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Exploring user experiences as predictors of MMORPG addiction

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ABSTRACT

The overuse of Massively Multiplayer Online Role Playing Games (MMORPGs) is becoming a significant problem worldwide, especially among college students. Similar to Internet addiction, the pathological use of MMORPG is a kind of modern addiction that can affect students' lives on both a physical and a psychological level. The purpose of this study is to understand MMORPG addiction from a user experience design approach. We first developed a complete model that includes eleven factors (*challenge*, *fantasy*, *curiosity*, *control*, *reward*, *cooperation*, *competition*, *recognition*, *belonging*, *obligation* and *role-playing*) to represent users' experience in MMORPGs. After that, we design a questionnaire to measure student' gaming experience and level of addiction. Students' demography information, including gender and game playing habits, was also collected. Four hundred and eighteen Taiwanese college students aged 18–25 years old took part in this online survey. Regression analysis was then conducted to evaluate the relative explanatory power of each variable, with addiction score as the dependent variable and the eleven user experience factors as the independent variables. The results of regression analysis reveal five critical factors (curiosity, role-playing, belonging, obligation and reward) that can be used to predict MMORPG addiction. In addition, this study also infers possible casual mechanisms for increasing college students' level of addiction. The implications of our findings for both design and educational practitioners were also discussed.

1. Introduction

Massively Multiplayer Online Role Playing Games (MMORPGs) are immersive 3D environments that enable large numbers of users to interact with one another via the Internet. This genre of games, which includes World of Warcraft, Lineage, and EverQuest, has spawned a multi-billion dollar global market (DFC-Intelligence, 2004). Today, there are over 16 million subscribers worldwide playing in a persistent game world (Woodcock, 2008). MMORPGs are bringing about a digital entertainment lifestyle among young people.

For most people, games do not force them to participate; people voluntarily use part of their leisure time to seek enjoyment from the game (Rieber, 1996). However, some people still cannot keep themselves from spending an excessive amount of time playing MMORPGs compared to the time playing game consoles such as Xbox 360, Nintendo Wii or PlayStation 3 (Ng & Wiemer-Hastings, 2005).

Much research has provided evidence to support the existence of MMORPG overuse. A marketing survey shows that approximately 9% of gamers overuse MMORPGs (ESA, 2005). In United States, approximately 45% of MMORPG users spend more than 20 h on MMORPGs per week (Ng & Wiemer-Hastings, 2005) and more than 50% of young people play MMROPGs for 10 h continuously or more (Yee, 2002). In Asia, a governmental survey in South Korea indicated that 2.4% of young people are excessive game users (Faiola, 2006). In Taiwan, 6% of college students considered themselves dependent on Internet activities, including online gaming (Chou & Hsiao, 2000). It is clear that the prevalence of MMORPG overuse is becoming a significant problem worldwide.

Some researchers are starting to use the term 'addiction' to describe the phenomenon of MMORPG overuse (Chou & Ting, 2003; Yee, 2006). They believe that MMORPG addiction is a kind of modern day addiction similar to Internet addiction, which affects peoples' daily lives on both a physical and a psychological level. For example, addicts may alienate themselves from the real world, hamper their interpersonal relationships, degrade their academic performance, and lose their sense of time (Chiu, Lee, & Huang, 2004; Chuang, 2006; Rau, Peng, & Yang, 2006). Some heavily addicted gamers even require psychological intervention to bring them back to a normal life (Griffiths, 1998). In addition, heavily addicted gamers may suffer from physical problems such as insomnia (Yee, 2002), epileptic seizures

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(Chuang, 2006), and in rare cases sudden death (Miller, 2002). The negative effects of MMORPG addiction have attracted the attention of the research community and government regulatory agencies (Chiu et al., 2004; Chuang, 2006; Rau et al., 2006; Wan & Chiou, 2006).

Unfortunately, there have not yet been any solid methods established for diagnosing this kind of modern addiction. Some researchers apply the diagnostic criteria for pathological gambling to game addictions because the symptoms of Internet addiction and online game addiction are similar to those of pathological gambling (Chou & Ting, 2003; Griffiths, 1998; Young, 1998). The diagnostic criteria for gambling addiction have been well established in the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders), which was published by the American Psychiatric Association (APA) and is used worldwide to diagnose gambling addiction (APA, American Psychiatric Association, 1994).

Several approaches have been established for preventing MMORPG addiction from both practical and academic perspectives. One of these approaches is for the server to force the users to stop their game after excessive play. For example, the Chinese government developed a fatigue monitor system to count the number of hours of users' game play. Under the protection of this anti-addiction system, the users' game character will lose power and experience points after a certain amount of game play. In reality, however, most MMORPG users have more than one account and multiple characters they could log on to in order to resume play in the game, even when they receive notice messages from the fatigue system (ChinaTechNews, 2007).

Another approach is to identify potential addicts and give warnings or appropriate education regarding addiction. Prior research on MMORPG addiction has identified the personal attributes of the individuals who are at high risk of becoming potential addicts. Personal attributes such as user personality, gender, age, skill, family structure, and playing habits are critical factors that can be used to predict a high risk of addiction (Chiu et al., 2004; Lo, Wang, & Fang, 2005). However, in the application of addiction prevention, it is difficult to ask users to provide personal information regarding game usage and overall lifestyle for the purpose of addiction prevention. Therefore, this approach has limited practical use in predicting the possibility of addiction and preventing it.

