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CONSTRUCT AND PREDICTIVE VALIDITY OF A BRIEF MMO PLAYER MOTIVATION SCALE

Cross-sectional and longitudinal evidence
based on Singaporean young gamers

**Dong Dong Li, Albert K. Liao, Douglas A. Gentile, Angeline Khoo
and Wei Da Cheong**

The purpose of the present paper is to validate a short version of the MMO Player Motivation scale. Two studies were conducted using adolescent gamers from Singapore secondary schools. Study 1 used a cross-sectional design for item deduction. Study 2 used a 2-year longitudinal design for scale validation. The results showed that the brief scale conformed to the three-factor motivation model, including achievement, socialization, and immersion. The model demonstrated acceptable model fit and construct validity. The study also showed that different types of gamer motivation predicted different gaming habits and behaviors 1 year later. With its predictive validity, the scale could be used to identify students who are likely to develop pathological gaming patterns and other at-risk behaviors based on their current playing motivations.

KEYWORDS MMO; player motivation; achievement; socialization; immersion; pathological gaming; in-game behavior

Introduction

Online role-playing games, including both text-based MUDs (Multi-User Dungeons/ Domains) and graphic-based MMOs (Massively Multiplayer Online games), offer persistent virtual environments for users to immerse themselves in. Past research had documented that MMO players spent over 20th on average per week (Cole & Griffiths, 2007; Shen & Williams, 2011; Yee, 2006:). It has been suggested that such games may affect children's cognition and behavior, for example, violent in-game behavior increases real-life aggressive thoughts and behavior (Anderson et al., 2010). As MMOs continue to gain popularity among gamers, models attempting to explain their motivation to spend time in these virtual worlds emerged in the literature. Yee's (2006) three-factor motivation model was one of the models grounded on empirical research to assess gamer motivation as a means to understand usage patterns and in-game behavior. The scale was designed to identify player's motivation in different types of activities. However, long surveys usually lead to impatience and non-response. Brief measures are especially necessary for studies with young online gamers. The purpose of this study is thus to validate a brief MMO Player Motivation scale. The usefulness and predictive validity of the scale are studied in relation to pathological gaming and in-game behaviors.

Uses and Gratification Theory and Player's Motivation Model

The theoretical framework for this research is the uses and gratifications theory which seeks to understand what people do with the media, rather than what the media do to people (Katz, Blumler, & Guervitch, 1974; LaRose & Eastin, 2004; Rubin, 1994;). The theory posits that the audience plays an active role in seeking out media to fulfill needs, and video games as one source of media compete with other sources for the fulfillment of gamers' needs. In the case of game playing, the theory approaches player motivation in terms of how gamers select and decide on the gaming activities that fulfill their needs and desires. In other words, motivation refers to the psychological needs that drive gamers' behaviors. In a virtual environment, gamers can create and customize their avatars or other attributes of a game based on learned reality or virtual fantasy. Hence, a focus on players' motivations from a uses and gratification approach may help us to understand how they are motivated to participate and select activities that best satisfy their needs (Kim & Ross, 2006).

A well-established model following uses and gratification approach is Yee's (2006) MMO Player motivation model. In his study of 3,000 online gamers, three major factors emerged: achievement, socialization and immersion.¹ According to Yee (2006), achievement in MMO games includes gamers' motivation to accrue status of power and wealth for their in-game characters, to understand how the game works in detail so as to utilize the systems better than others and to compete with other gamers. On the other hand, the social factor assesses the motivation to communicate with other gamers, to form significant and long-lasting relationships with other gamers and to cooperate with others in a collective effort to complete a task in the game. Finally, the immersion factor includes the gamers' motivation to learn and discover the game world, to customize the looks of their characters, to role-play in such world and to escape from problems that they face in real life.

Although a comprehensive understanding of gamers' motivation is beneficial, the thirty-nine-item scale developed from Yee's study (2006) is not parsimonious in many survey studies. Due to the length of the survey, respondents were likely to suffer from fatigue as they progress through the questions. Therefore, by reducing the number of items tested, it would greatly improve the response rate to the survey. Moreover, the original scale was divided into ten subscales under the three main factors. It would be too complex for a model to include all ten subscales of motivation (Jeng & Teng, 2008; William, Yee, & Caplan, 2008). Hence, the first objective of this study is to develop a brief MMO player motivation scale which is based on Yee's (2006) longer scale.

