younger students are more likely to derive self-efficacy from games. Although the effect of peer and family influence did not reach statistical significance, the difference in this dimension approached significance ($t(398) = 1.941$, $p = 0.053$). Fifth-grade students ($M = 4.069$) scored slightly higher in this dimension than sixth-grade students ($M = 3.916$). This may indicate that as students get older, they tend to be less influenced by peers and family, beginning to develop more independent gaming preferences and habits. Sixth-grade students may seek more complex and challenging activities to achieve Self-Efficacy rather than relying solely on mobile games. The lower self-efficacy scores among sixth graders may also be related to increased academic pressure. As students approach middle school, they may face greater learning demands, which could lead them to reduce their gaming time or shift their perceptions of games.

Table 4. T-test for grades

Constructs	Fifth grade (N=206)	Sixth grade (N=194)	t value	Significant *p*
Stress relief	4.150	4.144	0.080	0.936
Social Influences	4.069	3.916	1.941	0.053
Self-Efficacy	3.756	3.541	2.680	0.008
Flow state	4.028	3.916	0.824	0.411
Peer Relationships	4.223	4.248	-0.309	0.757
Attitude towards Mobile Gaming	3.761	3.712	0.606	0.089

T-test for Parents' attitudes towards children playing mobile games

Regarding parental attitudes, the results indicate that students whose parents do not restrict them from playing mobile games scored significantly higher than those whose parents impose conditional permissions in three dimensions: stress relief ($t = 2.201$, $p = 0.028$), flow state ($t = 2.874$, $p = 0.004$), and overall attitude towards mobile games ($t = 2.036$, $p = 0.042$). This suggests that parental attitudes

may influence student's motivations and attitudes towards mobile games. Liu et al. [42] also found that parental support is associated with more positive gaming experiences for children. Students whose parents do not restrict them from playing mobile games (M = 4.287) scored significantly higher in the stress relief dimension compared to those whose parents permit games under certain conditions (M = 4.107), t(398) = 2.201, p = 0.028. This indicates that when parents adopt a more open attitude, students are more likely to view mobile games as stress relief. In terms of flow state, students with unrestricted access (M = 4.168) also scored significantly higher than those with conditional access (M = 3.934), t(398) = 2.874, p = 0.004. This suggests that when parents have a more open attitude towards mobile games, students may benefit from them. This could be because these students feel more relaxed and less concerned about parental disapproval or restrictions while playing. Additionally, students whose parents do not restrict them (M = 3.869) had a significantly more positive overall attitude towards mobile games compared to those whose parents allow games conditionally (M = 3.687), t(398) = 2.036, p = 0.042. This indicates that parental attitudes may directly impact student's perceptions of mobile games.

Table 5. T-test for Parents' attitudes towards children playing mobile games

Constructs	Not preventing (N=120)	Conditionally allowing (N=280)	t value	Significant *p*
Stress relief	4.287	4.107	2.201	0.028
Social Influences	4.096	3.924	1.945	0.052
Self-Efficacy	3.664	3.590	0.940	0.348
Flow state	4.168	3.934	2.874	0.004
Peer Relationships	4.145	4.267	-1.327	0.185
Attitude towards Mobile Gaming	3.869	3.687	2.036	0.042

ANOVA Analysis

Subsequently, a one-way ANOVA was performed to investigate whether there are significant differences in the seven dimensions: "stress relief," "influence of peers and family," "flow state," "sense of self-efficacy," "attitude towards mobile phone use," "family relationships," and "peer relationships," concerning the background variables of "parental attitudes," "average daily mobile Gaming time," "average holiday mobile Gaming time," and "years of exposure to mobile games."

Next, we explored the differences in test variables based on the participants' daily mobile gaming time. To examine the significance of these differences, participants were categorized into four groups based on their daily Gaming time. One-way ANOVA was employed to test the mean differences across the six variables used in this study.

As shown in the results, the group with a daily usage time exceeding 4 hours scored significantly higher than the group with less than 1 hour of usage. This may indicate that individuals who play games for longer can better relieve stress through gaming. However, this also raises the question of whether the games are helping them to relieve stress or if they are immersing themselves more in games due to high-stress levels.

Similarly, the group with the longest usage time scored the highest in terms of self-efficacy motivation. This could be because spending more time on games allows players to achieve more goals or reach higher levels, enhancing their Self-Efficacy.

