The Adoption of Mobile Games in China: An Empirical Study

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Abstract. Mobile games have become very popular in recent years in China. This research aims to investigate the potential factors that influence users' intention to play mobile games. Through the employment of structural equation modeling technology, a research model by extending technology acceptance model (TAM) with flow experience and social norms was proposed. This research model was empirically evaluated using survey data collected from 388 users about their perceptions of mobile games. Eleven research hypotheses were proposed in the study. Eight research hypotheses were positively significant supported, while three research hypotheses were rejected in this study. The result indicates that attitude and flow experience explain about 75% of uses' intention to playing mobile games. It was found that social norms do not have direct effect on the intention to play a mobile game. But it affects the attitude directly. In addition, flow experience, perceived ease of use and perceived usefulness all have direct effects on users' attitude toward playing a mobile game, and the effect from flow experience is quite strong. Flow experience plays an important role in the adoption of mobile games according to the analytical results of our study.

Keywords: Mobile game, TAM, Flow experience, Social norms.

1 Introduction

With the widespread application of the 3G network and handheld technologies in recent years, a number of new mobile innovations have been pushed into the market. Mobile games are one of the most promising and profitable services among them. It is growing rapidly worldwide. According to a report from iResearch in January 2014, the users of mobile game in China were more than 300 million in 2013, and the market revenue of mobile game had reached 11.24 billion, 246.9% higher than last year. Consequently, China is estimated to be one of the largest and fastest-growing mobile markets in the world.

It is found that mobile games are getting increasingly popularity and more and more important in mobile industry [8]. The object of this research is to study the

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adoption of mobile games in China. We attempt to investigate potential factors that impact users' intention to play mobile games in China in this research.

Technology Acceptance Model (TAM) [3] has received considerable attention of researchers in the information system field over the past years, and it has been applied to examine IT usage. Many previous studies (e.g., [1, 17]) have verified that user's perceived ease of use and usefulness are key determinants of individual technology adoption. However, perceived ease of use and perceived usefulness may not reflect the motivation of mobile game users exactly. Depending on the specific technology context, additional explanatory variables may be needed beyond the ease of use and usefulness constructs [5-6]. In this study, we proposed additional variables, such as flow experience and social norms to enhance our understanding of mobile game user behavior. Flow theory was used to study the influence of user concentration on task activity [2]. Flow has been studied in the context of information technologies and has been recommended as useful in understanding user behavior. Furthermore, several theories suggest that social influence is important in shaping user behavior. Innovation diffusion research [19] also suggests that user adoption decisions are influenced by a social system beyond an individual's decision style and the characteristics of the information technology. Both the additional variables are necessary to consider in understanding the user behavior of the mobile game context. We used the structure equation model to assess the relationships of variables in the extended TAM in this study.

The remainder of this paper is organized as follows: Section 2 discusses the theoretical background of this study. The research model and hypotheses are presented in Section 3. The research method and results are described in Section 4. This is followed by a discussion of the findings in Section 5. Section 6 concludes this research.

2 Literature Review

The literature related to this research is discussed in this section.

2.1 Technology Acceptance Model (TAM)

TAM is widely acknowledged as one of the most robust and influential models for explaining user acceptance behavior. It has been revised to incorporate additional variables in specific contexts, such as the Internet [20], WWW [18], and so on. Numerous extended variables with specific contexts have been added to TAM, such as perceived playfulness proposed for studying WWW acceptance, perceived enjoyment [10] in using the Internet, trust [7] in using mobile information services, compatibility in virtual stores, flow and environmental psychology in a web-based store, and perceived critical mass in groupware usage. These studies with extended beliefs were proposed to improve the understanding of user acceptance behavior for specific contexts, and better explanations were enabled as a result.