Player Motivation and In-Game Behavior

We believe specific classes of motivation could predict players' cognitions, affect and behavior (Dweck & Leggett, 1988). As a way to test the validity of the brief player motivation scale, the relationship between different types of motivation and in-game behaviors could provide valuable insight. In a recent study by Suznjevic & Matijasevic (2010), specific in-game behaviors, such as raiding (working in a team to achieve a large game goal), PvP combat (player versus player, in contrast to player versus computer-controlled character), and communication were defined and matched with different types of motivation. The result showed that 89 per cent of players with high scores on the advancement subscale of achievement motivation increased gaming time in either raiding or in PvP combat. It is understandable that those players with high achievement motivation would

involve in such fighting and killing behaviors as a way to develop or demonstrate high ability, or to avoid demonstrating low ability (Nicholls, 1984).

The importance of examining different types of in-game behaviors has been supported by research indicating that the kinds of associations that are learned and activated by a video game depend on the content and activities of the game. Hence, although violent video games can lead to violent behaviors (Anderson, Gentile, & Buckley, 2007), prosocial video games, where players help and support each other in non-violent ways, can increase both short-term and long-term prosocial behaviors (Gentile et al., 2009). It is therefore meaningful to identify players with different types of motivation, as a way to help prevent them from developing risky online behaviors.

In this study, we examined three types of in-game behaviors: prosocial, violent, and experimental. Prosocial in-game behaviors are those that are intended to help whereas violent in-game behaviors are those that are intended to kill (Gentile et al., 2009). Experimental in-game behaviors are activities that players practice in games that they cannot in real life.

For those who play to make friends or role play to live in the games, they may behave more prosocially. For example, they may help each other in the game to complete quests. For them, the difference between killing monsters and killing other players need to be considered. As in MMO games, killing monsters might require players to cooperate in teams. Therefore, players with high socialization motivation might involve more in killing monsters (e.g., in raiding) but not killing other players (e.g., PvP combat). We thus hypothesize:

H1: Players with high socialization motivation will involve less in violent in-game behavior.

For those who play to accumulate power and compete with others, they may score high in all these behaviors, e.g., help each other killing monsters in order to level up as well as killing other players for a sense of achievement and high ability. For those who play to escape from the real-life world and to role play in the game world, they would be involved in more experimental behaviors in games. We thus hypothesize:

H2: Subjects who score high in achievement motivation will involve more in (a) prosocial, (b) violent, and (c) experimental in-game behavior.

H3: Subjects who score high in immersion motivation will involve more in experimental in-game behavior.

Player Motivation and Pathological Gaming

We also tested the predictive validity of the scale using relations between player's motivation and pathological gaming status. In the present study, we define pathological video gaming based on the similar DSM definition of pathological gambling. Both pathological video gaming and gambling are behavioral addictions, and are forms of games. The activities may also produce "flow" states, in which the player is focused, may lose a sense of place or time, have a sense of control, and find it intrinsically rewarding. At first, the activity is not pathological. But for some, it becomes pathological when the activity begins to produce serious negative life consequences. Past studies have shown that all the three types of motivation are associated with enjoyment of video game play and thus may provide meaningful indications for excessive and pathological gaming.

First of all, studies have repeatedly shown that immersion is linked to a lack of awareness of time and the real world, and is strongly correlated with game engagement and addiction (Calleja, 2007; Jennett et al., 2008; Li, Liao, & Khoo, 2011). In Yee's (2006) study, it was found that escapism component (a subscale of immersion motivation) is the best predictor of pathological gaming. In another study conducted by Yee and his colleagues, immersion motivation also emerged as the best predictor (Caplan, Williams, & Yee, 2009). We thus hypothesize:

H4: Immersion motivation is the best predictor of pathological gaming among all the three motivation subscales.

