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The role of family intimacy in playing collaborative e-sports with a Switch device to predict the experience of flow and anxiety during COVID-19 lockdown

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ABSTRACT

During the COVID-19 pandemic, most people have more time to stay at home and play games together. In particular, so as to maintain social distancing, most people play with their family members. To understand how people's family intimacy affects their game experience and perceived value of playing, the present study applied a boating game, River Survival, played collaboratively via Switch. People with experience of playing the game with family members were targeted in this study. They were notified via Facebook and Line special interest groups and responded to the questionnaire through a website. Data of 301 respondents were validated, and were subjected to structural equation modeling. The results of this study indicated that family intimacy positively predicted flow experience, but there was no significant relation to gameplay anxiety. Flow experience positively predicted perceived value, but gameplay anxiety did not significantly predict perceived value. The implication of this study is that without intimacy among team members, players cannot experience flow state or perceived game values.

The COVID-19 pandemic has affected the whole world, and the United Nations World Health Organization is trying to keep people indoors or at home. The demand for indoor entertainment has increased in order to relieve leisure time at home, and people have turned their attention to video games or online video games, driving up the sales of game consoles. Video games have become a way for people stuck at home to practice social distancing. The Switch gaming system is a Japanese Nintendo product, in which each player controls a character and plays in the same window. It is divided into real-time and turn-based games. During the COVID-19 lockdown period, it has also created a way to build a sense of community and interact with others without having to leave home (Takeda, 2020). A virtual sports device, Switch, has become very popular recently, and especially the game, River Survival. In 2021, there are expected to be 15.72 million downloads of this game (Nintendo "Super Mario Party" Schafer & Schwarz, 2019). One way of playing River Survival is to use the affordances of Switch to encourage players to do physical exercises and engage in social interaction; moreover, the river management game emphasizes enabling participants to collaboratively experience various river interventions and

stimulates social learning (den Haan et al., 2020). Drawn on emotion-value model, emotion can be changed in collaborative games (Darvin et al., 2021); however, few studies have considered how family members play together, or have discussed the emotion factors of their game experience. Thus, to address this gap, the present study targeted those players who had played River Survival with Switch, a game in Super Mario Party, to understand their perceptions of their emotional and mental states while playing with family members.

Some dimensions representing relationship quality affect performance in sports competition; for example, closeness is a critical function that allows team members with higher intimacy to have a higher sense of camaraderie in sports competitions (Brown et al., 2018). Intimacy and a sense of having "things in common" in higher quality father-child and mother-child relationships were both found to predict higher levels of player enjoyment, but lower stress levels (Harwood & Knight, 2015). Particularly, Ó'Sabhain and McGrath (2019) studied a distinctive family boating competition collaboratively known as the "hooker" which is actively used for recreation and leisure in the West of Ireland. To win the boating competition, an understanding of "rhythmic practices of place"

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is needed by all team members along with their intimate relationships to conquer all the challenges occurring along the river. Another study by Jang et al. (2018) found that sport consumers' levels of happiness differed when collaboratively playing a game which relies on a level of team identification and interdependence. However, few studies have explored family members playing the virtual boating game, River Survival, using Switch to understand the antecedent role of family intimacy related to cognitive and affective states and perceived gaming values as they collaboratively engaged in virtual boating during the COVID-19 lockdown. Thus, the purposes of this study were to explore the correlates between family intimacy as an antecedent role to predict participants' flow experience and gameplay anxiety that reflected their perceptions of gaming value.

1. Theoretical background

Family Intimacy in the Gaming Context.

Intimacy reflects perceptions of self-versus-others and has an influence on one's behaviors. Those people who are in intimate relationships tend to think more about their partner's interests than about their own (Aron et al., 2004). Family intimacy refers to the emotional connection between family members (Luo et al., 2020). Family intimacy can rebalance the family decision-making power and support the autonomy of family members (Tong et al., 2019). It can reduce family conflict and psychological maladjustment, depression, and emotional disturbance at the individual level. On the other hand, enhancing family intimacy can promote members' courage to take risks and responsibility to complete their own tasks (Maitland et al., 2017). While most games require players to take risks (Zhang & Fricker, 2021), intimacy may affect players' mutual dependence while playing together for a long time (Brown et al., 2018).

Intimacies are something other than a direct relationship between self and other. Intimacies become a space within which self and family members can experience emotional reflexivity (Belford & Lahiri-Roy, 2019). Generally speaking, individuals who are more intimate tend to be more affected by their intimate others, which is essential for collaborative sports competitions (Ulrich-French & Smith, 2006). Specifically, this study draws on Reis and Shaver's (1988) Intimacy Process Model (IPM), which is a well-researched model of how intimacy develops. It can be translated into mission targets which are related to intimate relational functioning (Maitland et al., 2017). In the model, intimacy is described as a dynamic, behavioral process consistent with focusing on identifying behavioral actions-in-context (Hayes et al., 2012). For family members to play Switch together as actions-in-context, how players perceived the intimacies of family members may affect their emotion in playing this River Survival. However, few studies have discussed family intimacy related to family members playing games together. This study therefore examined the role of family intimacy while playing a Switch game.

2. Flow experience

Flow is a concept related to immersion. It was defined by Csikszentmihalyi (1990) as a state of concentration in which individuals become so absorbed in an activity that they act with total involvement. It mostly focuses on changes in the player's internal condition. In the context of video gameplay, it has been found that sensory-motor networks are important for flow (Klasen et al., 2012). If games feature can motivate players intrinsically to achieve a goal, then, their flow experience can be generated (Procci et al., 2018). For instance, the flow dimension has been examined by changing game features or the level of difficulty (Ulrich et al., 2014), and by introducing a specific event (Klasen et al., 2012). Taking playing River Survival as a special feature of playing with Switch, players have to pay attention to some inhibitors of boating, such as avoiding hitting rocks. Additionally, sport psychologists studying within a transnational state of flow have explored

various directions of mobility and diverse participants (e.g., Emich et al., 2020; Roychowdhury et al., 2021), but to date the research has not focused on individual flow experiences "on the move" with Switch. Thus, flow state while playing with family members during the COVID-19 lockdown was of interest in this study.