In the context of mobile games, social factors and flow experience are considered as additional variables. Flow experience has been studied as a possible measure of mobile user experience. As game playing may involve unique experiences for players, flow experience was proposed as a motive for playing games in our study. Additionally, technical barriers may have a negative impact on flow experience, consequently, we also considered technical barriers here. Besides, social interaction has critical impact on game players. Therefore, social norms have been assumed to influence user participation and added as the additional belief.

2.2 Flow Experience

The original concept of flow was first introduced by Csikszentmihalyi [2], and has been defined as the holistic experience that people feel when they act with total involvement. In previous studies, flow has been widely used in information system and electronic commerce contexts, such as web navigation, World Wide Web, online shopping, online game and so on. It suggests that online user behavior is significantly affected by the flow experience. Recently, with the development of the mobile devices, flow has also been studied in the mobile environment. For example, Tao Zhou et al. [24] examined the effect of flow experience on mobile social networking service (SNS) users' loyalty, and the results showed that both information quality and system quality significantly affected users' trust and flow experiences, which further determined their loyalty. Moreover, Chia-Liang Hung et al. [12] did a research which examined the influence of usability and flow on user satisfaction of mobile gaming. They built two structural equation models tested the influences resulted from usability and flow, and found the integrative model of usability and flow could explain user mobile satisfaction well.

In summary, most of the previous studies about flow focus on the online environments. The study of flow experience in the mobile environment is just at the beginning, especially for mobile games. In addition, approaches to measuring flow can be broadly characterized as unidimensional or multi-dimensional. In most cases, flow is treated as a multi-dimensional construct and it has characteristics of control, enjoyment, concentration, intrinsic interest, curiosity, etc. Flow is defined as an extremely enjoyable experience in this study. Accordingly, an individual will engage in a mobile game activity with total involvement, control, concentration, enjoyment and intrinsic interest in the flow experience.

2.3 Technical Barriers

In diffusion research theory, barriers are relevant in explaining the difference between innovators and early adopters and other ideal types of adoption behavior, such as the early and late majority and laggards [19]. According to research from Kim et al. [14]., he technicality, defined as the degree to which a mobile service is perceived as being technologically excellent in the process of providing services, was considered as a sacrifice component of the perceived value of an advanced mobile service, reducing the value and intended adoption of a service. Technological barriers may reduce the

self-efficacy or perceived behavioral control of users. The technicality of smartphones and mobile services can be translated into the time and effort required to learn and use a system, which may have a negative impact on perceived behavioral control that is one of the characteristics of flow experience. Lack of technical support and training in using mobile systems, are argued to have a negative influence on the adoption of advanced mobile technologies and services [23].

2.4 Social Norms

Social norms represent a factor that is assumed to have a direct impact on perceived utility [15]. Some theories (e.g., [15]) suggest that social norms are crucial in shaping user behavior. Social norms consist of two distinct influences: informational influence and normative influence. Informational influence occurs when a user accepts information obtained from other users as evidence about reality, while normative influence refers that when a person conforms to the expectations of others to obtain a reward or avoid a punishment [4]. Informational influence is an internalization process that occurs when a user perceives information as enhancing his/her knowledge above that of reference groups [13]. Normative influence consists of two processes: identification, which occurs when a user adopts an opinion held by others because he/she is concerned with defining himself/herself as related to the group, and compliance, which occurs when a user conforms to the expectations of another to receive a reward or avoid rejection and hostility. In this study, we define social norms as the extent to which the user perceives the others' approval of his/her mobile game playing.