The other approach to preventing MMORPG addiction is to change the design of users' game playing experience. The concept of this approach is that the users' gaming experiences are created by interacting with game features such as episodes, music, sound/light effects, and virtual scenes. Different levels of game design features might be able to provide users with different gaming experiences. Therefore, it is possible to manipulate the characteristics of MMORPG design features to adjust user experience, both positively (e.g. fun, enjoyment) and negatively (e.g. sense of aggression). This research approach has been successfully applied to design user experience in both action (Hsu, Lee, & Wu, 2005) and strategy games (Hsu, Wen, & Wu, 2007). Thus, we may be able to change the game itself to make it less addictive.

In MMORPGs, Choi and Kim (2004) followed the approach of user experience design to explore the relationships between MMORPG users' experience and perceived fun. They simply separated the design factors of MMORPGs into two interaction levels, personal and social. They found that, by controlling the two design factors, they could manipulate users' gaming experience. Users who gained positive experience increased their loyalty to the game. However, the authors did not use the two factors to discuss addiction issues. Also, their general taxonomy of personal and social factors was too rough. The factors can still be decomposed from the conceptual level to the implementation level in order to provide specific suggestions for user experience design in MMORPGs.

To understand the causal factors of MMORPG addiction, Yee (2002) classified the possible addiction causal factors into motivational factors and attraction factors. Motivational factors are real life factors that may cause people to overuse the game (e.g. level of self-esteem, stress and other real life problem). Yee's research provides a link between users' real life problems and game addiction, which has been very useful in helping researchers to identify the high risk addiction groups. However, for addiction presentation practice, these motivational factors were depended on individuals. It is not easy to develop a game that can meet every user's personal needs and concerns about their real life problems.

On the other hand, the attraction factors in Yee's research, which include achievement, relationship and immersion, have shed light on the understanding of the addiction problem from a user experience design perspective. He has examined the relationships between these motivational factors and their subcomponents on users' playing hours. However, we know that online game addiction is a psychological dependency. Therefore, it will be more helpful to understand MMORPG addiction if we focus not only on users' behavioral dependency (e.g. playing hours), but also on their psychological symptoms.

1.1. Aim of the study

The purpose of this study was to understand MMORPG addiction from a user experience design approach. The study includes three parts. First, the study attempts to develop a complete model of users' experiences with MMORPGs. Second, the critical factors that can increase the possibility of game addiction are identified from the developed user experience model. Finally, the possible casual mechanisms of MMORPG addiction are discussed.

This study investigates college students with flexible school schedules and easy access to high-speed Internet. Previous studies have identified college students as a high risk group for Internet addiction (Griffiths, Davies, & Chappell, 2002; Moore, 1995). Earlier research also indicates that video games create significant effects on college students, and especially their academic performance. A recent study shows that college students' SAT (Scholastic Aptitude Test) and GPA (Grade-Point Average) scores were significantly affected by their game playing habits. As the amount of game play increases, GPA and SAT scores decrease (Anand, 2007).

2. Developing a user experience model for MMORPGs

2.1. Factors of user experience in MMORPGs

In order to develop a complete model to represent users' experience in MMORPGs, the current study applies the personal and social factors proposed by Choi et al. (2004) as the basic elements. Based on these two factors, this study attempts to determine their sub-factors that can contribute to user experiences with MMORPG. In this study, user experiences on the personal level include design factors

enhancing a user's intrinsic motivation focused on the interactions between user and game content, whereas user experiences on the social level include design factors satisfying a user's cybersocial needs focused on the interactions between the user and other users.

Eleven factors related to users' experience in MMORPGs have been identified in this study. Personal factors include five elements of user experience: *challenge*, *fantasy*, *curiosity*, *control*, and *reward*. Social factors also include five elements of user experience: *competition*, *cooperation*, *recognition*, *belonging*, and *obligation*. In addition, users need to do both personal and social activities by using their virtual body (also known as role, character or avatar) as a mediator between the users and the game world. Therefore, the user's experience of role-playing was also discussed in this study. Fig. 1 shows our proposed model that includes eleven factors to represent users' overall experience in MMORPGs.

Specifically, Fig. 1 proposes an avatar-mediated environment that illustrates the interactions between the user, other players, and game content. Through avatar-mediated interactions, the user can role-play their character(s) to communicate and interact with other players or the game world. Similarly, other players can also interact with the user and game world using their avatar. Specifically, this study proposes prersonal factors (*challenge*, *fantasy*, *curiosity*, *control*, and *reward*) to represent the interactions between the user (or other players) and the game world. The right-hand circle classifies other players into three main types, including game participants, the audience, and the community. The overlapping areas among these three player types represent multi-identities in MMORPGs. For example, a participant who joins a team and cooperates with the user may also be one of their guild members. Again, members in the same guild as the user may also act as an audience member, giving recognition to the user. This study therefore proposes five social factors (*recognition, cooperation, competition, belonging*, and *obligation*) to represent the cyber-social interactions between the user, the audience, participants, and the community.

2.1.1. Personal factors

Malone and Lepper (Malone, 1980, 1981a; Malone & Lepper, 1987) proposed four factors that can be used to model users' individual experiences when interacting with game content: *challenge*, *fantasy*, *curiosity* and *control*. These four factors have also been proven to have the ability to motivate people to play the game (Rieber, 1996). Therefore, the study adopted these four factors as a part of user experience model in MMORPGs.

