A Mixed-Methods Approach to Explore Users' Behavior in Playing Mobile Games

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Abstract. With the rapid growth and popularization of mobile phones, the use of mobile applications (Apps) is booming. According to the Market Intelligence & Consulting Institute indicated that mobile games have become an important leisure for people. The immediate goals of the study were threefold: First, this study presented a framework and attempted to acquire an in-depth understanding of the decision-making process with regard to play or not play massive multiplayer on-line role-playing games (MMORPGs) on mobile. Second, this study strove to build up a better model using an ethnographic decision tree modeling (EDTM) that introduced the decision-making process of mobile players. Finally, in practice, marketers and mobile game manufactures could easily become aware of the players' considerations and exactly recognizing what needs to be done to satisfy their demands. This study proposed a decision tree model which was built through 13 criteria where qualitative data gathered from in-depth interviews of 30 respondents. Then, the decision tree model was tested using qualitative and quantitative data from interviews and structured questionnaires involving the 153 respondents in model verification phase and predictive rate of the decision tree model was 85.62%.

Keywords: mobile applications, mobile games, MMORPGs, EDTM

1   Introduction

The pursuit of smart living technology is a recent trend and many countries around the world are adopting smart living technology to improve the quality of life and efficiency including education, housing, food, transportation, and digital entertainment. Increasingly, digital entertainment games have become one of the most popular leisure activities across the whole world [1-2] and had a significant political, economic, social, and technological impact on society [3]. In 2018, Newzoo estimated that 2.3 billion gamers all over the world spent $137.9 billion on games. This was an increase of 13.3% from 2017, or $16.2 billion. In Taiwan, 14.5 million players spent about $1.3 billion in 2018, making it the 15th largest gaming market in the world [4-5].

   According to the Market Intelligence & Consulting Institute (MIC) indicated that mobile phone is the most popular device for playing on-line games with 70.9% [6] and 86% of players use the mobile device to play games [7]. Mobile devices such as smartphones and tablets can be used for a variety of activities anytime and anywhere. The development of mobile technology has dramatically changed people's behavior and daily life. Moreover, advances in 3G and 4G networks are also driving demand for mobile applications (apps) and value-added services [8]. Mobile apps are small software programs designed to install on mobile devices to apply various functions, including web browsing, social networking, e-mail, calendar, health care, mobile payment, mobile wallet, and online gaming. According to the survey, nearly half of the top 100 apps in the Google Play and App Store iTunes in Taiwan are digital games [9]. The type of App that users prefer to download is digital games [10]. As a consequence of this, digital games have become one of the most important activity for youth culture in the early twenty-first century. Many people in their twenties have considered playing games as their main hobby and amusement [2]. Digital

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game revenues took 91% of the global market with $125.3 billion [4]. Overall, mobile revenues grew +25.5% year-on-year to reach $70.3 billion and mobile phones accounted for 80% of this, or $56.4 billion. This meant more than half of all game revenues came from the mobile segment for the first time. Moreover, Newzoo considered mobile games would continue to be the largest segment following ten years of double-digit growth since the first iPhone was launched in 2007. In the future, Newzoo predicts that mobile game revenue growth will continue to exceed the overall games market, growing to $106.4 billion in 2021 [4].

Previous research for playing mobile games had provided a variety of perspectives or built on different theory, including theory of planned behavior [11], technology acceptance model [12-14], experiential value [15], motivation [16-18], conformity theory [12], flow [19], and recommendation mechanism [20]. However, in terms of the majority of the basic aspects of mobile games, little has been done about decision process of playing mobile games used by players and non-players when they decide whether continue playing or not on the mobile device. In addition, since the Internet has spread over the past decade or so, the amount of qualitative research has gradually increased from a minority to an equal interest. Surprisingly, studies combining qualitative methods with quantitative methods have hardly been explored in the literature. Furthermore, this study advanced the trend in which a mixed research method, particularly integrating qualitative patterns with the quantitative one, had gone nearly unexplored in previous literature. Thus, the immediate goals of the study were threefold: First, this study presented a framework and attempted to acquire an in-depth understanding of the decision-making process with regard to play or not play MMORPGs on mobile. Second, this study strove to build up a better model using an ethnographic decision tree modeling (EDTM) that introduced the decision-making process of mobile players. Finally, in practice, marketers and mobile game manufactures could easily become aware of the players' considerations and exactly recognizing what needs to be done to satisfy their demands.