Second, studies have shown that social comparison and competition played an important role in game enjoyment and involvement for those who have high achievement motivation in games (Vorderer, Hartmann, & Klimmt, 2003). In Yee's (2006) study, the advancement component (a subscale of achievement motivation) was the second best predictor of pathological gaming among all the motivation subscales. However, a later study showed that achievement motivation, after adjusted for the effects of immersion motivation, was not a significant predictor of pathological gaming (Caplan et al., 2009). In view of these studies, we hypothesize:

H5: Achievement motivation is significantly correlated with pathological gaming, but is not a significant predictor of pathological gaming in the presence of immersion motivation.

For socialization motivation, we also found mixed results in the research literature. It is generally agreed that the social aspect of gaming is of great importance for many MMO players. For example, a significant positive correlation was reported between the amount of time spent on gaming and the number of friends within the game (Cole & Griffiths, 2007). However, both of Yee's studies mentioned previously did not find a significant relationship between socialization motivation and pathological gaming. Therefore, we hypothesize:

H6: Socialization motivation is not a significant predictor of pathological gaming.

Video gaming is known to be a gendered phenomenon. For example, past studies have shown that boys usually played more often than girls (Griffiths & Hunt, 1995, Lucas & Sherry, 2004) and that more boys than girls were addicted (Chiu, Lee, & Huang, 2004; Choo et al., 2010). However, these differences were not found for MMO players in some studies (Smahel, Blinka, & Ledabyl, 2008; Williams, Consalvo, Caplan, & Yee, 2009). In the development stage of the scale, Yee (2006) did not conduct a factorial invariance test between genders in the factor analysis. But he did find that male players score significantly higher on achievement factor and female players scored higher on the relationship component. This result was supported in another study (Williams et al., 2009). In the present study, factorial invariance analyses were carried out in a hierarchical and multistep approach to examine whether factor patterns, factor loadings, factor covariance as well as residual variance were invariant between genders (MacCallum, Roznowski, Mar, & Reith, 1994).

To sum up, we intended to develop and validate a brief MMO player motivation scale in order to better capture adolescent gamers' motivation and their behavioral consequences. Two studies were conducted in 2008. Study 1 used a cross-sectional design for item deduction. Study 2 used a 2-year longitudinal design for scale validation. The same students in study 2 were followed up in 2009. The survey was conducted in normal classroom settings

as part of a larger-scale study. Due to the heavy commitment required from the schools, a convenience sampling method was used. Permission for the study was sought from the principals who attended a cyber issues workshop. All schools in this study are public schools. Students who claimed to have MMO gaming experience volunteered for the study. Paper and pencil survey was conducted with the help of the form teachers from each respective class. The privacy of the students' responses was ensured by requiring the teachers to seal the completed questionnaires in envelopes while in the presence of the students.

Study 1

Study 1 was a cross-sectional study. The purpose of study 1 was to reduce the length of the original scale and to select items which best represent adolescent gamers' motivation using exploratory factor analysis (EFA).

Sample

Data were collected from 219 students who have MMO gaming experience from three public secondary schools in Singapore². The mean age of the sample was 14 years old ($SD = .77$). Forty-one per cent of the sample was male and 59 per cent was female. About 90.2 per cent of the sample was Chinese, 7.4 per cent was Malay and 0.7 per cent was Indian. These students on average spend 22.22h ($SD = 25.02$) per week on playing games.

Instrument

MMO player motivation scale. The original thirty-nine items of the MMO player motivation scale (Yee, 2006) were included in the study with minor revisions to the wording of the questions so that they were easier to understand for the Singapore sample. Respondents gave their responses by shading one of the options on a five-point Likert scale from Strongly Disagree to Strongly Agree. The reported internal reliability of the ten subscales ranges from 0.65 to 0.87 with factor loadings ranging from 0.53 to 0.88 (Yee, 2006).

Demographics and Gaming habits. General demographic questions were presented in the first page of the questionnaire. Questions include basic demographics such as their gender, race and age. Respondents' gaming habits were measured by two items (1) the name of the students' favorite game and (2) the time they spent playing this game per week.