Specifically, *challenge* refers to the achievability of in-game goals related to the difficulty level of an in-game problem. Examples of user challenge in MMORPGs include the complexity of achieving a quest or the required effort to progress to another level. Earlier research has found that a game with an intermediate level of goal achievability can produce an optimal challenge experience for users and make the game fun (Malone & Lepper, 1987). The current study therefore hypothesized that users who have high challenge experiences will in turn be more motivated to play the game and thus have a higher probability of developing an addiction to the games.

Fantasy describes a mental image that people have never experienced in their own life. It can stimulate users' imaginations and draw them into a world outside their own experience (Myers, 1990). Every MMORPG is built on a theme that provides a universe to allow users, non-player characters (NPC), monsters and other elements to live. These kinds of game worlds are always set on a specific space-time background that users have never experienced before. Also, users learn unique capabilities or skills in order to survive in the virtual world (e.g. to have wings to fly, to make their virtual body invisible when facing danger). The current study therefore hypothesized that users who have high fantasy experiences will be more motivated to play the game and in turn have a higher probability of developing an addiction to the games.

Curiosity can be divided into sensory curiosity and cognitive curiosity. Sensory curiosity includes the sound and light effects that enrich sensory experiences (Malone & Lepper, 1987). The sound and light effects in MMORPG are similar to a movie. Users experience different genres of music and sound effects when their character enters into different zones (e.g. town, village and battlefield). Cognitive curiosity refers to incompleteness and paradoxes in the game world that may surprise or intrigue users, and in turn, increase user motivation to explore the game (Malone & Lepper, 1987). The study therefore hypothesized that users who have high curiosity experiences will be motivated to play the game and in turn have a higher probability of developing an addiction to the games.

Control is related to whether users can effectively carry out their in-game tasks (Malone & Lepper, 1987), since MMORPG users have to use various types of commands to their character to perform the in-game actions. Therefore, the user interface features in MMORPGs such as shortcut bars, macro commands and direct manipulation techniques, play an important role in supporting the user when he or she is attempting to complete in-game tasks. A usable interface will not frustrate users, but helps provide them with a positive use experience. Control also refers to the influence, dominance and guide capabilities that a user has in the game (Novak, Hoffman, & Yung, 2000). Users who have a higher level of control feel that they have a high degree of liberty and are allowed to do anything in the games. We therefore

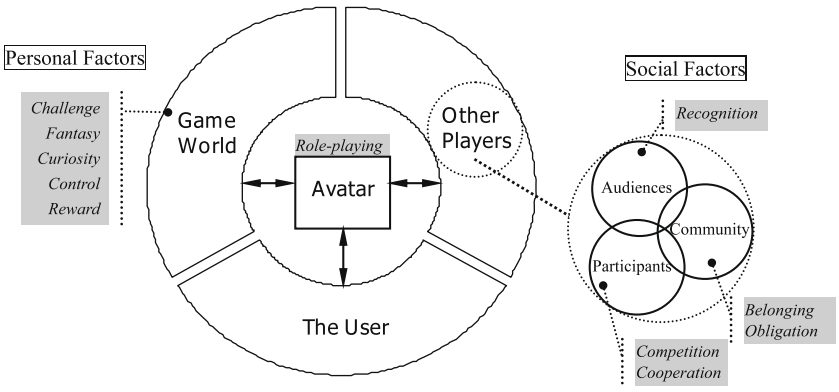

Fig. 1. User experience model for MMROPGs.

hypothesized that users who have a high sense of control will be motivated to play the game and in turn have a higher probability of developing an addiction to the games.

Reward is the factor that can satisfy users and reinforce their motivation in their current activity (Deci & Ryan, 1987; Ducheneaut & Moore, 2004). Reward in MMORPGs refers to the virtual items users can see and use to benefit themselves. For example, most users were motivated to slay monsters and complete quests in order to make money (gold), acquire rare equipment, complete quests, level up characters and optimize their character. The more time a user invests in the game, the more reward they will receive. This study therefore hypothesized that users might be addicted to this reward cycle. Users who have a high motivation to acquire rewards will in turn have a higher probability of developing an addiction to the games.

2.1.2. Social factors

Social bonding can be one of the most important factors for motivating people to play games (Rouse, 2000). Capitalizing on the benefits of the Internet, social factors address users' social interactions with other users. A user might have different experiences while interacting with different types of users. Users in the game world can be classified into three types: the game participant, the audience, and their community.

Game participants include those players who stay with the player throughout a game contest. Users interacting with participants have two types of experiences: competition and cooperation. Users' competition and cooperation experiences can enhance their enjoyment (Ducheneaut & Morre, 2004).

Competition is the desire to compete with others; it refers to a situation in which users try to reach a high score and must compete with other users to win (Yee, 2006). In MMORPGs, one example of user competition is play on a Player vs. Player (PvP) server, where a user may face unpredictable combat from other users or fight with other participants in the arena (Gilbert, 2007). This study hypothesized that users who tend to compete with other users in MMORPGs will stay longer in the game and increases their possibility of addiction.