Regarding flow state, the groups with 2-4 hours and over 4 hours of usage scored significantly higher than those with shorter usage times. This suggests that as gaming time increases, players may become more engaged with the game and experience greater enjoyment.

Similar trends were observed in peer relationships and attitudes toward mobile game use. The group with the longest gaming time scored the highest. This may indicate that individuals who spend more time gaming are more likely to build social connections through games and hold more positive attitudes towards gaming.

The results show that groups with longer gaming times, particularly those exceeding 4 hours, scored higher on most variables. This implies that individuals who spend more time on mobile games may have more positive experiences in terms of stress relief, self-efficacy, flow state, peer relationships, and attitudes towards games.

Table 6. ANOVA test for constructs based on average daily time spent on mobile gaming

Constructs	< 1hr (N=165)	1 – 2hrs (N=63)	2 – 4hrs (N=112)	> 240 mins (N=60)	Mean difference
Stress relief	4.034	4.111	4.173	4.439	4>1**
Social Influences	4.294	4.361	4.134	4.167	-
Self-Efficacy	3.477	3.540	3.688	3.875	4>1**
Flow state	3.822	3.921	4.083	4.317	3>1**; 4>1***; 4>2*
Peer Relationships	3.855	3.847	4.051	4.211	4>1**; 4>2*
Attitude towards Mobile Gaming	3.610	3.683	3.738	4.072	4>1**; 4>2*; 4>3*

Here, we discuss the impact of "average holiday mobile Gaming time" on student's motivations, attitudes, and peer relationships, using ANOVA for each dimension's scores. The trends for holiday usage time are similar to daily usage time but with some unique findings. Groups using mobile games for 2-4 hours and over 4 hours on holidays scored significantly higher than those with shorter usage times. This might reflect the increased opportunity to engage in more challenging tasks or achieve more goals during holidays.

Groups with longer holiday usage times scored higher in the flow state, likely because extended holiday periods allow for deeper immersion in games without the interruptions of work or study. Additionally, the group with the most extended holiday usage time had the highest scores in peer relationships, suggesting that more time spent interacting with friends in games during holidays enhances social connections.

Table 7. ANOVA test for constructs based on the holiday day time spent on mobile gaming

Constructs	< 1hr (N=77)	1 – 2hrs (N=97)	2 – 4hrs (N=97)	> 4hrs (N=129)	Mean difference
Stress relief	3.957	3.931	4.151	4.416	4>1***
Social Influences	4.299	4.191	4.222	4.258	-

Self-Efficacy	3.438	3.338	3.696	3.839	3>1***; 4>1***; 4>2***3; >2*
Flow state	3.685	3.808	4.086	4.238	4>1**; 3>2*; 4 >2***
Peer Relationships	3.823	3.753	3.979	4.189	4>1**; 4>2***
Attitude towards Mobile Gaming	3.541	3.512	3.725	4.000	3>2*; 4>1***; 4>2***

Further analysis of the impact of "years of mobile gaming experience" on student's motivations, attitudes, and peer relationships was conducted using one-way ANOVA for scores on each dimension. The duration of game experience reflects players' long-term exposure, and the analysis revealed some interesting patterns.

Groups with over 2 years of gaming experience scored significantly higher than those with 1-2 years of experience. This suggests that players become more adept at utilizing games for stress management over time. Long-term players (more than 2 years) scored higher in terms of self-efficacy motivation. This might be because they have mastered various skills and are better at completing challenging tasks.

The group with more than 2 years of gaming experience also scored significantly higher in flow state than all other groups. This indicates that long-term players are likely to appreciate the depth and complexity of games more, thus deriving greater enjoyment from them.

Regarding peer relationships and attitudes toward mobile game use, long-term players also scored higher. This may reflect the development of more robust social networks within the gaming community and a more positive attitude towards gaming over time.

These differences highlight how varying usage patterns and experience levels influence perceptions and experiences with mobile games. The peer and family influence variables did not show significant differences across groups. This suggests that social influence factors remain relatively stable and are not significantly affected by the duration of gaming experience or usage patterns.

Table 8. ANOVA test for constructs based on Years of mobile gaming experience

Constructs	< 0.5 year (N=29)	0.5-1year (N=42)	1 -2 years (N=53)	> 2 years (N=276)	Mean difference
Stress relief	4.080	3.960	3.881	4.232	4>3**
Social Influences	4.224	4.042	4.255	4.270	-
Self-Efficacy	3.500	3.327	3.387	3.701	4>2*; 4>3*;
Flow state	3.724	3.706	3.591	4.130	4>1*; 4>2**; 4>3***;
Peer Relationships	3.713	3.762	3.692	4.070	4>3**
Attitude towards Mobile Gaming	3.678	3.532	3.384	3.827	4>3*

*Significant at $p<0.05$; **significant at $p<0.01$; ***significant at $p<0.001$.