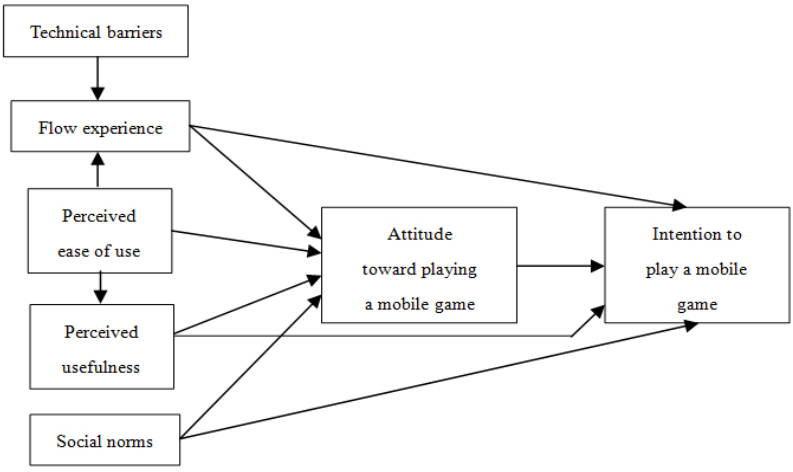

Fig. 1. Research Model

3 Research Model and Hypotheses

The proposed research model (See Figure 1) is an extension of TAM, with a consideration of flow experience, social norms, and technical barriers in addition to

perceived ease of use and perceived usefulness, to study the user adoption of mobile games. The perceived usefulness is defined as the degree to which the user believes that playing mobile games will fulfill the purpose. The perceived ease of use to mobile game playing is defined as the degree to which users feel free from engaging in mental and physical efforts. The attitude toward playing a mobile game is defined as user preferences as to mobile game playing. Moreover, the intention to play a mobile game is the degree to which the user would like to reuse mobile games in future.

3.1 Perceived Ease of Use, Perceived Usefulness, Attitude from TAM

In this study, the research model is based on the TAM model. Therefore, our research model adopted the belief-attitude-intention-behavior relationship. According to the TAM, the following hypotheses were proposed in the context of mobile game playing:

H1: Perceived ease of use has a positive effect on the attitude toward playing a mobile game.

H2: Perceived ease of use has a positive effect on perceived usefulness.

H3: Perceived usefulness has a positive effect on the attitude toward playing a mobile game.

H4: Perceived usefulness has a positive effect on the intention to play a mobile game.

H5: Attitude has a positive effect on the on the intention to play a mobile game.

3.2 Flow Experience

A positive relationship between flow and perceived ease of use was identified from the past studies. Besides, Webster el al. found that flow experience was related to positive subjective experience and exploratory behavior [22]. Flow experience seemed to prolong Internet usage. On the basis of the former research, the following hypotheses were proposed:

H6: Perceived ease of use has a positively effect on the flow experience of playing a mobile game.

H7: Flow experience has a positively effect on the attitude toward playing a mobile game.

H8: Flow experience has a positively effect on the intention to play a mobile game.

3.3 Technical Barriers

The technicality of smartphones and mobile services can be translated into the time and effort required to learn and use a system, which may have a negative impact on perceived flow experience. Accordingly, we argue that technical barriers influence the acceptance of mobile games by reducing users' flow experience. Therefore, we proposed the following hypothesis:

H9: Technical barriers have a negative effect on flow experience of playing a mobile game.

3.4 Social Norms

Numerous empirical studies have found that social factors positively impact on user's IT usage. For instance, Venkatesh et al. noted that social norms represent a factor that is assumed to have a direct impact on perceived utility [21]. Accordingly, the following hypotheses were proposed:

H10: Social norms have a positive effect on the attitude toward playing a mobile game.

H11: Social norms have a positive effect on the intention to play a mobile game.

4 Data Analysis

Empirical data was collected by conducting an online survey. We choose college students as the major participants for the following reasons. According to iResearch, the users of mobile game are relatively young, and more than 60% concentrated in 18-30 years old in 2012. Meanwhile, almost 57.6% of the mobile game users have the college degree at least. Therefore, the college students are very representative as the participants for our study.

The survey yielded 412 responses both online and offline, 396 of them were usable. Among the participants, 98.0% had the experience of playing mobile game. Thus, we considered the 388 respondents as our analysis objects. 29.9% of the participants were male, and 70.1% were female. 88.9% of the respondents played mobile game on smartphones. Furthermore, 43.8% were most likely to play mobile game in the dormitory. Besides, about 80% had played mobile games for more than 1 year.