3. Gameplay anxiety

According to Taylor et al. (2007), anxiety sensitivity is a construct that captures individual fear which arises from maladaptive interpretations related to experience of anxious arousal. The level of anxiety sensitivity is largely dependent on environmental influences such as in extremely competitive environments in which people can experience emotional anxiety if they have a conscious desire to win (Hong et al., 2020). A feeling of anxiety makes it hard to relax while engaging in a competitive game (Ju & Wallraven, 2019). Consistent with perceptions related to affective state change, Hong et al., (2020) defined that gameplay anxiety in a competitive game can be raised with time pressure. Additionally, anxiety is significantly associated with biokinematically-driven behavioral engagement (Bakhshaei et al., 2020). This study explored when players interacted with Switch involving biokinematically-driven movement and with time pressure to avoid the risk of the boat stopping due to hitting rocks or big fish. How their perceived anxiety as family members collaboratively controlled the boat affected their gameplay anxiety during the COVID-19 lockdown was examined in this study.

4. Perceived values

Personal values are comprised of cognitive, affective or directional aspects as individuals to judgment and choose (Lin, 2020). In line with this, a means-end chain (MEC) (Gutman, 1982) has been suggested to reveal the psychological process that players undergo to perceive the consequences associated with a game (Shen, 2021). Personal values, which are seen as the "end" in MEC theory, can be divided into either instrumental or terminal values, where instrumental values result from preferences or behavioral outcomes, whereas terminal values reveal the ultimate status of existence that consumers actually want to achieve (Lin et al., 2017). Game play values represent the concrete outcomes of using a system, while psychosocial enjoyment is evoked as users' subjective feelings (Shen, 2021). Yuksel et al. (2021) explained that innovative digital technology can provide players with experiential value and arouse their enjoyment and control of devices with a sense of camaraderie in virtual collaborative sports games. As challenge in games has positive effects on the perceptions of utilitarian and hedonic value (Alan et al., 2022), an aim of this study was to reveal the personal psychological process when playing River Survival with Switch during the COVID-19 lockdown, and experiential value (including hedonic and utilitarian value) was adopted as the basis to examine participants' personal values.

5. Research model and hypotheses

Research Model.

Gamer interest is dependent upon the interaction of the three factors of player characteristics (including their gaming background and preferences), game types (including their genre and design), and the platform (including their controls and affordances) (Halloran & Minaeva, 2019). MEC theory was proposed by Gutman (1982) to elicit the linkages between product or service attributes and behavioral consequences and personal values. The linkages between the attributes (As), consequences (Cs), and personal values (Vs) of a product or service construct A-C-V ladders (Lin et al., 2020). In MEC theory, the attributes of a product or service are the "means" that allow users to achieve their desired results (Lin et al., 2017). Accordingly, the attributes in the present study are considered as the features of River Survival. The

behavior consequence is related to the flow and anxiety of boating, thus achieving a sense of value in playing this game. To understand the linkage of A-C-V when participants played River Survival together by using Switch, the present study conceptualized a research model to explore the correlates between family intimacy, flow experience, gameplay anxiety, and perceived value.

6. Hypotheses

Social presence can be studied from the perspective of constructs such as immediacy (psychological distance) and intimacy (interpersonal closeness) (Sajjadi et al., 2019). Game experience can be activated through social presence. Waterworth et al. (2015) found a correlation between perceived social presence and learning motivation when there are higher levels of perceived social presence in online education. However, it is common that those who lack family intimacy can easily lose emotional control and use aggressive attitudes toward problem-solving that brings conflict with family members, particularly with parents (Jin et al., 2019). Participants who find difficulty in adjustment will have a more distressing experience in sport exercise, as they need to ask for support. If support is provided by intimate others, they will feel the enabling support to be more effective (Brown et al., 2018). Moreover, Sajjadi et al. (2019) identified a bidirectional relationship, indicating that family intimacy can be considered as having a positive association with flow experience, but may have a negative association with gameplay anxiety when players collaboratively play Switch during the COVID-19 lockdown. To understand the correlates, two hypotheses were proposed as follows:

H1. Family intimacy is positively related to flow experience.

H2. Family intimacy is negatively related to gameplay anxiety.

Game-based learning can result in improvements to learning outcomes, and learning experiences can be enhanced by promoting engagement (Yaqi et al., in press). Challenge and interactivity as representatives of flow experience in games have been found to have positive effects on the perceptions of utilitarian and hedonic value (Alan et al., 2022). For example, escape room games as cooperative style games can facilitate the acquisition of key professional competencies (Anguas-Gracia et al., 2021). However, the accessibility of new devices may be problematic for some players, especially if they have frustration in the game challenge, when they may experience mood states with negative thoughts and feelings (such as depression and anxiety). That is, anxiety has been associated with the development of problematic technology use in general (Liang & Leung, 2018). On the other hand, players may experience flow state from the hypo-arousal and in optimally challenging games, leading them to consequent positive value, such as psychological relief (Larche & Dixon, 2021). In playing the Switch game, River Survival, there are four players in a boat, and they have to work collaboratively. How their experienced flow and anxiety influenced their perceptions of playing values was hypothesized as follows:

H3. Flow experience is positively related to perceived value.

H4. Gameplay anxiety is negatively related to perceived value.

Value perception, which may be either functional or psychosocial, refers to the results that users hope to achieve through certain product or service attributes (Lin et al., 2020). For players, perceived value can be either positive or negative. Positive value will be perceived if the relationship between players is intimate; on the other hand, negative consequences will be perceived when risks are incurred due to interpersonal distance (Lin et al., 2020). Briefly, in social games that require players to actively engage in social interaction, in order to facilitate effective learning, it is highly desirable to evoke good game experience and high levels of perceived family intimacy (Sajjadi et al., 2019). In light of this, to investigate whether family intimacy can affect perceived value mediated by game experience while playing the Switch game

collaboratively, a hypothesis was proposed as follows:

H5. Family intimacy is positively related to perceived value mediated by game experience.