Results

The Kaiser-Meyer-Olkin measure of sampling adequacy index was .88 and Bartlett's test of sphericity was significant, $\chi^2(741, N = 219) = 2886.87, p < 0.001$, indicating that the data were appropriate for factor analysis. An initial solution yielded eight factors that explained 65.45 per cent of variance³ (see Appendix). However, the last five components explained less than 5 per cent of the total variance each. Items were thus selected based on the following criteria: (1) face validity; (2) satisfactory factor loadings (> 0.6), communality (> 0.5) and diagonal value of the anti-image matrices (> 0.7); (3) no substantial cross-loading; (4) variance explained (> 60 per cent). Principal component analysis with promax rotation was conducted on the data. After trials of dropping items and comparisons with

TABLE 1
Exploratory factor analysis with promax rotation of the Brief MMO Player Motivation scale

Variable	Items	Socialization	Achievement	Immersion	Communality
S1	I find myself having meaningful conversation with other players.	.74			.65
S2	I enjoy chatting with other players.	.88			.76
S3	I enjoy getting to know other players.	.90			.83
S4	I enjoy working with others in a group.	.78			.52
A1	It is important to be well known in the game.		.80		.63
A2	It is important to level up my character as fast as possible.		.94		.78
A3	I enjoy acquiring rare items that most players will never have.		.83		.77
A4	It is important that my character is as optimized as possible for their profession/role.		.71		.75
I1	I enjoy being immersed in a fantasy world.			.74	.62
I2	I often play to relax from the day's work.			.87	.71
I3	I often role-play my character			.74	.57
I4	I often play to avoid thinking about some of my real-life problems or worries.			.74	.58
	Eigen value	5.67	1.99	1.35	
	Percentage of variance explained	43.65	15.27	10.39	
	Internal reliability	.86	.87	.74	

Note. Factor loadings < .30 were suppressed. S1 to S4 = Socialization subscales; A1 to A4 = Achievement subscales; I1 to I4 = Immersion subscales.

different rotation methods, a three-factor structure that explained 69.31 per cent of variance was deemed parsimonious. The items with factor loadings are presented in Table 1. This brief version of twelve items was further tested in study 2.

Study 2

Study 2 used a 2-year longitudinal design. The purpose of study 2 was twofold. First, the data were used to validate the MMO player motivation scale by using confirmatory factor analysis and correlations with the other criterion variables. Second, the data were used to examine the predictive validity of the scale in relation to pathological gaming and different types of in-game behaviors. Data on the same variables were collected 1 year later with the same sample of respondents.

Sample

In study 2, the sample included 281 students who have MMO gaming experience from two public secondary schools. The mean age was 12.9 years old ($SD = .77$). In this sample, 81 per cent of the students were males and 19 per cent were females. There were 88.8 per cent Chinese, 3.8 per cent Malays and 3.5 per cent Indians. Out of the 281 cases, two students did not provide names in Wave 1 and were not invited to participate in Wave 2; four of the students who were invited in Wave 2 did not respond. A total of 275 students participated in Wave 2 survey.

Instrument

The Brief MMO player motivation scale. The twelve items as specified from the previous EFA analysis were included in this study. Students gave their responses by shading one of the options from a five-point Likert scale from Strongly Disagree to Strongly Agree. The internal reliability for socialization is .92, achievement .90, and immersion .81.

Demographics and Gaming habits. General demographics questions were presented in the first page of the questionnaire, such as gender, race, age, and academic results. The questions measuring students' video game habits were adapted from the General Media Habits Questionnaire (Anderson et al., 2007; Gentile, Lynch, Linder & Walsh, 2004). The gaming habits were measured by their gaming time per week and in-game behaviors for top three favorite games. The students' in-game behavior was measured on a four-point Likert scale with the options: Never, Seldom, Often and Almost Always. Violent in-game behaviors were measured by items such as: "How often do you shoot or kill creatures in this game?" and "How often do you shoot or kill other players in this game?"; prosocial in-game behaviors were measured by items such as: "How often do you help others in this game?" and lastly, experimental in-game behavior was measured by items such as "how much is your in-game character like the person you want to be in real life?" and "how often do you try to make your in-game characters do things that you cannot do in real life?" A mean score across three games was used to represent each type of behavior.