Developed from the literature, the measurement questionnaire consisted of 22 items. A seven point Likert scale, with 1 being the negative end of the scale (strongly disagree) and 7 being the positive end of the scale (strongly agree), was used to examine participants' responses to all items in the survey. In addition, data were analyzed using the structural equation modeling (SEM).

4.1 Measurement Model

The fitness measures are shown in Table 1. Except for the GFI and RMESA, the other fitness measures were all within acceptable range. In practice, GFI values above 0.8 are considered to indicate a good fit. Meanwhile, RMESA is also acceptable when it is less than 0.08 [9]. Consequently, all the fitness measures are within acceptable range. Therefore, we consider the measurement model is acceptable, and the measures indicate that the model fit the data.

The item reliabilities range from 0.51 to 0.93, which exceed the acceptable value of 0.5. Table 2 shows the composite reliability and average variance extracted. All the reliabilities exceed the threshold value of 0.7. Meanwhile, the average variances extracted for all constructs exceed the benchmark of 0.5. As the three values of reliability are above the recommended values, the scales for measuring these constructs are deemed to exhibit satisfactory convergence reliability.

Table 1. Fit indices for the measurement model

Measures	Recommended criteria	Measurement model
Chi-square/d.f.	<3.0	2.950
GFI	>0.9	0.880
AGFI	>0.8	0.844
CFI	>0.9	0.903
RMESA	<0.05	0.071

Table 2. Construct reliabilities

Construct	Composite reliability	Average variance extracted
Technical barriers	0.744	0.509
Social norms	0.957	0.917
Perceived ease of use	0.879	0.709
Perceived usefulness	0.910	0.772
Flow experience	0.873	0.579
Attitude	0.919	0.791
Intention to play	0.833	0.624

Furthermore, the variances extracted by the constructs are more than the squared correlations among variables. The fact reveals that constructs are empirically distinct. As the convergent and discriminant validity measures are quite well, the test of the measurement model is satisfactory.

4.2 Tests of the Structural Model

The structural model was tested using Amos 20. The results of the structural model are shown in Fig. 2.