7. River Survival

7.1. Game features

Nintendo of Japan developed the Switch, a gaming console with a wide variety of games that can be played by inserting game chips. In this study, participants were asked to play the game River Survival on Super Mario Party, and they had to play with their family members. Some features are illustrated as follows:

- 1 (see Fig. 1) The game mode is that the player uses the Joy-con as the controller and swings it to simulate the paddle of the game character on the screen to control the boat (see Fig. 2).
2. Breaking the level increases the voyage time by seconds (see Fig. 3).
3. Players must arrive at the end point within the set time, and if they fail to arrive, the challenge will be lost (see Fig. 4).
4. Players who successfully reach the end point will get "Party Points" (see Fig. 5 and Fig. 6).

Note: Figs. 2–6 are screenshots from Nintendo Switch "River Survival" on Super Mario Party.

How to Play.

1. The family members are teammates and control the direction of the boat together during the voyage.
2. They have to avoid hitting rocks in the river and work together to break through the small level challenges, such as moving to collect crystal pieces, passing and catching balls, shooting darts, and so forth.

8. Method

8.1. Procedure

The survey was conducted during the COVID-19 lockdown period when more people were staying at home and had more opportunities to play River Survival in the Nintendo Switch Super Mario Party with family members. The samples were purposively targeted from those who had played River Survival. First, we posted information about our study on Facebook game and Line game groups and asked respondents to complete the questionnaire by linking to SurveyCake which is a website that allows scholars to upload questionnaires. The questionnaire was opened on May 31, 2021 and closed on June 14, 2021. In terms of ethical considerations, participants were provided with information about what they were being asked to do, and were asked to provide their consent. They also had the option to withdraw from the study whenever they wished. Participants knew they were participating in an evaluation study and that the data they provided were anonymous. They also knew that the study could be published.

8.2. Participant

In this study, the participants were selected by the intentional sampling method and had played the game River Survival via Switch with their family members. A total of 565 valid questionnaires were completed after eliminating 136 incomplete responses. In terms of gender, 316 (55.9%) females and 249 (44.1%) males responded to the survey. As for age, 97 (17.2%) respondents were below 22 years old, 148 (26.1%) were 24–31 years old, 241 (42.7%) were 31–40 years old, and 79 (14.0%) were over 40 years old.

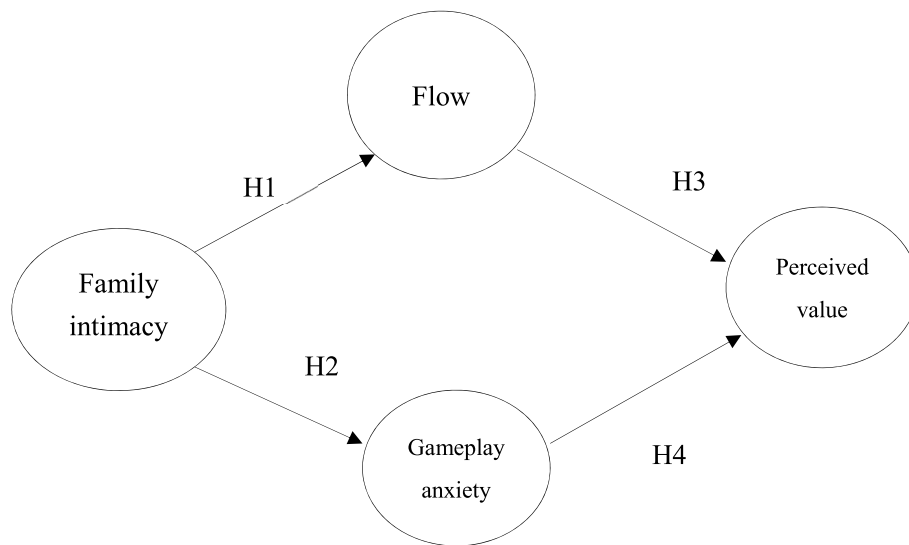


Fig. 1. Research model



Fig. 2. Basic operation of playing.



Fig. 3. Achieving a level.



Fig. 4. Fail to arrival before time-up.



Fig. 5. Get "team points".



Fig. 6. Successfully reach the end.

8.3. Questionnaire

The content of the questionnaire in this study was modified from the questionnaires of previous studies, and five domain experts checked the accuracy of the translation to ensure face validity. Then, the questionnaire was given to 10 university students to complete and to point out any confusing wording to ensure its content validity. A 5-point Likert scale was adopted, where 1 indicated *strongly disagree* and 5 indicated *strongly agree*. Because this was a confirmatory study, after data collection the reliability and validity of the questionnaire were re-analyzed.

8.4. Measurement

Family intimacy: A high level of intimacy involves frequent exchanges of sensitive, confidential, and complex support (Stanko et al., 2007). Accordingly, six items were designed to test participants' perceptions of family intimacy. Example items include: *We keep each other informed about the risk coming during virtual boating. We shout "watch out" to each other frequently without pre-specified agreement during virtual boating.*

Flow experience: Based on flow theory (Csikszentmihalyi, 1997), flow can only occur when concentration, enjoyment, and interest in an activity are experienced at the same time. Therefore, seven items were designed for measuring participants' flow state while they played River Survival. Example items include: *When playing the game, I have a sense of psychological relief. When I played the game, I was not aware of time passing so fast.*

Gameplay anxiety: To measure anxiety while playing a competitive game, the Competitive State Anxiety Inventory-2 (CSAI-2), originally developed by Martens et al. (1990) and revised by Hong et al., was modified for this study. Seven items were included in the questionnaire. Example items include: *When I play the game, I worry I cannot control Switch well so that our boat will move slowly. I have been complained about by my team members when playing the game and it makes me feel nervous to control Switch.*

Perceived value: According to Dhar and Wertenbroch (2000), perceived experiential value represents the rational and enjoyment purpose when using a product. Their scale was revised by Hong et al. (2020). Hence, the present study designed corresponding measurement items. Example items include: *Playing River Survival with my family members reduces my conflict with my family members. Playing River Survival with my family members is fun for me.*

9. Results

Data analyses included testing the credibility of the items and constructs of the questionnaire by using SPSS 20.0, and verifying the research model by structural equation modeling with AMOS 20.0. The results are described as follows.

10. Item analysis

To test the internal validity of the questionnaire items, first, those values of factor loading (FA) less than 0.5 were deleted. Second, first-order confirmatory factor analysis (CFA) was performed to delete those items with the highest residual value in each construct until the required indexes suggested by Hair et al. (2019) were met. Table 1

Table 1
Item analysis.