Pathological Game Use (PGU). Pathological game use was measured with a 10-item scale (Choo et al., 2010). This scale was constructed based on DSM-IV-R pathological gambling

TABLE 2
Summary of fit indices for confirmatory factor analysis

Model	χ^2 / df	df	RMSEA (90% CI)	SRMR	CFI	TLI
Hypothesized three-factor oblique	2.18**	51	.065 (.05-.08)	.04	.98	.97
Competing three-factor orthogonal	8.77**	54	.17 (.15 to .18)	.38	.83	.79
Competing one-factor	10.83**	54	.19 (.17 to .20)	.08	.78	.73
Competing three-factor second order	2.18**	51	.065 (.05-.08)	.04	.98	.97

Note. ** $p < .01$.

items. The three point Likert scale was labeled “No”, “Sometimes” and “Yes” for each of the ten symptoms. A sum score was used to represent a student’s level of pathological gaming. This measure yielded acceptable reliability (Cronbach $\alpha = .79$ and $.83$ for Wave 1 and Wave 2, respectively). Pathological game use data were collected over 2 years.

Results

On average, boys in this study spent 24.9 (SD = 23.5) and 24.1 (SD = 22.5) hours per week playing games for each wave; girls spent 24.1 (SD = 28.7) and 24.1 (SD = 26.2) hours per week respectively each wave. Out of the ten pathological symptoms, boys reported on average 2.8 (SD = 2.1) and 2.6 (SD = 2.2) symptoms while girls reported on average 2.0 (SD = 2.0) and 1.3 (SD = 2.0) symptoms for each wave.

To verify the factor structure as well as to test the reliability and validity of the short version MMO player motivation scale, a confirmatory factor analysis was conducted using AMOS 16. The maximum likelihood approach was used for model estimation.

Model Fit

The hypothesized three-factor oblique model was compared to three competing models: (1) three-factor orthogonal model, which assumes zero correlation among the factors; (2) one-factor model; and (3) a second-order-factor model. The fit indices suggested that the hypothesis model and the second-order-factor model fit well compared to the other two models (Table 2). All values for the hypothesized model satisfied the recommended level of acceptable fit (Hair, Black, Rabin, Anderson & Tatham, 2006). The standardized residuals were checked and all values were lower than $|2.5|$, which indicates no associated problem.

Construct Validity

Construct validity, including convergent validity and discriminant validity, were then assessed for this model (Tables 3 and 4). First of all, the standardized loadings were between 0.62 and 0.94 ($p < .001$). The variance extracted for each construct was over 50 per cent for all the constructs, as shown in Table 3. Construct reliability ranged from 0.87 to 0.97. Using the criteria suggested by Hair et al., (2006), these measures supported the convergent validity of the model. Discriminant validity was assessed by zero-order correlation and by using chi-square difference tests. Table 3 presents the correlation between the three factors. All the correlations were between 0.6 and 0.68, which indicates

TABLE 3
Standardized regression loadings for confirmatory factor analysis

Variable	Socialization	Achievement	Immersion
S1	0.81		
S2	0.82		
S3	0.94		
S4	0.91		
A1		0.69	
A2		0.84	
A3		0.89	
A4		0.91	
I1			0.83
I2			0.75
I3			0.68
I4			0.62
Variance extracted	0.76	0.70	0.53
Construct reliability	0.97	0.95	0.87
Correlation	<i>Socialization</i>	<i>Achievement</i>	<i>Immersion</i>
Achievement	.66**		
Immersion	.60**	.68**	

Note. ** $p < .01$.

no problem of convergence. Comparisons were then made between the unconstrained model (all constructs are correlated freely) and a constrained model where the correlation between two constructs was set to 1. If the two models differed significantly on a chi-square difference test, there would be discriminant validity between them. As shown in Table 4, the chi-square differences were all significant, which implied that the three constructs were different from each other in the current model.