2 Mobile Games and Literature Review

Mobile devices, such as tablet(s) and smartphone(s), have become progressively popular with our daily lives for (the) new generation globally [21-22]. Owing to the technological development of smartphones and the availability of mobile Internet, the circumstances of mobile gaming are progressively changing [8]. At present, people can download more kinds of mobile games from the online App stores [23]. Mobile games are generally defined as games operated in handheld mobile devices played through the internet or computer network available [24]. However, if games played on specialized handheld video game systems such as the Nintendo 3DS (N3DS), Switch or PlayStation Vita (PS Vita), they are not referred to mobile games. Furthermore, mobile games are differentiated from other platform games such as console, personal computer, and arcade games in terms of their accessibility, networkability, simplicity, and mobility (i.e. portability) [24]. Due to the above characteristics, mobile games are different from other platforms in that user can play games anytime or short periods. Additionally, more and more new capabilities that promote interactions between players in mobile games are developing and becoming a popular leisure activity [25]. In terms of the classification, there are different kinds of mobile games in the virtual world such as action, adventure, puzzle, racing, role-playing, strategy, first-person shooter, fighting, sports, platform, cards, and so on. In Taiwan, the top three kind of popular mobile game are bejeweled (44.1%), role-playing game (31.7%) and strategy/simulation game (27.6%) [6], and explain its characteristics as follows: Bejeweled is a tile-matching puzzle game. During the games, players would recognize a specific number of game elements, such as candy, jewels, fruit, from a seemingly chaotic matrix of game elements, and then remove them by putting them together. When a required number of game elements are matched and deleted, players win and can challenge the next harder level [26]. Role-playing games (RPGs) which enable thousands of players to interact at the same time in an online environment and provide players an opportunity to involve themselves in the virtual character during the games. Generally speaking, RPGs have rich storylines by embracing innovative ways of storytelling [27-28]. Simulation/Strategy: The primary elements of the simulation /strategy games are that match the real world through reasoning and problem-solving. This type of games require players to have the ability of making decisions and the process of making decisions will have a significant impact on the outcome [27].

Owing to mobile games had become a growing business in the world, many scholars and research institutions with similar interests dedicated to gain an in-depth understanding of mobile games from a

variety of perspectives, including players' behavior intention, network externality, theoretical standpoint, and user motivation. For example, previous research adopted factor analysis to investigate the willingness of consumers to play mobile games on mobile device and focused on the three dimensions of manufacturer, service platform, and mobile game itself. After incomplete responses and duplicates were removed, 633 usable responses remained. The factor of company operating and service capacity, marketing strategy, quality of visual appeal, storytelling, and interactivity would enhance the willingness of consumers to play mobile games [29]. Moreover, Hsiao and Chen administered an open-ended questionnaire to identify the key factors affecting mobile game players' payment intention. SEM was used to assess the proposed model which was empirically evaluated using a web survey of 3,309 mobile game players. The results found the perceived values (reward, access flexibility, connectedness, and playfulness) of the game had direct influence on the loyalty of all players. Two values of good price and loyalty were found to have a direct impact on a player's intention to make an in-app purchase for mobile games [8]. Research on network externality as an example, Wei and Lu adopted structural equation modeling (SEM) technology to examine the research model in which basing 237 responses collected from online questionnaires. The results indicated both network externalities and individual gratifications significantly influence the intention to play social games on mobile devices [30]. From the theoretical standpoint, the previous research conducted a model based on the theory of planned behavior and experience value which consisted of aesthetics, consumer return on investment, playfulness, and service excellence. The results demonstrated that the attitude, subjective norm in planned behavior theory, service excellence, and playfulness in experience value had significantly positive influence on the intention of playing mobile games. Then, customers return on investment and service excellence in experience value have significant positive impact on playing behavior. Survey on user motivation as an example, MIC investigated more than 7,000 online users for understanding usage behavior and intentions in playing digital games on the Internet in Taiwan. Overall, players (choose) choosing to play a mobile game mainly focused on the product itself and social relationships. The top five reasons included gameplay, influencing from friends or classmates, wanting to try a new game out, depending on the quality of visual appeal, and inviting from friends [6]. However, many of the literature in the past were inclined to discuss these influencing factors independently and quantitative paradigms were typically considered the dominant research method in the mobile games environments. In the light of this, a mixed-method was approached to explore user behavior in playing mobile games in this study.