Cooperation is the coordinated effort of individuals who strive for the same goal. In a cooperation situation, users help each other accomplish a game goal that is beneficial to both of them (Tjosvold, West, & Smith, 2003). In most MMORPGs, users join a party that includes several complementary professional characters in order to efficiently progress their character's level. Also, in some cases, users will be forced to cooperate with other users in order to attack a big monster or solve a group quest. This study hypothesized that users who experience a high level of cooperation will be more satisfied with the game, which will in turn increase their motivation to play the game, which may increase the possibility of addiction.

Audiences refer to 'game-watchers' in the virtual world as other users who have no direct conflicts of interest with the user. However, with the presence of audiences, the users have to build their virtual reputation in order to create opportunities to develop friendships and seek help. People need to be recognized by others in order to gain self-esteem, according to Maslow's hierarchy of needs (Maslow, 1954). The current study hypothesized that user experiences recognized by other users will motivate users to continue to play the game. The highly recognized users will thus have the highest probability of becoming addicted.

Communities (also called "guilds" or "clans" in MMORPGs) are groups of users who share the same goals and interests in virtual worlds (Ducheneaut, Yee, Nickell, & Moore, 2006). Dependent on different games, the size of a guild may range from thirty to more than a hundred members. When interacting with a community, users often have two types of social experiences: *belonging* and *obligation*.

Belonging is the core factor in building a community (Block, 2008). It refers to users' sense of affiliation with the community, which is a social need in Maslow's hierarchy of needs (Maslow, 1954). McMillan and Chavis (1986) define that belonging is a 'feeling' that a member matters to other members and their community. When a user is immersed and deeply engaged in her/his community, he or she experiences a sense of belonging and feels accepted by the community. The current study therefore hypothesized that users who experienced a high sense of belonging will prefer to stay longer in the game and thus increase their possibility of addiction.

Obligation refers to the sense of duty that drives users to contribute to their community. With a strong sense of obligation, the social pressure imposed by the community will drive members to carry out their tasks more enthusiastically (Seay, Jerome, Lee, & Kraut, 2004). For example, a community member is supposed to obey community rules, participate in weekly activities (e.g. guild war), and help newbies. The current study therefore hypothesized that users who feel highly obligated to participate in their community will therefore feel forced to play more often and more regularly, which will in turn increase their possibility of addiction.

2.1.3. Role-playing factor

As MMORPGs are avatar-mediated virtual environments, the users always see the world though the viewpoint of their role. Therefore, the role and user are not only tightly interconnected with each other but also allows users to accomplish their in-game goals at the personal and social levels (Yee, 2006). For example, they use their role to explore undiscovered virtual worlds, hunt monsters, level up their characters, collect items and solve in-game quests (Kelly, 2004). The social interactions between users are also mediated through role-playing operations by using a simulated face-to-face metaphor (Moore & Ducheneaut, 2007). Users interact with each other through the information revealed by their avatar such as facial expressions, gesture, posture, eye gaze, proxemics or text-based chat (Colburn, Cohen, & Drucker, 2000; Moore & Ducheneaut, 2007). This study therefore hypothesized that users who engaged in a high level of role-playing will increase their possibility of addiction.

3. Methods

This study conducted an online survey to gather data. Participants were first asked questions about their gaming experience in terms of the eleven dimensions of user experience in MMORPGs. After that, participants rated an adapted DSM addiction measurement scale as well as provided their demographic information including gender and gaming habits. The survey was advertised on several MMORPG online forums to recruit volunteers to participate in this study.

The Traditional Chinese version of the questionnaire was translated from English into Traditional Chinese by two bilingual translators. The translated questionnaire was then re-translated into English. To resolve any discrepancies between translated versions, two game experts discussed each item and verified its clarity in the translated versions. Twelve experienced MMORPG users then reviewed the

translated version to ensure readability and make semantic corrections as needed. The following section provides detailed information about the research method in this study.

3.1. Participants

Four hundred and eighteen Taiwanese college school students with an age range between 18 and 25 years old took part in this online survey. The gender distribution of participants was 307 (73.4%) males and 111 (26.6%) females. Students were also asked to answer questions about their current game playing habits ("How many hours do you usually play the game in a day?" and "How many days do you usually play the game in a week?") Results indicated that the average of their current game playing habits was 3.23 h per day (Std. = 1.99) and 4.08 days per week (Std. = 2.09).

3.2. Users' experience measurement in MMORPGs

This study developed a questionnaire for measuring the eleven user experience factors through a review of relevant literatures and experiences gathered from users. Specifically, questions about the five user experience factors, *challenge*, *fantasy*, *curiosity*, *control* and *reward*, were adapted from previous literature (Myers, 1990; Novak et al., 2000). The questions on the rest of the factors, role-play, *competition*, *cooperation*, *recognition*, *belonging* and *obligation*, were developed by ten professional MMORPG users (with the mean of 3.9 years gaming experiences) from a focus group session on game playing experience, as well as a review of the relevant literatures. All of the user experience questions were measured using a five-point Likert scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree and 5: strongly agree).

In order to ensure the validity of the user experience measurement questions, a principal axis factor analysis with pro-max rotation method was conducted. Questions with factor loadings below 0.5 were deleted. After this procedure, 44 questions were included in the questionnaire to measure the eleven aspects of user experience. Overall, the Cronbach's alpha value for all questionnaire items was 0.93, with each factor being greater than 0.5. This suggests that the factors had adequate internal consistency reliability (Churchill, 1991; Nunnally, 1978). More detail information about the validity and reliability analysis for each factor are shown in Appendix.