As the three constructs were all measuring player motivation, a second-order confirmatory factor analysis (CFA) was considered. This model showed adequate model fit (fit index identical to the first-order model). The result implied that player motivation can be represented by the three factors of socialization, immersion and achievement while a common motivation factor accounted for the variances of all the three dimensions.

After the best fitting three-factor model was established, group invariance was tested by gender. Four increasingly restrictive models were tested, with each retaining the equality constraints of the preceding model (Table 5). Group invariance in factor patterns, factor loadings as well as constant covariance of the latent variables was supported by acceptable model fit index and a non-significant chi-square difference test between Model 1, Model 2 and Model 0.

TABLE 4
Chi-square difference tests of discriminant validity

Model	Chi-square	df	Chi-square change
Unconstrained model	111.40	51	
AI (achievement-immersion)	126.89	52	15.49*
AS (achievement-socialization)	131.21	52	19.81*
SI (socialization-immersion)	138.82	52	27.42*

Note. * $p < .01$.

TABLE 5
Tests of invariance by gender

Model	Specification	χ^2	df	χ^2/df	CFI	GFI	RMSEA	$\Delta\chi^2$	Δdf
Model 0	Unconstrained and factor patterns are constant	189.03	102	1.85	.96	.91	.055		
Model 1	Model 0 & Factor loadings are constant	195.13	111	1.76	.97	.91	.052	6.10	9
Model 2	Model 1 & covariance of the latent variables are constant	208.11	117	1.78	.96	.91	.053	12.98	6
Model 3	Model 2 & Residual variances of the measured variable are constant	236.32	129	1.83	.96	.88	.055	28.21**	12

Note.** $p < .01$.

TABLE 6
Correlation coefficients for predictive validity

Wave 1	Wave2	Wave2	Wave2	Wave2	Wave2	Wave2	Wave2	Wave2	Wave2
Motivation	Pathological Video Game Use	Pathological Video Game Use	Experimental Behavior	Prosocial Behavior	Violent Behavior: Total	Violent Behavior: Killing Monsters	Violent Behavior: Killing Other Player	Violent Behavior: Killing Other Player	Violent Behavior: Killing Other Player
Socialization	.12 [^]	.11 [^]	.02	.21**	.12	.14*	.08	.08	.08
Immersion	.24**	.29**	.21**	.22**	.11	.10	.10	.10	.10
Achievement	.21**	.24**	.26**	.21**	.21**	.21**	.16*	.16*	.16*
Overall motivation	.22**	.25**	.19**	.25**	.17*	.17*	.13	.13	.13

Note. ** $p < .01$. * $p < .05$. [^] $p < .07$.

TABLE 7
Summary of regression analysis for variables predicting Wave 2 PGU ($N = 187$)

Variables	B	SE	beta
Step 1			
Boy	.91	.37	.16*
Wave 1 PGU	.42	.07	.38**
Step 2			
Socialization	-.28	.25	-.10
Achievement	.16	.24	.07
Immersion	.57	.24	.21*

Note. $R^2 = .27$. * $p < .05$. ** $p < .01$.

Predictive Validity

Motivation and pathological play

Table 6 presents the correlation coefficients between motivation and PGU. As expected, immersion and achievement motivation was significantly related to pathological gaming. Socialization motivation was only marginally significantly related to pathological gaming. In the regression analysis, both gender and Wave 1 PGU were significant predictors of Wave 2 PGU in the first step (Table 7). The addition of motivation in step two resulted in an increment of 3.9per cent in the variance explained for Wave 2 PGU. This increment was significant, $F(3, 181) = 3.26, p < .05$. Among the three motivation variables, immersion was the only significant predictor to Wave 2 PGU.

Motivation and in-game behavior

Table 6 presents the correlations between motivation factors and different types of in-game behaviors. Socialization motivation was significantly correlated with prosocial in-game behavior, as well as violent in-game behavior of killing monsters. Immersion motivation was significantly correlated with experimental behavior and prosocial behavior. Achievement motivation was significantly correlated with all three types of in-game behaviors.