Bivariate correlations among variables

The correlation analysis results reveal significant positive correlations among all variables. This suggests that these factors may reinforce each other; for example, a higher flow state might lead to stronger self-efficacy motivation and vice versa. Although peer relationships are positively correlated

with other variables, the strength of these correlations is relatively weak, indicating that the impact of mobile games on social relationships may be somewhat independent of different factors.

These findings provide valuable insights into the behaviour and experiences of mobile gaming. However, it is important to note that these correlations might reflect variations in perceptions and experiences based on different usage patterns and levels of expertise rather than indicating causal relationships. Future research should further explore the nature of these relationships and potential underlying factors.

Table 9. Bivariate correlations among variables

Constructs	V1	V2	V3	V4	V5	V6
Stress relief	1					
Social Influences	0.566***	1				
Self-Efficacy	0.636***	0.570***	1			
Flow state	0.552***	0.560***	0.647***	1		
Peer Relationships	0.197***	0.329***	0.183***	0.220***	1	
Attitude towards Mobile Gaming	0.564***	0.518***	0.617***	0.624***	0.211***	1

*Significant at p<0.05 ; **significant at p<0.01; ***significant at p<0.001.

Structural Equation Modeling

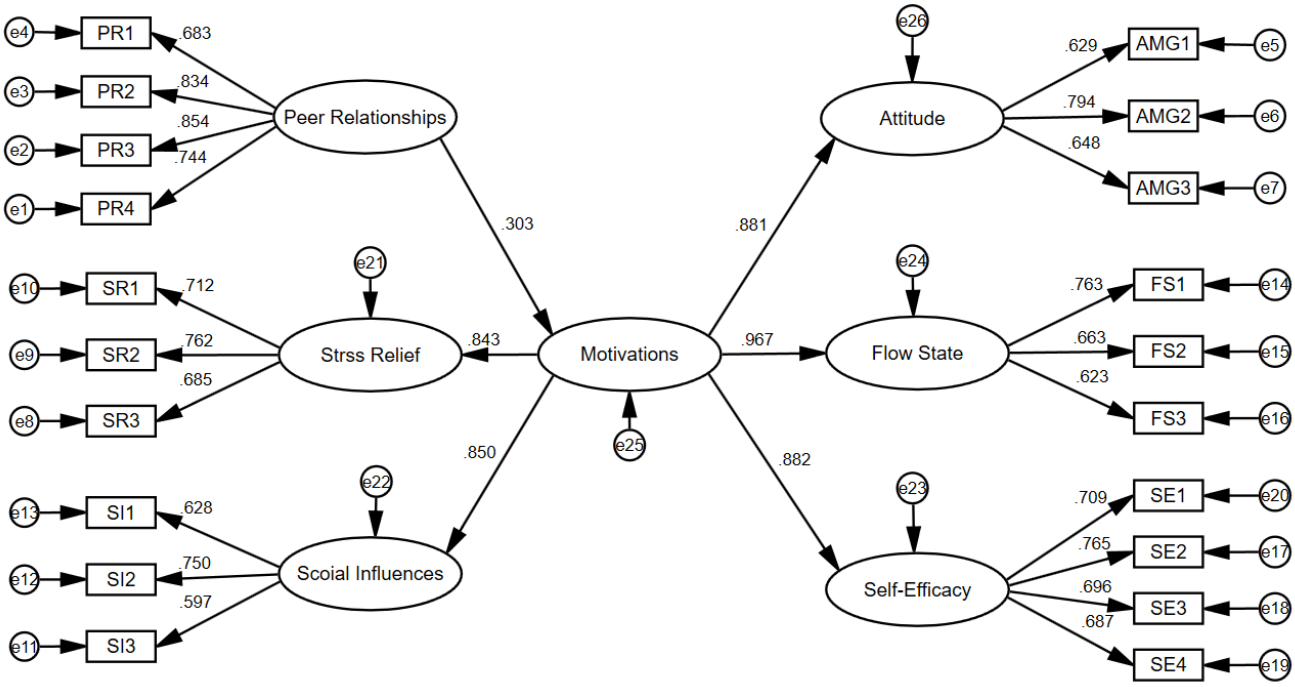
Structural Equation Modeling (SEM) was utilized for model generation [43], incorporating both exploratory and confirmatory elements rather than adhering strictly to a confirmatory approach. During the model generation process, when the initial model did not fit the data well, modifications were made based on model modification indices. This involved deleting, adding, or adjusting paths within the model and re-testing it with the same dataset. The ultimate goal was establishing a theoretically sound model that aligns well with the data [44]. However, modifications were restricted to the paths between exogenous and endogenous variables, removing insignificant paths. The best-fitting model is illustrated in Figure 3.