3 Research Methodology

3.1 Research procedure

EDTM is a formal technique used to combine individual decision-makers' criteria and rules or expert systems into a computer-programmed decision model for the group, which can be tested against actual choice data collected from a sample of decision makers in the group. This research procedure contains two phases (shown as Fig. 1). The decision tree development phase which bases on qualitative research paradigms include an iterative process of asking a series of ethnographic questions, collecting and analyzing ethnographic data, and discovering appropriate questions that assist the researcher in identifying key decision criteria. This study used in-depth interviews and open-ended questionnaires to collect data. The handwritten notes recorded during the in-depth interviews with the consent of the participants and then converted into the verbatim transcripts for future analysis. Through the content analysis, the verbatim transcripts were systematically analyzed to elicit criteria and appropriate questions. The specific segment of content was characterized by setting it in a given category and the frequency with a symbol, idea, or subject matter occurred in a stream of messages tended to be interpreted as a measure of importance, attention, or emphasis [35]. The categories were the criteria of decision-making for formalizing the preliminary model. The decision tree verification phase which bases on quantitative research paradigms to verify the decision tree until the predictability reaches an 85% success rate. The predictability of any given model is determined by dividing the total number of successes by the total number of cases, producing a prediction rate expressed as a percentage. If the model's predictability is less than 85%, it will be modified. Modification of the model might involve reordering the path of the tree or adding new criteria [31].
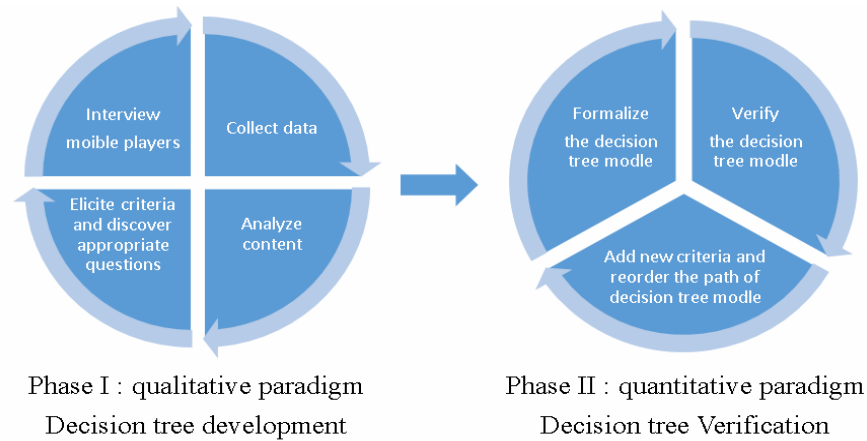
Phase I : qualitative paradigm
Decision tree development

Phase II : quantitative paradigm
Decision tree Verification

Fig. 1. The research procedure

3.2 Samplings and Type of Mobile Games

According to the MIC indicated that the age of mobile game players are between 16 and 31 years old, with the highest percentage of players between 21 and 25 years old [6]. In addition, the survey pointed out that most players play games through mobile phones, and the majority of players like massive multiplayer on-line role-playing games (MMORPGs). From purposive sampling point of view, the samplings of the study were mainly from 21 to 25 years old, and the types of mobile games are focused on MMORPGs. The characteristics of samplings in the first phase will be consistent with the second phase.

3.3 Data Collection and Analysis

The study used open-ended questions in data collection to solve the user's thoughts on playing mobile games, reasons for continuing playing or not to play mobile games, and the factors that influenced decision making. With the consent of the participants, handwritten notes are recorded or summarized during the interview. Participants then reconfirmed their interviews which were recorded and converted into verbatim transcripts for future analysis. All verbatim and reports would not identify individuals, thus assuring confidentiality.

Content analysis is a class of research methods at the intersection of the quantitative and qualitative traditions [32] and a systematic technique for compressing many words of text into fewer content categories based on explicit rules of coding [33-34]. Due to the research method of EDTM, content analysis was suitable for this study and adopted to elicit information from verbatim. The specific segments of content (such as symbols, ideas or subject matters) in verbatim were placed in given categories, and the frequency in which were expounded as a measure of importance, attention, or emphasis [35].