Index	Threshold	Family intimacy	Flow experience	Gameplay anxiety	Perceived value
χ^2/df	<3	2.89	2.28	2.32	2.59
RMSEA	<.08	.07	.08	.06	.06
GFI	>.8	.99	.99	.99	.97
AGFI	>.8	.98	.98	.96	.95
t-value	>10	12.99–14.0	15.38–17.63	13.10–15.44	9.61–12.27

presents the χ^2/df , RMSEA, GFI, and AGFI of each construct. Accordingly, five items were retained for family intimacy, and the number of items was reduced from five to four for flow experience and gameplay anxiety, and from 10 to eight for perceived value (see Fig. 7).

Note: dotted lines indicate items with a factor loading of less than 0.5 which were deleted. The others indicate the residual value left in each construct.

In this study, external validity was verified by using the extreme group validation method, in which the top 27% of the scale scores were classified as the high group, and the bottom 27% were selected as the low group for independent sample *t* tests. A *t*-value above 10 ($p^{***} < 0.001$) is considered statistically significant (Awang, 2015). The *t*-value in this study was higher than 13.31*** ($p < .001$), indicating that all questions in this study were discriminatory, that is, all questions can be used in different situations on different samples (Green & Salkind, 2004).

11. Reliability and validity analyses

Awang (2015) indicated that when the Cronbach's α value and composite reliability (CR) fall between 0.70 and 0.98, there is a high level of reliability. Table 2 shows that the values of Cronbach's α are all over 0.81, indicating that those constructs had good internal consistency, and the CR values are all over 0.77, revealing that those constructs had acceptable external consistency.

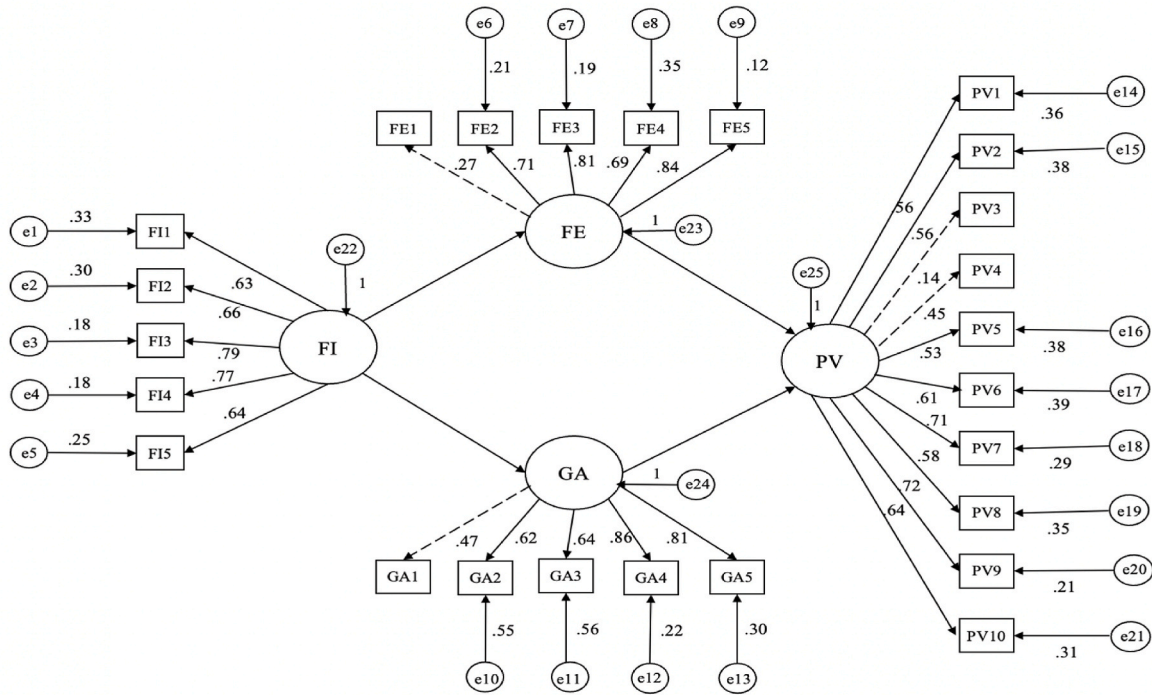
To test the convergent validity of each construct, the values of AVE and the factor loading of each construct should be above 0.5 (Hair et al., 2019). Table 2 shows that the values of FL are over 0.67, and the values of AVE are over 0.53, indicating that all constructs had good convergent validity.

The analysis of construct discriminant validity is to verify whether there is a difference between two different constructs, so the correlation coefficient between two constructs should be lower than the square root of the AVE of the construct (Awang et al., 2015). Table 3 shows that the square root of the AVE of each construct is higher than the absolute value of correlation coefficients between constructs, indicating that the questionnaire had good construct discriminative validity.

12. Model fit analysis

In this study, an overall fitness analysis was performed to verify the suitability of the hypothetical model as the validation tool for this structural equation model. The absolute fitness of this study applied the specifications suggested by Hair et al. (2019). In examining Absolute Fit Measures, the χ^2/df value of this study model = 2.47, which is less than the threshold value of 3; the RMSEA = 0.06, which is less than the critical value of 0.8; the GFI = 0.99, and the AGFI = 0.98, which are greater than the threshold value of 0.9. All values meet the threshold requirement.

In this study, the Incremental Fit Measures were based on the suggestion of Hair et al. (2019). The NFI = 0.99, NNFI = 0.98, CFI = 0.99, IFI = 0.99 and RFI = 0.98, which are all larger than the threshold value of 0.8. All values are in line with the suggestion of Hair et al. (2019). In the present study, the Parsimonious Adjusted Measures were also adopted from Hair et al.'s (2019) suggestion. The PNFI = 0.66 and the PGFI = 0.69, which are greater than the threshold value of 0.5. All values met the recommended thresholds.



Note: dotted lines indicate items with a factor loading of less than 0.5 which were deleted. The others indicate the residual value left in each construct.

Fig. 7. First-order confirmatory factor analysis.

Table 2
Construct reliability and validity analysis.