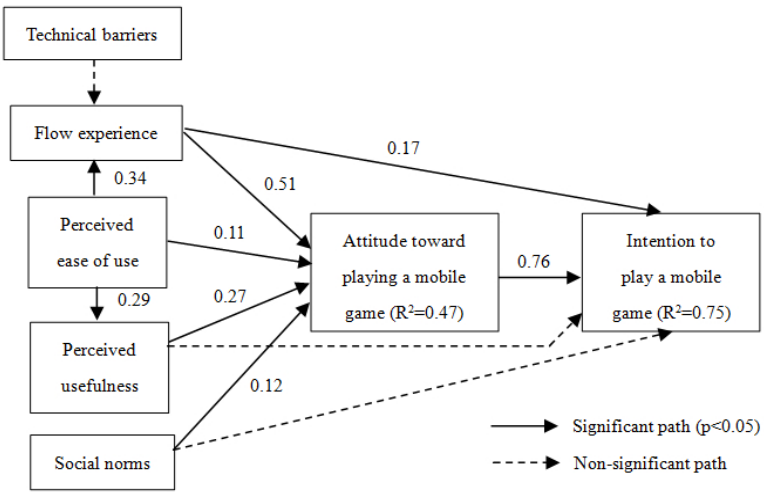

Fig. 2. Results of structural modeling analysis

The standardized path coefficients between constructs are presented, while the dotted lines stand for the non-significant paths. As a result, eight hypotheses were supported, while three hypotheses were rejected in the research model. The path coefficient from flow experience, perceived ease of use, perceived usefulness and social norms to attitude toward playing a mobile game are all statistically significantly. The positive effects of flow experience and perceived usefulness on attitude were relatively strong, as shown by the path coefficient of 0.51 and 0.27 ($P<0.001$). The other path coefficients of perceived ease of use and social norms were statistically positively significant at $P<0.05$. The path from flow experience, perceived ease of use, perceived usefulness and social norms explains 47% of the observed variance in attitude toward playing a mobile game. Thus, H1, H3, H7 and H10 were supported. The effect of attitude toward playing a mobile game on intention to play a mobile game is quite strong, as indicated by the path coefficient of 0.76 ($P<0.001$). The other path coefficient from flow experience to intention to play a mobile game is statistically significant at $P<0.05$. Besides, 75% of the observed variance in intention to play mobile games can be explained by the two paths. Therefore, H5 and H8 were supported. Furthermore, H2 and H6 are also supported with the perceived ease of use positively related to flow experience and perceived usefulness by the path coefficients of 0.34 and 0.29 at $P<0.001$.

5 Discussion

In our study, we find that three hypotheses are not supported. Firstly, technical barriers do not directly affect uses' flow experience. In previous study, it was found that the technicality have a negative impact on perceived behavioral control which is one of the characteristics of flow experience. But, according to our results, technical barriers did not appear to directly affect flow experience. The possible explanation might be that most users are young people and they have skills in playing games. Meanwhile, most mobile games are relatively easy to use. Thus, technical barriers may not be the obstacles in enjoying flow experience for the users. Secondly, the results show that perceived usefulness directly affect the attitude toward playing a mobile game, but it does not motivate users to play mobile games. Some previous studies found the similar results too (e.g.,[16] [11]). It seems reasonable that users would like to play mobile games if they find them useful, while mobile games can entertain the users and bring enjoyment to them. But the results indicate that perceived usefulness does not appear to drive users' participation. The users consider mobile games as an entertainment technology, and they usually want to kill time by playing mobile games. Thus, the significant effect of perceived usefulness to intention to play a mobile game might decrease. Thirdly, the hypothesis that social norms have positive effect on intention to play a mobile game is also not supported. The social norms directly affect the attitude towards playing a mobile game but it does not motivate users to play mobile games similar to the perceived usefulness. Users of mobile games may draw their attention to some mobile games when their friends or classmates recommend them. The systems on the mobile devices will recommend the

new and popular games to the users. They can easily find most popular and newest games through the mobile systems. As most users regard the mobile game as an entertainment technology, they always choose the most convenient way to find a mobile game to play. Therefore, the users are more likely to play a mobile game recommended from the mobile systems than from the friends or classmates. In summary, social factors may have positive effect on the adoption of mobile games for the users to some extent, but the influence might not be strong.

Flow experience plays an important role in the adoption of mobile games. It has strong effect on the attitude to mobile game playing, and it also directly affects the intention to play a mobile game. We find that if the users have ever experienced being absorbed in playing a mobile game, they are more likely to adopt a mobile game.

We find that perceived ease of use has positive effect on both flow experience and perceived usefulness. The user-friendly interface of a mobile game is an important factor in forming flow experience of the users. If a user has difficulty in playing a mobile game, he/she may not have the flow experience and may not perceive the usefulness of the game, and then he/she may give up playing the mobile game.

6 Conclusion

With the development of mobile technology, mobile games are becoming more and more popular among the mobile users, but only few studies are concerned with identifying the factors that affect user behavior of mobile games. This study examined users' adoption of mobile games by extending TAM with two additional construct, flow experience and social norms. A research model with 11 research hypotheses was proposed in the study. Eight research hypotheses were positively significant supported, while three research hypotheses were rejected in this study. The results indicated that perceived ease of use directly affects the flow experience, and the flow experience has positive effect both on the attitude and intention to playing mobile games for the users. Meanwhile, social norms do not have positive effect on user's intention to play mobile games, but it affects uses' attitude toward playing mobile games directly. Thus, mobile game providers should be concerned with both flow experience and social factors to facilitate user adoption and usage of mobile games.

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