3.3. MMORPG addiction rating scale

This study used an addiction rating scale, adapted from an online game addiction measurement item developed by Chou and Ting (2003). They developed this addiction rating scale by referring to both the DSM-IV and previous game addiction studies (Gold & Heffner, 1998; Griffiths, 1998). Example questions of addiction rating scale such as "I repeatedly made unsuccessful efforts to control or stop playing this game", "I felt depressed when I stop to play this game", and "Sometimes I lie to my family or friends to conceal how often and how long I play this game".

The rating scale measured students' addiction level from the dimensions of salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse (Griffiths, 1998). In this study, eight questions were developed to measure the level of addiction. Each question was assessed using a five-point Likert scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree and 5: strongly agree). The study calculated the average of these eight questions for representing participants' addiction level. In addition, the reliability of the addiction rating scale has been demonstrated with a high reliability (Cronbach's alpha = 0.901) in previous study (Chou & Ting, 2003). In this study, the coefficient alpha of the addiction scale was 0.726.

3.4. Data analysis

The data analysis in this study included two parts. We first evaluated the effect of addiction measurement. Both the dependent variable (addiction) and criterion variables (the eleven experience factors) in this study were subjective self-report measurement. Therefore, the measured addiction score needed to be examined in terms of the effect from an objective approach. To do so, we applied a correlation analysis to see the relationship between subjective measurement (addiction) and objective behavior assessment (daily and weekly gaming habits) to ensure validity of the addiction measurement in this study.

Second, we attempted to identify critical user experience factors that could be used to better predict game addiction. To do so, a linear regression analysis was conducted to model the relationships between the eleven experience factors and addiction. Also, a multi-collinearity analysis was conducted to detect the degree of collinearity present for the eleven predictors through calculating their variance inflation factor (VIF).

4. Results

4.1. Demography

We compared the mean difference between genders in their daily and weekly gaming habits by conducting an independent *t*-test. Our results found that the daily game playing time of male students was significantly higher than that of female students (t [416] = 2.704, $p < .01$). Male students spent an average of 3.38 h (Std. = 2.09 h) a day playing games, whereas female students spent an average of 2.79 h (Std. = 1.60 h). However, there was no significant gender difference in weekly gaming habit (t [416] = .730, $p > .05$). Again, independent *t*-test was also conducted to examine the difference in addiction between male and female students. However, the result indicated that students' level of addiction did not significantly by gender (t [416] = −.248, $p > .05$) in this study. Therefore, this study did not concentrate on gender issues in the following analyses.

4.2. Evaluating the effect of addiction measurement

Results of the correlation analysis show that the level of addiction is significantly positively correlated with the number of hours students spent gaming daily ($r = .161$, $p < .001$) and weekly ($r = .144$, $p < .001$). Therefore, the more time they spent playing the game, the higher the level of their addiction. This result indicates that the measurement of addiction in both subjective and objective aspects was consistent. The addiction measurement in this study was valid.

Also, the relationship between students' daily and weekly playing habits was also highly positively correlated ($r = .503$, $p < .001$). This result can help us to understand how a heavy gamer arranges his or her time schedule to play the game. Heavy gamers not only spent more hours playing per day, but also spent more days in the game world per week.

4.3. Identifying predictors for MMORPG addiction prediction

Regression analysis was then conducted to evaluate the relative explanatory power of each variable with addiction score as the dependent variable and the eleven user experience factors as the independent variables. The analysis generated the following formula:

$$\text{MMORPG addiction} = 0.126\ \textit{curiosity} + 0.243\ \textit{role-playing} + 0.206\ \textit{belonging} + 0.145\ \textit{obligation} + 0.193\ \textit{reward}$$

Regression results indicate that the significant predictors of MMORPG addiction are *curiosity*, *role-playing*, *belonging*, *obligation* and *reward*. Note that the other factors *challenge*, *fantasy*, *control*, *competition*, *cooperation* and *recognition* are not shown in this regression formula due to their low predictive power. In addition, the ranges of Variance Inflation Factor (VIF) for the experience factors were all smaller than 1.929, which demonstrates that there was no collinearity of the factors in this study (Kutner, Nachtsheim, & Neter, 2004). In this analysis, the R^2 value demonstrated good accuracy of the prediction, with the model accounting for 65.1% of the variance in addiction. In addition, the Durbin–Watson coefficient was 2.042, which is near to the optimal value (DW = 2.0) and represents no autocorrelation in the residuals of the regression. Table 1 shows the regression model of MMORPG addiction.

5. Discussion

5.1. Addiction and gaming habits

Students' level of addiction in this study was found to have a positive correlation with both hours spent gaming per day and days spent gaming per week. High level addiction students tended to spend more time playing the games. In particular, it seemed easier for the games to hook male students as compared to female students. Both of these findings provide evidence to support the phenomena of game addiction among college students. Indeed, the students spent more than three hours per day and four days per week playing the games. In doing so, they might be sacrificing things such as learning activities, real world social activities or sleep in order to continue playing online games (Griffiths, 2002).

5.2. Factors and mechanisms for addiction prediction

This study identified five critical user experience factors that researchers can use to predict MMORPG addiction. These five factors were *curiosity*, *reward*, *belonging*, *obligation* and *role-play*. We discussed why these factors could dominate the level of addiction as below.