The Goodness of Fit Index (GFI) indicates the robust structural model. The GFI exceeds 0.9, the RMSEA value is well below 0.08, and the SRMR value is substantially below 0.05. Since Amos can estimate all parameters in the model, it is concluded that it is well-specified.

The results also indicate that the “Motivations towards Mobile Gaming” dimension is robust, with all four observed variables loading strongly and relatively equally on the latent variable. Error correlations were established among stress relief, peer and family influence, self-efficacy, and flow state, reflecting the commonality among these items.

Based on the SEM analysis, the study examined various psychological and social factors influencing individual mobile gaming behaviour. The model shows that mobile gaming behaviour is closely related to factors such as “relationships,” “stress relief,” “peer and family influence,” “flow state,” and “self-efficacy.” Specifically, the correlation coefficients for the “relationships” factor range widely (.683 to .854), indicating a significant impact of peer relationships on mobile gaming behaviour. Additionally, the correlation coefficients for “stress relief” and “flow state” range from .685 to .762 and .623 to .763, respectively, suggesting that the relaxing effects and flow state nature of games somewhat drive gaming participation.

Regarding the model fit indices, the chi-square value is 354.906, with a chi-square value/degree of freedom (df) ratio of 2.151, and the p-value is significantly below 0.05, indicating the statistical significance of the model. Furthermore, the Comparative Fit Index (CFI) is .944, the Tucker-Lewis Index (TLI) is .935, the Normed Fit Index (NFI) is .901, the Goodness of Fit Index (GFI) is .916, and the RMSEA is .054, all of which suggest that the model fits well and provides a reasonable explanation of the observed data.



χ^2 = 354.471 df = 164 p-value= 0.000 RMSEA = 0.054 SRMR = 0.048 GFI = 0.916

Fig. 3. SEM for the integrated model.

The latent variables under investigation included “Relationships,” “Stress relief,” “Social Influences,” “Flow state,” “Self-Efficacy,” and “Motivations towards Mobile Gaming.” Each latent variable was operationalized through multiple observed indicators, all exhibiting significant factor loadings, affirming their effectiveness in capturing the respective latent constructs.

The path coefficient from “Motivations towards Mobile Gaming” to “Attitude towards Mobile Gaming” was 0.881, indicating a substantial positive effect. This high value suggests that motivation significantly influences individuals’ attitudes towards mobile gaming, which aligns with motivational theories that assert the profound impact of internal drives on behavioural attitudes.

The path coefficient from “Motivations towards Mobile Gaming” to “Flow state” was 0.967, reflecting a powerful effect. This result indicates that motivation substantially enhances the perceived flow state of mobile games, corroborating existing literature on the robust connection between motivation and gaming immersion.

Similarly, the path coefficient from “Motivations towards Mobile Gaming” to “Self-Efficacy” was 0.882, demonstrating a significant positive association. This finding suggests that heightened motivation is associated with increased feelings of self-efficacy within the gaming context, aligning

with research that emphasizes the relationship between motivation and psychological rewards in gaming experiences.

"Relationships" showed a path coefficient of 0.303 to "Motivations towards Mobile Gaming," indicating a moderate positive influence. This result highlights the role of peer interactions in shaping gaming motivation, particularly within socially active environments where social support and peer pressure can enhance motivational factors.

The path coefficient from "Stress relief" to "Motivations towards Mobile Gaming" was 0.843, underscoring its importance as a key driver of gaming motivation. This finding suggests that individuals who experience stress are more inclined to utilize gaming as a means of stress relief, thereby increasing their motivation to engage with games.

"Social Influences" exhibited a path coefficient of 0.850 to "Motivations towards Mobile Gaming," indicating a strong positive relationship. This result implies that the influence of peers and family significantly impacts gaming motivation.