Multiple regressions were conducted using the backward elimination method. Only significant predictors were reported in Table 8. For violent in-game behavior, achievement was the only significant predictor. For prosocial in-game behavior, immersion was the only significant predictor. For experimental behavior, socialization motivation was a significant

TABLE 8
Summary of regression analysis for variables predicting in-game behaviors ($N = 212$)

Variables	B	SE	beta
Violent behavior ^a			
Achievement	.20	.07	.21**
Prosocial behavior ^b			
Immersion	.23	.07	.22**
Experimental behavior ^c			
Socialization	-.36	.10	-.32**
Achievement	.39	.10	.37*
Immersion	.17	.10	.15($p = .09$)

Note. ^a $R^2 = .05, p < .01$. ^b $R^2 = .06, p < .01$. ^c $R^2 = .13, p < .01$. * $p < .05$. ** $p < .01$.

negative predictor. On the other hand, achievement motivation was a significant positive predictor of experimental behavior.

Discussion

The purpose of the present paper was to validate a brief version of the MMO player motivation scale, reducing the number of items from the original thirty-nine items to just twelve items. Findings from EFA of the first study indicated that the motivation scale has three distinct factors: socialization, immersion and achievement. This three-factor structure was confirmed using CFA in the second study. Multiple fit indices supported the hypothesized three-factor model as well as a second-order three-factor model, as compared to a competing one-factor and three-factor orthogonal model. The three factors of the brief scale were consistent with the original longer scale (Williams, Yee, & Caplan, 2008; Yee, 2006). The hypothesized model demonstrated adequate convergent validity and discriminant validity. Factorial invariance analyses showed no gender difference in the factor pattern, factor loading and covariance among latent factors. Findings from the two-wave longitudinal study also provided additional support for the predictive validity of the brief scale.

As expected, students with higher socializing motivation reported more prosocial behavior as well as violent behaviors of killing monsters but not killing other players. It supports our hypothesis that the killing behavior could have resulted from the intention of making friends or helping out other players. By helping other players to kill monsters (as is typical in a "raid" where groups work together to achieve a goal), this could be regarded as an act of prosocial behavior. This result may have implications for studies that investigate the effects of video gaming on aggressive behaviors. Previous meta-analyses studies had shown small but significant effect sizes for the relation between violent video game exposure and aggression (Anderson, 2004; Anderson et al., 2010; Sherry, 2001). Based on uses and gratifications theory, the motivations and choice of media can be important factors in determining media effects (Papacharissi & Rubin, 2000; Rubin, 1994). Therefore, future studies could explore the possibility of socializing motivation as a moderator in this relationship. For example, the motivation to help one's teammates while killing game creatures may mitigate the aggression effect, whereas the motivation to be the best fighter in the game may enhance it. Although this has been hypothesized before (e.g., Gentile, 2010), no studies have yet tested it. The motivation scaled tested in this article may help research move in this direction.

In this study, socialization motivation is not significantly related to pathological gaming. Numerous studies have shown that the social aspect of MMO games might be the most important factor for game enjoyment and involvement (Caplan et al., 2009). It thus seems to imply that socialization motivation is related to game involvement but not game addiction. Future studies could explore the effect of socialization motivation on game involvement while differentiating between high engagement and addiction (Charlton & Danforth, 2007). For example, they may spend large amount of time in gaming but not show pathological gaming symptoms.

A possible explanation for the above result could be derived from the relation between socialization motivation and experimental behavior. With a non-significant correlation but significant negative contribution in regression to experimental behavior, it indicates that socialization motivation influences experimental behavior in an opposite way after controlling for immersion and achievement motivations. In other words, for gamers with the

same level of immersion and achievement motivation, those who have higher level of socialization motivation are less likely to engage in activities that they cannot do in real life. It suggests that these gamers might perceive the in-game social activities the same as what they do in real life. In other words, they use games to satisfy their social needs, even though they are meeting them online rather than face-to-face. If that is the case, things to worry about these students are not preventing them from pathological gaming but other risky behaviors such as offline meetings. For example, gamers who are high in socialization motivation but not other motivation may go offline meeting with strangers more often than others.