The first significant factor that contributes to the development of online game addiction is curiosity. Curiosity is the factor that often motivates users to interact with game content, which is positively related to addiction. This study infers that the reason curiosity leads to an increase in the possibility of addiction is that it motivates users *to repeatedly discover* new aspects of the game world. Previous studies have indicated that human curiosities are related to their discovery behaviors. People are motivated to discover the unknown characteristics of their environment in order to build up their mental image and complete their cognitive map (Berlyne, 1966; Malone & Lepper, 1987). Most MMORPGs have a dynamic sprawling game world and endless story; users have to spend a lot of time exploring the game in order to satisfy their curiosity. Therefore, users' *motivation to make new discoveries* of the game will lead them to become more addicted (Chou & Ting, 2003).

Table 1
The regression model of MMORPG addiction.

Dependent variable	Predicting variables	*B*	S.E.	*B*	VIF	Sig.
Addiction	*Challenge*	.043	.023	.060	1.251	.066
	Fantasy	.030	.024	.042	1.346	.220
	Curiosity	.126	.028	.145	1.165	.000*
	Control	.050	.028	.065	1.535	.076
	Role-playing	.243	.029	.308	1.623	.000*
	Competition	.018	.026	.023	1.361	.493
	Cooperation	−.055	.029	−.067	1.462	.059
	Recognition	−.053	.032	−.064	1.777	.100
	Belonging	.206	.030	.278	1.929	.000*
	Obligation	.145	.025	.207	1.434	.000*
	Reward	.193	.025	.263	1.305	.000*
	(constant)	.077	.151			.609

$R^2 = .651$, Adjusted $R^2 = .642$.
* Significant at the 0.01 level.

Reward was another factor that was positively related to game addiction on the personal level. Users who experienced in high rewards tended to have a higher likelihood of addiction. There are two types of reward included in most MMORPGs. One type involves rewards that can satisfy people's psychological needs in the real world. Another type includes rewards that the real world fails to provide to people. Both of these are provided by games with fewer struggles and no threat of painful failure (Kelly, 2004). Research has indicated that rewards can enhance peoples' intrinsic motivation, control their behavior and distract them from the responsibility of regulating themselves (Deci, Koestner, & Ryan, 1999). Therefore, people who are highly involved in reward-related activities in MMORPGs such as the accumulation of gold and acquisition of rare items will form *reinforcing reward-loops*. These reward-loops enhance the motivation to play the game, and in turn, to increase the possibility of becoming addicted to a game.

Belonging and obligation are two social factors related to community in MMORPGs, and significantly predict addiction. Users who experienced a high level of belonging and obligation tend to have a high probability of addiction. The social community in the cyber world creates relationships that increase users' time spent online. For example, Ducheneaut and his colleagues (2006) found that World of Warcraft users who participated in a community spent more time playing the game than users who do not belong to a community. Seay (2004) indicated that sometimes social communities put "social pressure" on their members to make them play longer. In addition, Ng and Wiemer-Hastings (2005) discovered that social interaction in the cyber world is an essential factor in motivating users to stay online for long periods. Some studies also support the notion that a virtual community is a critical factor in causing Internet addiction (Li & Chung, 2006; Song, Larose, Eastin, & Lin, 2004). According to human motivation theory, people will be motivated to seek interaction with others in order to fulfill their needs for affiliation (McClelland, 1961). Therefore, the two community factors, belonging and obligation may form *long-term cybersocial relationships* between the user and their guild members, focused on satisfying their cybersocial needs from the aspects of affective, behavioral and cognitive needs (Pisan, 2007).

Role-playing was also found to be positively related to addiction. In our results, participants who engaged in high levels of role-playing tended to have an increased likelihood of addiction. This finding is consistent with the argument of an earlier role-playing game study, which found that the characteristics of role-playing tend to attract users by affiliating them with the virtual world (Hsu, Kao, & Wu, 2007). We infer two possible reasons why role-playing experiences lead to increased addiction. The first reason was users' *motivation to progress character*. In most MMORPGs, users need to spend a lot of time to progress their character because higher levels allow the characters to use more powerful equipment and skills. The PlayOn project at the Palo Alto Research Center (PARC) was examined the accumulated leveling hours of 78,861 characters in World of Warcraft and found that the high level users wanted to spend as much time as they needed to level up the character. Users spent an average of 15 full days to level up their character from Level 1 to Level 70 (PlayOn, 2007).

The second reason role-playing causes addiction is the *users' emotional attachment* to their avatar. In MMORPGs, the users also spent time building their characters' physical and psychological identities in the virtual worlds. They decided whether to reproduce some of their personal characteristics in their avatar or to create an idealized version of themselves (Bessiere, Seay, & Kiesler, 2007). Physical identity is focused on customizing avatars' appearance such as hairstyle, hair color, skin tone, and body type (PlayOn, 2008). Psychological identity is focused on creating a persona with a background story and interacting with other users to create an improvised story (Yee, 2006). Therefore, the more effort users invest in customizing their role, the more emotional attachments they may create to their role, which may motivate them to play the game longer.

Moreover, six factors were identified as less effective predictors of addiction: *challenge*, *fantasy*, *control*, *competition*, *cooperation*, and *recognition*. Challenge refers to the goal achievability of the game (Malone, 1981a; Malone & Lepper, 1987). Indeed, an MMORPG is composed of several short-term goals, so users do not have time pressure about accomplishing all of these short-term goals. They can also stop and resume the game at any time due to the automatic save feature. Therefore, users are not forced to play the game longer in order to accomplish their in-game goals. This might help explain why challenges do not significantly predict addiction.