Constructs	M	SD	Cronbach's α	CR	FL	AVE
Family intimacy	3.94	0.60	0.81	0.77	0.67	0.57
Flow experience	3.96	0.64	0.85	0.83	0.74	0.56
Gameplay anxiety	3.33	0.80	0.84	0.81	0.72	0.53
Perceived value	3.72	0.49	0.83	0.83	0.73	0.53

Table 3
Construct discriminative validity analysis.

Constructs	1	2	3	4
1. Family intimacy	(.81)			
2. Flow experience	.55	(.85)		
3. Gameplay anxiety	.10	.24	(.84)	
4. Perceived value	.67	.57	.30	(.83)

13. Path analysis

The results of the path analysis are summarized in Fig. 8, which examines the direct relationships among the research constructs and verifies the hypotheses. Table 5 shows that H1: Family intimacy is positively related to Flow experience ($\beta = 0.74, t = 12.59^{***}, p < .001$); H2: Family intimacy is not significantly related to gameplay anxiety ($\beta = -0.18, t = -3.69, p > .05$); H3: Flow experience is positively related to perceived value ($\beta = 0.66, t = 10.4^{***}, p < .001$); and H4: gameplay anxiety is not significantly related to perceived value ($\beta = -0.05, t = -1.32, p > .05$).

Structural equation modeling is a multivariate statistical method based on regression, and the explanatory power is measured by the coefficient of determination (R^2) (Colombo et al., 2017). Additionally, Cohen's f^2 value of 0.02 represents a small effect, 0.15 a medium effect, and 0.35 a large effect (Schafe & Schwarz, 2019). The explanatory

power of family intimacy on flow experience was 54% ($R^2 = 0.54$) with a large effect size of 0.52. The explanatory power of family intimacy on gameplay anxiety was 3% ($R^2 = 0.03$) with a small effect size of 0.08. The explanatory power of flow experience and gameplay anxiety on perceived value was 45% ($R^2 = 0.45$) with a medium effect size. $**p < 0.01, ***p < 0.001$.

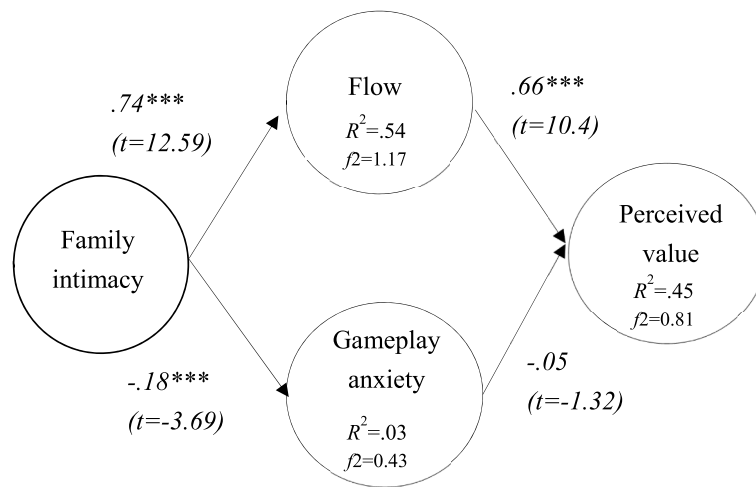
14. Indirect effect analysis

For the indirect effects, the results of the bootstrapping method indicated that the indirect effect of family intimacy on flow experience and gameplay anxiety reflecting perceived value was 0.26 with a 95% confidence interval: [0.32-0.61]; the 95% confidence interval did not include zero, which revealed that there was a mediator effect for flow experience and gameplay in the relationship between family intimacy and perceived value. Table 4 shows H5: Family intimacy is positively related to perceived value ($\beta = 0.26, p^{***} < 0.001$), representing a significant indirect association between the two constructs.

15. Discussion

Gamer interest is dependent on the interaction of the three factors of player characteristics, the genre and design of games, and the platform (Halloran & Minaeva, 2019). Moreover, MEC theory severs the linkages between a product's attributes, consequences, and personal values (Lin et al., 2020). According to MEC, the attributes of Switch are the "means" by which players achieve their desired goal of arriving at the end point. To understand the cognitive and emotional effect when participants played River Survival together using Switch during the COVID-19 lockdown, the present study verified those hypotheses related to the direct effect and indirect effect between family intimacy, flow experience, gameplay anxiety, and perceived value.

Playing virtual sports is significantly associated with biokinematically-driven behavioral engagement (Bakhshaie et al.,



** $p < 0.01$. *** $p < 0.001$.

Fig. 8. Verification of the research model.

Table 4
Indirect effect analysis.

Constructs	Family intimacy	
	β	CI
Perceived value	.26***	[.32-.61]

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

Table 5
The hypothesis verification.

Hypothesis	Results
H1: Family intimacy is positively related to flow experience.	Supported
H2: Family intimacy is negatively related to gameplay anxiety.	Supported
H3: Flow experience is positively related to perceived value.	Supported
H4: Gameplay anxiety is negatively related to perceived value.	Unsupported
H5: Family intimacy is positively related to perceived value mediated by game experience.	Supported

2020). When playing River Survival, one of the features is to avoid the risk of the boat stopping by hitting rocks or big fish with time pressure by using Switch. In addition, the game requires team members to collaboratively control the boat, which makes occurrence dependencies explicit in activity process models (Adamo et al., 2021), and the effects of the interdependencies affect their game experience (Diehlmann et al., 2021). Game experience can be activated by family intimacy which can affect emotion control if there is conflict with family members, particularly with parents (Jin et al., 2019). Participants found that difficulty in adjustment will have a more distressing experience in sport exercise, and they need to ask for support. If the supports are provided by intimate others, they will feel enabled to complete the task more effectively (Brown et al., 2018). Moreover, Sajjadi et al. (2019) revealed that family intimacy can be considered as having a positive association with flow experience, but it may have a negative association with gameplay anxiety. In examining the effect of playing a boating game with family members, the results of this study indicated that family intimacy can positively predict flow experience, but it was not significantly related to gameplay anxiety; that is, drawing on MEC, the game features only afford positive effects for players engaged in playing River Survival.