4 Analysis of Results

4.1 Profile of Participants

Through in-depth interviews and using open-ended questionnaires, 30 respondents (15 male and 15 female) participated in developing the decision tree, which reached information saturation. The profiles of the respondents are shown as Table 1. The age of the respondents ranged from 18 to 23, with average age being 20.79. There were 18 respondents who continued to play mobile games, while 12 respondents had stopped playing. The profiles of the model-testing participants are also presented in Table I. Out of the 153 respondents, 76 were male and 77 were female, while 131 were MMORPGs players and 22 were non-players. The average age, 22.18, with values ranging from 18 to 24, is close to the value of the model development phase.

Table 1. Profile of participants

Phase	Status	Age	Gender	Subtotal	Percentage
Model Development	Player	20.79	Male	10	33.3%
			Female	8	26.7%
	Non-player		Male	5	16.7%
			Female	7	23.3%
Model Verification	Player	22.18	Male	64	41.8%
			Female	67	43.8%
	Non-player		Male	12	7.8%
			Female	10	6.6%

4.2 Model Development Phase

This study adopted content analysis to systematically analyze the verbatim of the interviews collected in the model development phase. When using content analysis, selecting the unit of analysis is the most basic decision [36]. Following the suggestions, the verbatim of interview was used as unit of analysis. Keywords or phrases mentioned the reasons behind respondents' decisions were identified from the verbatim. After identifying keywords or phrases, categories were organized by disintegrating those keywords or phrases with similar meaning into higher order categories and derived the influencing factors that were called criteria. In order to minimize the potential bias introduced by the researchers and enhance the quality of thematic analysis, three research assistants who had qualitative research methods training, especially content analysis, were invited to participate the data-category checking and validating the process.

In total of 13 decision categories were identified from analyzing the 30 respondents. Table 2 shows the frequency of the 30 respondents who referred to a decision category when describing how they made their MMORPGs playing decision in mobile games. The top five categories that 30 respondents mentioned were "play mobile games because feel bored", "when kith and kin recommend to play", "have free time to play mobile games", "play mobile games depending on the quality of visual appeal" and "the habit of playing mobile games". Other decision categories that were less frequent appeared to be more related to personal needs such as a sense of accomplishment, relaxation and interaction with other players. This study utilized these 13 criteria to build up the preliminary decision tree model. Each question on the preliminary decision tree model is expressed one criterion. Those criteria were then phrased as questions, which merged the keywords and phrases that respondents themselves said. Moreover, each criterion was developed into a single question requiring a "yes" or "no" answer and mapped out as the decision tree node. The ordering of criterions in the decision tree model can be built up through the frequency statistics and logic [31]. The more frequencies of decision criteria, the higher located in the decision tree model. The decision-making process of the respondents as logic could help to determine the ordering. For pilot study purpose, ten respondents who experienced with/without MMORPGs in mobile games were selected conveniently to check the preliminary decision tree model. There were no new criteria added to the preliminary decision tree model. Consequently, the model seems suitable for further testing in the model verification phase.

4.3 Model Verification Phase

Quantitative procedures through deductive methods were conducted in data analysis during model verification phase. First of all, 153 respondents were interviewed individually with a questionnaire in the previous phase. Soon afterward, this study compared the respondent's actual decision with the predicted outcomes from a series of yes/no answers to each decision criteria. Accordingly, the appropriateness of the decision pathway direction was situated (shown as Fig. 1). If the respondent was mentioned a different fact than predicted by the decision tree model, case was considered as failed. Finally, the error rate of the preliminary decision tree model was calculated to evaluate the predictability. While trying to predict 153 respondents, the preliminary decision tree model made 22 errors. A predictive rate of the preliminary decision tree model is 85.62% and has reached the threshold [31]. Therefore, it is not necessary to go back to the model development phase to modify. The results indicated that respondents decide to play or not familiarly have 13 main criteria and these can be probably classified into three