Fantasy appealed to users' emotional needs by evoking their mental images of specific situations that do not actually exist (Malone, 1981b). Fantasy elements might be able to attract users' attention when they are experiencing new things. However, these kinds of fantasy experiences might have a short-term effect on keep users' attraction fresh, but weakens over time and dissipates after they terminate game play. Therefore, the fantasy experience does not exert a long-term effect on the users and, therefore, does not tie the users to the game.

Control focused more on satisfying users' needs in terms of skill and behavior level. Users who have a high sense of control tend to have more liberty in dealing with the game world. From the game design perspective, ensuring usability and providing a friendly environment for the users is a basic requirement. Users may not be surprised because the games provide controllable features. In addition, to satisfy users from a behavioral standpoint independent of cognition, it may not be easy to create a long-term effect for the users (Norman, 2004). Therefore, the effects of control may not significantly affect addiction.

Two social factors, competition and cooperation, were both insignificant predictors of addiction. This may be because the users' experience of competition and cooperation were more focused on the interactions between the user and other game participants. Users may randomly join a party for only a few hours or few rounds for a specific purpose such as team PvP fighting or hunting a monster (Kelly, 2004). However, although the users improvise playing together in order to achieve their individual goals, they separate when the goal is reached. This may be why competition and cooperation do not significantly affect addiction.

Finally, recognition helps users build their personal identities and self-values in the game world. Users can gain recognition from the audience (game-watchers) by amassing achievements (e.g. exploits, wealth, power) and forging in-game identities (e.g. top hit parade, top level of profession; Yee, 2005). It is easier for recognized users to attract other users' attention to create their first impression. However, the users' socio-emotional attachment to the audience may not have as strong an effect as belonging or obligation. Thus, it may help the user to attract other users' attention, become more accepted, and make it much easier to deal with other users, but not cause them to become addicted.

6. Conclusions

This study identified five critical factors that can be used to predict MMORPG addiction. The five significant factors provide long-term effects or create refining mechanisms for the user and tend to increase the user's motivation to stay in the game longer. To the contrary, the six insignificant factors are relative weak to create long-term effects to the users. Therefore, the conclusion of this study is that in order to

design a less addictive MMORPG, one must carefully design the user experience in those five significant factors to avoid possible causing mechanisms of addiction.

In addition, the possible casual mechanisms for increasing addiction were discussed. Specifically, the curiosity factor tends to increase students' addiction level through enhancing their *motivation to make new discoveries* of the game world. Reward affected addiction by using *reinforcing reward-loops* in the game. Belonging and obligation created *long-term cybersocial relationships* among the guild members. Role-playing increased the level of addiction through users' *motivation to progress character* and users' emotional attachments to their character. Fig. 2 shows the possible addiction-causing mechanisms among the users, characters, other users and game content in MMORPGs.

To prevent MMORPG addiction, however, we cannot merely minimize the addiction-causing factors identified in this study. This is because these casual factors may not only increase the possibility of addiction, but also affect users' positive attraction to the game (also known as fun or flow experience). As many studies indicate, fun is the major determinant of a game's success (Lo et al., 2005; Myers, 1990; Novak et al., 2000). Therefore, a less attractive game might eventually have no players, which will reduce its life cycle, and its company would end up going out of business. Therefore, from the business point of view, it is important to explore the line between positive attraction and addiction. To do so, future research can apply the proposed user experience framework and addiction prediction formula to find a balance between the goal of business benefits and addiction prevention.

The current study has discussed a few applications from both the *design aspect* and *educational aspect* to shed light on the implications of our findings. First, to prevent addiction from a game design point of view, this study follows a design strategy that simultaneously maintains the fun factor while decreasing the possibility of addiction. This study also suggests some implications of our findings for MMORPG design practice. For example, our finding proves that *curiosity* is correlated with game addiction because curiosity motivates students to constantly discover new things, keeping them in the game longer. However, game designers cannot completely remove the design of discovery from the game for preventing addiction because this will remove 'fun' from the game as well. To strategically maintain fun and prevent addiction, game developers should design the game with "safeguards" based on monitoring the student's playing time and behavior. This approach to preventing addiction can be realized by manipulating the relative design features of addiction-causal mechanisms proposed in this study. For instance, if someone has been logged in for too long, the system can prevent them from traveling to new zones so that they can only see areas they already know. This restriction does not satisfy their curiosity, and should help protect them from excessive play. However, the game is still fun when they play it reasonably (e.g. within the limits of daily playing time), and they can still access new zones. Alternately, when students exceed the reasonable playing time, the game can manipulate the relative features of role-playing by slowing the pace of their character, reducing the power of their weapons, and decreasing the defense of their armor.

In addition, from the educational point of view, this study also suggests some implications of addiction prevention for government, educators, students, and their parents. First, the proposed addiction prediction formula can help educational policy makers develop an addiction-grading system for classifying MMORPGs (e.g. general, parental guidance, and restricted) for meeting different age group. In other words, before a new MMORPG becomes available on the market, educational regulatory agencies could evaluate its possibility of addiction using the proposed addiction prediction formula. To do so, educators could simply measure the implementation levels of the five significant predictors with representative samples and then calculate the score of addiction. Second, based on the output of the developed addiction-grading system, educational regulatory agencies could also provide warning messages with restricted game products to notify parents or teachers. Third, again, embedding a "safeguard" to monitor students' playing time could determine whether or not they play too long. With this information, the system could make students aware of an addiction problem and give them advice.