Challenge and interactivity, as representatives of flow experience in games, have been shown to have positive effects on perceiving utilitarian and hedonic value (Alan et al., 2022). A previous study reported that both a definitive decrease in anxiety and deepened flow can

reinforce sportive performance in collaborative-competition sport (Kim & Kim, 2020). Players feel that they are immersed in the game and can perform at an optimal level (Gutierrez, 2021), and a higher level of flow can make individuals make meaningful progress in physical activities (Jackman et al., 2021). Supporting their studies, H3 in this study was positively supported. Moreover, in collaborative sports, the emotion regulatory process indicates that a state in relation to some goals or outcomes, that states can directly regulate another person’s emotional state (Niven, 2016). For example, for those players with improved affect, their anxiety can enhance the team’s ability to achieve success, but for those players with worsened affect, anxiety can hinder their goal achievement (Tamminen et al., 2021). To play the Switch game, River Survival, four team members in a boat have to work collaboratively. Their flow and anxiety state may influence each other, and those experiences may impact their perceptions of playing values. H4 was not significantly supported; that is, taking anxiety as an affective state, neither affect-improving nor affect-worsening influenced players’ perceived value of playing River Survival.

Value perception, which can be either functional or psychosocial, refers to the results that users seek to achieve with certain product or service attributes (Lin et al., 2020). Game-based learning can improve learning outcomes, and game experiences can be enhanced by promoting engagement to have positive effects on perceiving utilitarian and hedonic value (Alan et al., 2022). For players, perceived value can be either positive or negative. Positive value perceptions are considered to be benefits, while negative consequences refer to the risks that are incurred by interpersonal distance (Lin et al., 2020). As real-world social support but not in-game social support is related to game performance (Tham et al., 2020), family intimacy is considered as a pre-game and real-world social support before playing River Survival. The relationships between family intimacy that participants perceived, and the value of perception of playing this game was positive, indicating that H5 was positively supported.

16. Conclusion

During the COVID-19 pandemic, most people have more time to stay at home and play games together. In particular, in order to maintain social distance, most people play with their family members. That is, to avoid being infected by COVID-19, most people increase their interaction time with family members, but an increase in interaction time does not always mean an increase in a sense of interdependence if the family members lack intimacy. To understand the role of intimacy among

family members and how it affects game experience, drawing on MEC theory, this study explored how players' flow and anxiety were affected when they played River Survival with their family members. Conclusively, the present study verified the research model and found that there was an antecedent role of family intimacy that affected participants' flow state and perceived experiential value in playing River Survival.

17. Contribution

Switch provides players' doing bodying exercise by seeing and responding situation that suddenly appearing on the screen, which requires players to pay attention and responding action from more than one person's action. In line with this playing, players' family intimacy may trigger players cognition and emotion varied during teamwork to play, however, to study the correlates between those factors of cognition and emotion, the results of this study revealed that to align with the boating goals, so that it inherently stimulates social interaction to promote family interaction. Therefore, it is suggested that family members can enjoy playing River Survival at home.

18. Implication

A practical implication of this study is including family intimacy as an antecedent in the relation to flow experience and experiential value in collaborative playing of the game, River Survival, with a new technological device, Switch. That is, family intimacy played a key role of interdependence as a pre-factor of succeeding in virtual boating in this study. Moreover, the results indicated that the higher the level of family intimacy before playing this game, the higher the level of flow experience players would have, and consequently, they would have greater perceived value of collaboratively playing River Survival. Therefore, if people want to collaboratively play virtual sports games during the COVID-19 pandemic or on other occasions, they can organize team members with high levels of intimacy.

A particular feature embedded in the Switch system provides remote competition, meaning that players can organize their teams to compete with other teams while playing River Survival. Such a playing mechanism may result in other practical implications suggested by this study. That is, people in countries which are still encountering the COVID-19 pandemic can spend more time with the same team members to build up a sense of camaraderie. Moreover, as they become more familiar with the operability of the Switch device and know the locations of the rocks or where fish will appear, then they can easily reach the end point.

19. Limitations and future study

Besides "River Survival," there are many other virtual sports games on the market which need players to play collaboratively. Every game has different design features based on the A-C-V model, which may have different results using the same research framework. Thus, future studies can implement other collaborative sports virtual games to study the mental and emotional factors mentioned in this study and to compare the differential power between different games.

The participants in this study included different age groups; however, perceptions of family intimacy from parents' points of view may differ from children's points of view. This perspective was not studied in this research. Future studies may compare the different points of view of parents and children to see how the differences in their perceptions of game experience affect family intimacy.

Credit author statement

Jon-Chao Hong: Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing, Formal analysis. **Hsiao-Chi Juan:** Visualization, Investigation, Data curation,

Conceptualization, Writing – original draft. **Wei-Chen Hung:** Data curation, Formal analysis.