The primary objective of this study was to explore the multifaceted factors affecting student's motivations towards mobile gaming, including "Peer Relationships," "Stress relief," "Social Influences," "Flow state," and "Self-Efficacy." Furthermore, the study analyzed how these factors collectively construct "Motivations towards Mobile Gaming" and examined the effect of these motivations on student's attitudes toward mobile gaming, with particular attention to the role of peer relationships in this process.

Different latent variables interact to shape student's gaming motivation, with these variables being functionally complementary. For example, flow state is identified as a core motivation for student's participation in mobile games, consistent with previous research emphasizing the importance of flow state in driving gaming motivation [34]. Mobile games are stress-relief tools, helping children manage school and social pressures [45].

Social Influences also play a crucial role in motivation. Social support from peers can significantly enhance student's gaming motivation, as studies show that children engaged in multiplayer games are more influenced by positive peer feedback, strengthening their participation [46]. Support from peers and family is a significant driver of gaming motivation [14]. The results show that the Flow state is pivotal in driving students' gaming motivation, as it fulfils psychological needs such as escaping reality or finding pleasure [47].

The study found no significant direct relationship between peer relationships and student's attitudes toward mobile gaming. While peer and social pressures may influence behaviour and mental health, their direct impact on digital game attitudes might be less evident. Other variables might mediate peer relationships, explaining this study's lack of direct effect. Despite the lack of a direct impact, motivation mediates between peer relationships and attitudes.

Overall, the study confirms the complementary roles of various latent variables in shaping students' mobile gaming motivation. Flow state is identified as a key driver, while Social Influences indirectly affect students' gaming attitudes through motivation. Future research should further explore these variables across different cultural contexts and age groups and investigate how to leverage these motivations to guide positive gaming behaviour in children.

Limitations and future research directions

The current study has several limitations. First, the sample for this study is limited to upper-grade elementary school students in Kaohsiung City, Taiwan, which may restrict the generalizability of the findings to students in other regions or age groups. Future research should consider expanding the sample to include students from diverse areas, socioeconomic backgrounds, and age groups to obtain a more comprehensive understanding of the relationship between peer relationships and motivation for mobile gaming. Second, students' attitudes and behaviours toward mobile games may vary based on their cultural backgrounds. Future research could conduct cross-cultural comparisons to explore the differences in mobile game usage and experiences among students from various countries and investigate how cultural factors influence their attitudes and behaviours toward games. Third, this study relied on questionnaire surveys, which may be susceptible to self-report bias. Future research could incorporate additional data collection methods, such as behavioural observations or interviews, to more objectively assess students' gaming behaviours and motivations, thereby enhancing the accuracy and reliability of the results. Fourth, this study found that multiple variables collectively influence students' gaming motivation; however, it did not thoroughly investigate the interactions among these variables. Future research could further analyze the intricate relationships between these factors, particularly by examining how students with varying personality traits are affected by peer pressure or how stress relief influences their gaming motivation. This would yield a more comprehensive understanding of the factors that shape gaming motivation. Fifth, this study did not consider how different types and content of games affect students. Future research could compare various game genres (e.g., action games, puzzle games, role-playing games, etc.) and analyze how these genres influence students' gaming motivation, attitudes, and behaviours, thereby providing a clearer understanding of the effects of diverse game content.

Future research could investigate how mobile game motivation relates to other psychological factors, such as self-esteem, anxiety, and impulse control, revealing the potential impact of mobile gaming on students' mental health. Furthermore, it should study how to utilize the motivational factors identified in this research to design effective educational interventions that help students develop healthy gaming habits and use games effectively to promote learning and development. Additionally, it should explore the roles and strategies of parents and teachers in guiding students to engage with mobile games healthily, as well as examine how support from both home and school can enhance students' mental health and learning outcomes during mobile game use.

5. Conclusions

This study explores multiple factors related to peer relationships and mobile gaming motivations among schoolchildren, including stress relief, peer influence, flow state, and self-efficacy in relation to attitudes toward mobile games. The results indicate significant impacts of various background variables such as gender, grade level, and parental attitudes on students' mobile game behaviours. For example, males scored higher than females in terms of self-efficacy and flow state, while fifth-grade students scored higher than sixth-graders in terms of self-efficacy. These findings underscore the importance of individual differences in shaping students' gaming experiences, providing valuable insights for educators and parents to better understand and guide students' gaming behaviours.

The study found that children who spent more time on games generally scored higher on most variables, suggesting they derive more positive experiences from gaming. However, this also raises

concerns about the potential negative impacts of excessive use. This complex relationship highlights the need for further research to determine the optimal balance between Gaming time and positive experiences while considering potential adverse effects.