Finally, the study acknowledges some limitations of this exploratory research. First, this study did not find gender differences in MMORPG addiction. However, this result is not consistent with the findings of earlier studies. For instance, from the psychological perspective, Chiu et al. (2004) found that the difference in-game addiction based on gender is significant; males were more easily attracted to games. Similar results from a physiological study by Ko, Yen, Chen, Chen, and Yen (2005) also concluded that older male players with lower self-esteem and lower satisfaction in their daily life will be more addicted to games. For getting more understanding of gender difference in addiction, we encourage future studies should involve a comprehensive survey or solid experimental design to explore the effects of gender difference on MMORPG addiction.

Second, although this study identifies the mechanisms that influence addiction, they still too rough and cannot be directly applied by game designers when designing a game. Future research should focus on developing specific design guidelines for each mechanism in order to optimize user's experiences in MMORPGs.

Third, the participants used in this study were Taiwanese college students, and whether or not these findings be applied to another age group such as teenagers or children needs to be examined. Again, game users from Asian, European, and American cultures may have different styles of game play. The culture-bound syndromes of MMORPG addiction for different countries should also be determined.

Finally, the study acknowledges the arguments that users' individual issues in real life such as personal lifestyle, personality, self-esteem, and family structure may also have partial influence on game addiction (Griffiths, 2002; Yee, 2002). We believe the best way to

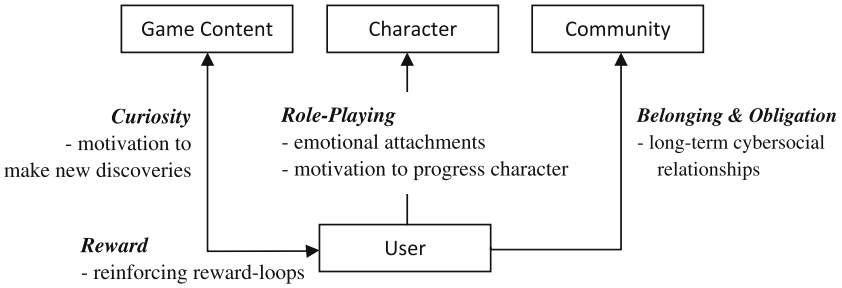

Fig. 2. Addiction-causing mechanisms in MMORPGs.

prevent addiction is to consider the findings from the user experience design perspective in this study and the real life problem perspective reported in earlier studies.

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Appendix. Users' experience measurement in MMORPGs

Experience factors (Cronbach's α)	Measure items	Factor loading
Challenge (α = .864)	This game fully disclose my potential ability	.787
	This game provide an appropriate test of my skills	.877
	This game challenge me to perform to the best of my ability	.810
Fantasy (α = .748)	This game arouses my fantasies	.630
	While I am playing this game, I can imagine I am someone else	.684
	This game lets me enter a world outside my own experiences	.807
Curiosity (α = .700)	This game arouses and satisfies my curiosity	.772
	Playing this game always surprises me in a good way	.652
	This game is novel and unique	.569
Control (α = .695)	I can do whatever I want to do in this game	.532
	I feel I am an influential person in this game	.746
	I can dominant anything I want in this game	.702
Role-play (α = .749)	I like my character very much and I often image that I was the character	.715
	I have spent much time and effort on my character	.644
	I like to play the role of the game and to do something which I cannot achieve in my real life	.687
	I try to create new persona and styles into my characters	.568
Competition (α = .807)	I can be more powerful and wealthy than others	.809
	I can compete with other people to win something	.837
	I can do something in order to achieve a specific goal	.561
	This game can fulfill my desire to compete with other players	.664
Cooperation (α = .855)	I can work with others to achieve goals and quests	.749
	This game enables me to cooperate with other players	.761
	I will comply with my team member's action in order to achieve our goal	.783
	I think the utility of teamwork is better than solo play	.793
Recognition (α = .790)	I can gain recognition and esteem from other players	.865
	I feel I can do something which is appreciated by other players	.716
	My success and achievements can be visible to other players	.667
Belonging (α = .917)	I think my guild and members let me feel comfortable and safe	.796
	I share pleasures and pains with the other guild members	.800
	I can participant in in-game activities with guild members	.759
	I can join a guild and feel a sense of belonging to it	.829
	I hope my guild can provide me with various group activities for participating	.716
	I want to stay longer in the game due to my guild	.756
	My guild taught me how to be a good member of guild	.739
	I can join a guild which I feel is interesting in the game	.711
Obligation (α = .860)	I will share knowledge and help other guild members	.802
	This game helps me learn about how to manage a guild	.789
	I observe other members and adapt to their actions accordingly	.804
	The guilds arouse a sense of obligation in me	.722
Rewards (α = .849)	I can optimize my character according to his or her profession	.789
	The unique items that I have can be known in the game	.700
	This game lets me accumulate resources, items, and money	.781
	I can acquire rare items that most players will never have	.714
	I can know as much as possible about the game rules	.664

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