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

- Adamo, G., Di Francescomarino, C., Ghidini, C., & Maggi, F. M. (2021). Beyond arrows in process models: A user study on activity dependences and their rationales. *Information Systems*, *100*, 101762. <https://doi.org/10.1016/j.is.2021.101762>
- Alan, A. K., Kabadayi, E. T., & Aksoy, N. C. (2022). Replaying online games for flow experience and outcome expectations: An exploratory study for the moderating role of external locus of control based on Turkish gamers' evaluations. *Entertainment Computing*, *40*, 100460. <https://doi.org/10.1016/j.entcom.2021.100460>
- Anguas-Gracia, A., Subiron-Valera, A. B., Anton-Solanas, I., Rodríguez-Roca, B., Satústegui-Dorda, P. J., & Urcola-Pardo, F. (2021). An evaluation of undergraduate student nurses' gameful experience while playing an escape room game as part of a community health nursing course. *Nurse Education Today*, *103*, 104948. <https://doi.org/10.1016/j.nedt.2021.104948>
- Aron, A., Mashek, D. J., & Aron, E. N. (2004). Closeness as including the other in the self. In D. J. Mashek, & A. Aron (Eds.), *Handbook of closeness and intimacy* (pp. 27–44). Mahwah, NJ: Erlbaum.
- Awang, Z. (2015). SEM made simple: A gentle approach to learning structural equation modelling. *MPWS Rich Resources*.
- Bakhshaie, J., Lebowitz, E. R., Schmidt, N. B., & Zvolensky, M. J. (2020). Anxiety sensitivity and bodily kinematics. *Behaviour Research and Therapy*, *133*, 103694. <https://doi.org/10.1016/j.brat.2020.103694>
- Belford, N., & Lahiri-Roy, R. (2019). Re)negotiating transnational identities: Notions of 'home' and 'distanced intimacies'. *Emotion, Space and Society*, *31*, 63–70. <https://doi.org/10.1016/j.emospa.2018.11.004>
- Brown, C. J., Webb, T. L., Robinson, M. A., & Cotgreave, R. (2018). Athletes' experiences of social support during their transition out of elite sport: An interpretive phenomenological analysis. *Psychology of Sport and Exercise*, *36*, 71–80. <https://doi.org/10.1016/j.psychsport.2018.01.003>
- Colombo, M., Bucher, L., & Sprenger, J. (2017). Determinants of judgments of explanatory power: Credibility, generality, and statistical relevance. *Frontiers in Psychology*, *8*, 1430. <https://doi.org/10.3389/fpsyg.2017.01430>
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. NY: Harper & Row.
- Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life. The master minds series*. New York, NY: Basic Books.
- Darvin, L., Mumcu, C., & Pegoraro, A. (2021). When virtual spaces meet the limitations of traditional sport: Gender stereotyping in NBA2K. *Computers in Human Behavior*, *122*, 106844. <https://doi.org/10.1016/j.chb.2021.106844>
- Dhar, R., & Wertenbroch, K. (2000). Consumer choice between hedonic and utilitarian goods. *Journal of Marketing Research*, *37*(1), 60–71.
- Diehlmann, F., Lüttenberg, M., Verdonck, L., Wiens, M., Zienau, A., & Schultmann, F. (2021). Public-private collaborations in emergency logistics: A framework based on logistical and game-theoretical concepts. *Safety Science*, *141*, 105301. <https://doi.org/10.1016/j.ssci.2021.105301>
- Emich, K. J., Norder, K., Lu, L., & Sawhney, A. (2020). A comprehensive analysis of the integration of team research between sport psychology and management. *Psychology of Sport and Exercise*, *50*, 101732. <https://doi.org/10.1016/j.psychsport.2020.101732>
- Green, S., & Salkind, N. (2004). *Using SPSS for Windows and Macintosh: Analyzing and understanding data*. NJ: Prentice Hall.
- Gutierrez, J. P. (2021). Do game transfer phenomena lead to flow? An investigation of in-game and out-game immersion among MOBA gamers. *Computers in Human Behavior Reports*, *3*, 100079. <https://doi.org/10.1016/j.chbr.2021.100079>
- Gutman, J. (1982). A means-end chain model based on consumer categorization processes. *Journal of Marketing*, *46*(2), 60–72.
- den Haan, R. J., van der Voort, M. C., Baart, F., Berends, K. D., van den Berg, M. C., Straatsma, M. W., Geenen, A. J. P., & Hulscher, S. J. M. H. (2020). The Virtual River Game: Gaming using models to collaboratively explore river management complexity. *Environmental Modelling & Software*, *134*, 104855. <https://doi.org/10.1016/j.envsoft.2020.104855>
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2019). *Multivariate data analysis* (8th ed.). Andover, England: Cengage.