Table 2. The criteria of decision-making

No.	Decision Criteria	Original Statement	frequency
1	Do you play mobile games when you feel bored?	P_2: When I feel bored, I would play mobile games to kill time.	13
2	Do you play mobile games when your kith and kin recommend?	P_1: My friend recommended me to play mobile games at first, and then I became addicted.	8
3	Do you have free time to play mobile games?	P_{23}: I have no free time to play mobile games.	7
4	Do you play mobile games depending on the quality of visual appeal?	P_{16}: I think the visual effect of the game needs to be quality	6
5	Do you have the habit of playing mobile games?	P_{25}: I didn't have the habit of playing mobile games.	5
6	Do you play mobile games because it is interesting?	P_{17}: I play mobile games because I am interested in mobile games.	5
7	Do you play mobile games because you see ads?	P_5: I saw the adverts of the mobile game repeatedly, just download and try it out.	4
8	Do you not continue to play mobile games because it wastes time?	P_{20}: It is a waste of time to play mobile games	4
9	Do you think mobile games are playable?	P_{13}: mobile games is very playable for me to play.	4
10	Do your kith and kin invite you to play mobile games together?	P_{19}: Friends will invite me to play together.	3
11	Do you get a sense of accomplishment from mobile games?	P_6: I have a sense of accomplishment in playing mobile games	2
12	Do you play mobile games for relaxation?	P_{14}: I am playing mobile games for relaxation.	2
13	Do you think it is valuable to play mobile games?	P_{22}: Playing mobile games has no value to me.	1

categories: social interaction, technological perspective, and personal engagement. The social interaction contains three criteria: "Do your kith and kin invite you to play mobile games together?", "Do you play mobile games when your kith and kin recommend?" and "Do you play mobile games because you see ads?" The technological perspective consists of three criteria: "Do you play mobile games depending on the quality of visual appeal?", "Do you play mobile games because it is interesting?" and "Do you think mobile games are playable?". Finally, the personal engagement perspective reflect: "Do you play mobile games when you feel bored?" "Do you have the habit of playing mobile games?", "Do you have free time to play mobile games?", "Do you not continue to play mobile games because it wastes time?", "Do you get a sense of accomplishment from mobile games?", "Do you play mobile games for relaxation?" and "Do you think it is valuable to play mobile games?". In order to improve and refine decision tree model, in terms of errors, the cases were further interviewed to understand extra information to assist recognize where the decision tree model pathway or decision criteria need to be modified in the future. Three respondents who were inconsistent with the decision tree model prediction were randomly selected and responded as in the following explanation:

I considered the majority of mobile games were low in playability. After playing for a while, I wanted to change to a new one (Case No. 35).
Overthinking is what kills you. Whether I had time or not, I played mobile games when I just wanted (Case No. 27).
Normally, if I had free time, I would like to go shopping or have dinner with friends (Case No. 46).

{ To play mobile games or not? }

⟨ Do you play mobile games when you feel bored? ⟩

Yes → ⟨ Do you play mobile games when your kith and kin recommend ? ⟩

No → ⟨ Do you have free time to play mobile games? ⟩

Yes → ⟨ Do your kith and kin invite you to play it together? ⟩

No → ⟨ Do you play it depending on the quality of visual appeal? ⟩

Yes → ⟨ Do you not continue to play mobile games because it wastes time? ⟩

No → ⟨ Do you have the habit of playing mobile games? ⟩

Yes → ⟨ Do you get a sense of accomplishment from it? ⟩

No → ⟨ Do you play mobile games for relaxation? ⟩

Yes → ⟨ Do you think it is valuable to play mobile games? ⟩

No → ⟨ Do you think mobile games are playable? ⟩

Yes / No

Not play 4 cases

⟨ Do you get a sense of accomplishment from it? ⟩
Yes: **Play** 47 cases 5 errors
No: **Not play** 5 cases 2 errors

⟨ Do you play mobile games for relaxation? ⟩
Yes: **Play** 31 cases 4 errors
No: **Not play** 2 cases 1 error

⟨ Do you play mobile games because it is interesting? ⟩
Yes: **Play** 32 cases 4 errors
No: **Not play** 1 case

⟨ Do you play mobile games because you see ads? ⟩
Yes: **Play** 21 cases 3 errors
No: **Not play** 0 case

⟨ Do you think it is valuable to play mobile games? ⟩
Yes: **Play** 3 cases 1 error
No: **Not play** 1 case

⟨ Do you think mobile games are playable? ⟩
Yes: **Play** 5 case
No: **Not play** 1 case 2 errors