Structural equation modelling analysis further revealed that mobile game motivation strongly affects students' gaming attitudes and is highly related to flow state and self-efficacy. Understanding and guiding students' gaming motivations may be key to shaping their gaming attitudes and behaviours. Educators and game developers can utilize this finding to design games that meet students' flow state needs while promoting positive learning and development.

Peer relationships were found to have a moderate positive influence on gaming motivation, highlighting the importance of social factors in driving gaming behaviour. This finding emphasizes the potential of mobile games as social tools and reminds us to consider how to leverage this social aspect to promote student peer skills development. The study also pointed out that stress relief and peer and family influences are key drivers of gaming motivation, reflecting mobile games' multiple roles in student stress management and social interaction. This finding underscores the potential of mobile games as multifunctional tools in student's lives, providing a flow state and serving as a medium for stress management and social interaction. However, it also raises an important question: How can we ensure that children do not become overly dependent on mobile games to cope with stress or fulfil social needs while neglecting the development of other important life skills?

Although the study did not find a significant direct relationship between peer relationships and students' attitudes toward mobile games, motivation served as a mediator between the two. This finding reveals the role of gaming motivation as a bridge connecting social factors and gaming attitudes, emphasizing the need to consider the complex interactions of multiple factors in understanding student's gaming behaviour.

Notably, the flow state was confirmed as a core motivation for student engagement in mobile games. This highlights the fundamental function of games—providing fun and flow state—as a crucial factor in attracting children. However, this also poses a challenge: How can we incorporate educational and developmental elements into games while maintaining their flow state to maximize their positive impact on student's growth?

The results also indicate that different usage patterns and experience levels affect student's perceptions and experiences with mobile games. For example, long-term players seem to gain more self-efficacy and flow state from games. This finding suggests that we need to consider student's gaming experience in shaping their gaming attitudes and behaviours and may provide guidance for designing game content suited to different experience levels.

In the digital age, mobile games have become an indispensable part of student's lives. Therefore, we need to adopt a balanced approach, recognizing the positive impacts of mobile games, such as providing a flow state, fostering social interaction, and helping manage stress and the potential risks of excessive use. By delving into the various factors influencing students' gaming behaviours, we can better guide them to use mobile games healthily and beneficially, making them a powerful tool for learning and development rather than a source of potential problems. The results of this study also provide a basis for developing related policies and guidelines. For example, more targeted Gaming guidelines can be formulated based on the findings to help parents and educators better guide students'

gaming behaviours. At the same time, game developers can utilize these insights to create game content that is more beneficial to student's development, incorporating elements that promote social interaction and stress management.

Appendix A

Based on your experiences and feelings, please rate the following statements and tick the number that best reflects your opinion. (1 = strongly disagree, 5 = strongly agree)

A.1. Stress Relief
SR1: I feel that playing mobile games helps me relax.
SR2: I feel that playing mobile games allows me to express my emotions.
SR3: I feel that playing mobile games helps me change my mood and forget about unpleasant things in life.

A.2. Social Influences
SI1:I maintain friendships with classmates and friends through mobile games.
SI2:I find playing mobile games together with classmates and friends to be a delightful activity.
SI3:I play mobile games that my classmates, friends, or family members like to accommodate them.

A.3. Self-Efficacy
SE1:In real life, sports are not my strong suit, but I can get high game scores, making me feel capable.
SE2:In mobile games, the growth of my game character gives me self-efficacy.
SE3:I've made many friends while playing mobile games, which makes me feel accomplished.
SE4:When I get high scores in mobile games, it attracts me to become more engrossed.

A.4. Flow State
FS1:There are many games to choose from according to one's preferences, which I find very interesting.
FS2:I enjoy competing with others or challenging game levels in mobile games.
FS3:I think playing mobile games is the most interesting thing in life.

A.5. Peer Relationships
PR1:I have a regular group of close friends in my class.
PR2:I discuss things that happen in life with my classmates or friends.
PR3:I share various resources with classmates or friends to solve problems.
PR4:When I encounter difficulties, my classmates or friends assist me.

A.6. Attitude towards Mobile Gaming
AMG1:I consider mobile gaming to be a way to pass the time.
AMG2:I find mobile games' content, characters, and other elements so attractive that I can't resist playing them.
AMG3:I think picking up my phone to play games is the most ordinary leisure activity because people nowadays can't be separated from their phones.

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