- Halloran, J., & Minaeva, A. (2019). Touch and play? Investigating the value of touchscreens for gamer experience. *Entertainment Computing*, 32, 100312. <https://doi.org/10.1016/j.entcom.2019.100312>
- Harwood, C. G., & Knight, C. J. (2015). Parenting in youth sport: A position paper on parenting expertise. *Psychology of Sport and Exercise*, 16, 24–35. <https://doi.org/10.1016/j.psychsport.2014.03.001>
- Hayes, S. C., Barnes-Holmes, D., & Wilson, K. G. (2012). Contextual behavioral science: Creating a science more adequate to the challenge of the human condition. *Journal of Contextual Behavioral Science*, 1(1–2), 1–16. <https://doi.org/10.1016/j.jcbs.2012.09.004>
- Hong, J. C., Hwang, M. Y., & Tai, K. S. (in press). Gestalt perception: A game designed to explore players' gameplay self-efficacy and anxiety reflected in their learning effects. *Journal of Research on Technology in Education*. <https://doi.org/10.1080/15391523.2021.1967819>.
- Hong, J. C., Chen, M. L., Wang, C. M., Ye, J. N., & Ye, J. H. (2020). Relationship between the urban and rural students' cooperative attitude, creative task engagements and competition value in participating a STEAM co-creation contest. *International Journal of Information and Education Technology*, 10(12), 873–881.
- Jackman, P. C., Dargue, E. J., Johnston, J. P., & Hawkins, R. M. (2021). Flow in youth sport, physical activity, and physical education: A systematic review. *Psychology of Sport and Exercise*, 53, 101852. <https://doi.org/10.1016/j.psychsport.2020.101852>
- Jang, W., Wann, D. L., & Ko, Y. J. (2018). Influence of team identification, game outcome, and game process on sport consumers' happiness. *Sport Management Review*, 12(1), 63–71.
- Jin, C. C., Zhao, B. B., & Zou, H. (2019). Chinese delinquent and non-delinquent juveniles: An exploration of the relations among interparental intimacy, interparental conflict, filial piety and interpersonal adjustment. *Children and Youth Services Review*, 103, 148–155. <https://doi.org/10.1016/j.childyouth.2019.05.042>
- Ju, U., & Wallraven, C. (2019). Manipulating and decoding subjective gaming experience during active gameplay: A multivariate, whole-brain analysis. *NeuroImage*, 188, 1–13. <https://doi.org/10.1016/j.neuroimage.2018.11.061>
- Kim, T. Y., & Kim, J. H. (2020). High school baseball players' experiences with static qigong training: A qualitative approach. *Complementary Therapies in Clinical Practice*, 39, 101158. <https://doi.org/10.1016/j.ctcp.2020.101158>
- Klasen, M., Weber, R., Kircher, T. T. J., Mathiak, K. A., & Mathiak, K. (2012). Neural contributions to flow experience during video game playing. *Social Cognitive And Affective Neuroscience*, 7(4), 485–495.
- Larche, C. J., & Dixon, M. J. (2021). Winning isn't everything: The impact of optimally challenging smartphone games on flow, game preference and individuals gaming to escape aversive bored states. *Computers in Human Behavior*, 123, 106857. <https://doi.org/10.1016/j.chb.2021.106857>
- Liang, J., & Leung, L. (2018). Comparing smartphone addiction: The prevalence, predictors, and negative consequences in Hong Kong and Mainland China. *The Journal of Social Media in Society*, 7(2), 297–322.
- Lin, C. F., Fu, C. S., & Chi, T. H. (2020). Constructing a hybrid hierarchical value map to understand young people's perceptions of social networking sites. *Behaviour & Information Technology*, 39(2), 150–166.
- Lin, Y. L., Lin, H. W., & Yang, Y. T. (2017). Players' value structure in digital games. *Games and Culture*, 12(1), 72–99.
- Luo, Y., Zhang, H., & Chen, G. (2020). The impact of family environment on academic burnout of middle school students: The moderating role of self-control. *Children and Youth Services Review*, 119, 105482. <https://doi.org/10.1016/j.childyouth.2020.105482>
- Maitland, D. W. M., Kanter, J. W., Manbeck, K. E., & Kuczynski, A. M. (2017). Relationship science informed clinically relevant behaviors in functional analytic psychotherapy: The awareness, courage, and love model. *Journal of Contextual Behavioral Science*, 6(4). <https://doi.org/10.1016/j.jcbs.2017.07.002>
- Martens, R., Vealey, R. S., & Burton, D. (1990). *Competitive anxiety in sport*. Champaign, IL: Human Kinetics.
- Niven, K. (2016). Why do people engage in interpersonal emotion regulation at work? *Organizational Psychology Review*, 6(4), 305–323. <https://doi.org/10.1177/2041386615612544>
- Ó'Sabhain, P., & McGrath, B. (2019). Traditional sailing boats, embodied knowledge(s) and dwelling in coastal rural communities: The case of the 'Galway Hooker' in South West Conamara, Ireland. *Journal of Rural Studies*, 72, 228–239. <https://doi.org/10.1016/j.jrurstud.2019.10.029>
- Procci, K., Bowers, C. A., Jentsch, F., Sims, V. K., & McDanielb, R. (2018). The revised game engagement model: Capturing the subjective gameplay experience. *Entertainment Computing*, 27, 157–169. <https://doi.org/10.1016/j.entcom.2018.06.001>
- Reis, H. T., & Shaver, P. (1988). Intimacy as an interpersonal process. In S. W. Duck (Ed.), *Handbook of personal relationships* (pp. 367–389). Chichester, England: Wiley & Sons.
- Roychowdhury, D., Ronkainen, N., & Guinto, M. L. (2021). The transnational migration of mindfulness: A call for reflective pause in sport and exercise psychology. *Psychology of Sport and Exercise*, 56, 101958. <https://doi.org/10.1016/j.psychsport.2021.101958>
- Sajjadi, P., Hoffmann, L., Cimiano, P., & Kopp, S. (2019). A personality-based emotional model for embodied conversational agents: Effects on perceived social presence and game experience of users. *Entertainment Computing*, 32, 100313. <https://doi.org/10.1016/j.entcom.2019.100313>
- Schafer, T., & Schwarz, M. A. (2019). The meaningfulness of effect sizes in psychological research: Differences between sub-disciplines and the impact of potential biases. *Frontiers in Psychology*, 10, 813. <https://doi.org/10.3389/fpsyg.2019.00813>
- Shen, Y. C. (2021). What do people perceive in watching video game streaming? Eliciting spectators' value structures. *Telematics and Informatics*, 59, 101557. <https://doi.org/10.1016/j.tele.2020.101557>
- Tamminen, K. A., Kim, J., Danyluck, C., McEwen, C. E., Wagstaff, C. R. D., & Wolf, S. A. (2021). The effect of self- and interpersonal emotion regulation on athletes' anxiety and goal achievement in competition. *Psychology of Sport and Exercise*, 57, 102034. <https://doi.org/10.1016/j.psychsport.2021.102034>
- Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., & Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment*, 19(2), 176–188. <https://doi.org/10.1037/1040-3590.19.2.176>
- Tham, S. M., Ellithorpe, M. E., & Meshi, D. (2020). Real-world social support but not in-game social support is related to reduced depression and anxiety associated with problematic gaming. *Addictive Behaviors*, 106, 106377. <https://doi.org/10.1016/j.addbeh.2020.106377>
- Tong, Y., Chen, F., & Shu, B. (2019). Spousal migration and married adults' psychological distress in rural China: The roles of intimacy, autonomy and responsibility. *Social Science Research*, 83, 102312. <https://doi.org/10.1016/j.ssresearch.2019.06.003>
- Ullrich-French, S., & Smith, A. L. (2006). Perceptions of relationships with parents and peers in youth sport: Independent and combined prediction of motivational outcomes. *Psychology of Sport and Exercise*, 7(2), 193–214. <https://doi.org/10.1016/j.psychsport.2005.08.006>
- Ulrich, M., Keller, J., Hoenig, K., Waller, C., & Grön, G. (2014). Neural correlates of experimentally induced flow experiences. *NeuroImage*, 86, 194–202.
- Waterworth, J. A., Waterworth, E. L., Riva, G., & Mantovani, F. (2015). Presence: Form, content and consciousness. In M. Lombard, B. F. Freeman, & J. Jsselsteijn (Eds.), *Immersed in media* (pp. 35–58). Springer.
- Yaqi, X., Lau, Y., Cheng, L.J., & Lau, S. T. (in press). Learning experiences of game-based educational intervention in nursing students: A systematic mixed-studies review, *Nurse Education Today*, <https://doi.org/10.1016/j.nedt.2021.105139>.
- Yuksel, M., Smith, A. N., & Milne, G. R. (2021). Fantasy sports and beyond: Complementary digital experiences (CDXs) as innovations for enhancing fan experience. *Journal of Business Research*, 134, 143–155. <https://doi.org/10.1016/j.jbusres.2021.05.037>
- Zhang, Y., & Fricker, J. D. (2021). Incorporating conflict risks in pedestrian-motorist interactions: A game theoretical approach. *Accident Analysis & Prevention*, 159, 106254. <https://doi.org/10.1016/j.aap.2021.106254>