Fig. 2. The model of playing mobile games

5 Conclusions and Discussion

5.1 Conclusions

This study aimed to build up a framework and to obtain a more in-depth understanding of the decision-making process about playing or not playing MMORPGs on mobile device. A two-phase mixing method in both qualitative and quantitative procedures that was called EDTM had adopted in this study and gave empirical evidence that the decision tree model could be an advantageous framework to predict players' behavior intention. In model development phase, the decision tree model was built through 13 criteria where qualitative data gathered from in-depth interviews of 30 respondents. Then, the decision tree model was tested using qualitative and quantitative data from interviews and structured questionnaires involving 153 respondents in model verification phase. A predictive rate of the decision tree model was 85.62%. The framework not only for understanding in depth explanation and more comprehensive of playing MMORPGs phenomenon on mobile device, but also for further interpretation the players' considerations and exactly recognizing what needs to be done to satisfy players' demands. Furthermore, the results of this study provided 13 main criteria and these can be roughly classified into three categories: social, technological, and personal engagement perspectives. From the viewpoint of social interaction, three decision criteria such as No.2, 7, and 10 were included. In terms of technological perspective, three decision criteria such as No.4, 6, and 9 were involved. Finally, the personal engagement perspective was reflected as No.1, 3, 5, 8, 11, 12, and 13.

5.2 Discussion

The insights for theoretical and practical implications of playing mobile games as specified in the following list: From social interaction perspective, playing online games had become a channel for players to immediately and anonymously communicate, share experience, socialize, and evolve virtual communities in the end [37]. Social interaction was what served as primary drivers to continue playing MMORPGs [38]. Based on the results of this study, experience and observation of players in mobile games, to encourage players learn to cooperate or organize as a team to complete missions for game designers was important. Furthermore, the study found many respondents who playing mobile games were mainly influenced by classmates, friends, and family. Recently, social media had become a ubiquitous part of our daily life. Social media such as Instagram, Facebook, Twitter, YouTube, Twitch might be a useful channel for mobile gaming companies to enhance players' intent and spread brand awareness.

In view of personal engagement, in order to satisfy personal needs that were not satisfied in the real-world had been determined as the important purpose of the Internet [39-40]. Compared to personal computers and game consoles, although mobile phones are not good devices for playing, they are personal belongings [41]. Because of the feature of convenience, portability, and cost, playing mobile games have become a popular leisure activity choice for people to kill time or the transition between two activities [14, 25, 42] such as commuting time, break time, and stand in a queue. Previous research had found when people felt bored, lonely and depressed, they would try to play low-cost or even free mobile games to get pleasure. Playing mobile games could effectively and immediately solve their annoyances to fill the gap in real life [43]. This study identified seven criteria related to personal engagement and summarized the eventful element of accomplishment, relaxation, and added value for heightening the playability in mobile games. In other words, when players got more enjoyment from mobile games, they would continue to play games with a stronger motivation or a positive attitude [30, 44].

From a technological perspective standpoint, the study demonstrated that the criteria of visual appeal, interesting playable were important for simulating the decision-making process of whether or not to play mobile games. Previous research had also found enjoyment which was primarily driven by the game system's capacity of regeneration, design aesthetics and easy to use [44]. The perceived value of the game such as connectivity and access flexibility had direct influence on the loyalty [8]. Moreover, plentiful visual appeal and attractive sound effects had a positive influence and increased the playability of game. As a consequence, this satisfied players' need for emotional release, aesthetic enjoyment, escape from reality and pastime [45]. An enjoyable experience was positively affected consumers' intention to pay for using mobile value-added services [46]. Affirmatively, more visual appeal, attractive sound and enjoyable will be a new challenge for game developers designing mobile games.

5.3 Future Work

There are still many topics that can be further explored in the future. This study used demographic variables of age and gender as the standard of interview. Certainly, more demographic variables such as income, level of educational, marital status, location or occupation might as an important consideration for market segmentation and marketing strategy would be discussed.

Because mobile games have become an important leisure for people, many scholars and research institutions with similar interests dedicated to gain an in-depth understanding of mobile games from a variety of perspectives, including players' behavior intention, network externality, theoretical standpoint, and user motivation. However, this study only presented a framework and acquired in-depth understanding of the decision-making process about MMORPGs on mobile. There are still many different kinds of mobile games that need to be explored deeply in the future.

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