In this study, immersion motivation emerged as the best predictor for future pathological gaming habits as expected. This result supported earlier findings using the original scale by Yee (2006). While for in-game behaviors, the result showed that gamers who enjoyed immersing in games reported more experimental in-game behavior and prosocial in-game behavior but not necessarily violent in-game behavior. Immersion motivation may therefore be one risk factor for becoming a pathological gamer, and may differentiate those who should be monitored more closely to keep from poor habits. In contrast, achievement motivation is positively related to all three types of in-game behaviors as well as pathological gaming. Previous studies have shown that adolescent gamers were very likely attracted to violent video games (Lemmens, Bushman, & Konijn, 2006) and they tended to immerse in such games and identify with violent heroes (Jansz, 2005; Frostling-Henningsson, 2009). There were also studies showing a positive link between addiction and aggression (Kim, Namboong, Ku, & Kim, 2008; Ko, Yen, Liu, Huang, & Yen, 2009). This relationship could be further explored when controlling for their level of immersion motivation and achievement motivation. It would be also interesting to classify gamers based on their motivation level using a cluster analysis. For example, a gamer who is high in both immersion motivation and achievement motivation might be most likely to develop pathological gaming and conduct violent behaviors in games.

One of the limitations of the study is that the brief MMO player motivation scale was not compared with other motivation scales, for example, the player experience of need satisfaction model (PENS, Ryan, Rigby, & Przybylski, 2006). This model investigated player motivation from the perspective of basic needs satisfaction including autonomy, competence and relatedness. Their result showed that socialization motivation is correlated with relatedness at $r = .66$ while immersion correlated with presence at $r = .57$. These analyses could be replicated with the brief MMO player motivation scale.

This research is limited by the self-report nature of the data. Nonetheless, there are no other informants who could reliably describe what gamers' motivations may be, or how they play games. If any self-presentation biases exist, they would likely diminish our ability to find significant relations between variables. It is also unclear how well these results would generalize to other cultural contexts, although our results were similar to those collected by others in other countries (e.g., Yee, 2006, Williams et al., 2009), and the prevalence of pathological gaming is almost identical between Singapore (8.7 per cent; Choo et al., 2010) and the United States (8.5 per cent; Gentile, 2009).

In conclusion, this paper presents two studies to validate a brief MMO player motivation scale. Three factors of player motivation, including socialization, immersion and achievement, were supported using both EFA and CFA. Compared to the original measure, the brief scale provides a quicker assessment of gamers' motivation suitable for large-scale survey studies. With its predictive validity, the scale could be used to identify students who are likely to develop pathological gaming patterns based on their current playing

motivations. The scale also provides implications for gamers' future behavior. Early interventions could then be employed to help these students cope with future possible problems in their gaming habits. Future research could further validate the measure using other samples in different cultures or research settings.

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NOTES

1. The scale was further divided into 10 subscales under the three main factors: (1) Achievement, with the subscales: Advancement, Mechanics and Competition; (2) Socialization, with the subscales: Socializing, Relationship and Teamwork; and (3) Immersion, with the subscales: Discovery, Role-playing, Customization and Escapism.
2. The participants were self-selected MMO gamers from each school and most of these students played similar games such as Maple Story. So we didn't expect school effect on their motivation of playing. ANOVA was conducted to check the school effect. Out of the thirty-nine items, four had a significant difference between schools at $p = .017$ level. If we use a more stringent level of $p = .01$, then there is no significant difference. So the school effect was not included in the final analysis.
3. The initial solution was based on the criteria of eigen value greater than 1. However, this cut point is argued to be too arbitrary (Fabrigar, Wegener, MacCullum, & Strahan, 1999). In this article, eigen values around 1 are used as guidelines to determine the number of factors, together with other criteria.

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APPENDIX: EXPLORATORY FACTOR ANALYSIS WITH PROMAX ROTATION OF THE FULL MMO PLAYER MOTIVATION SCALE

Variable	Items	Component							
		1	2	3	4	5	6	7	8
S2	I enjoy chatting with other players.	.920							
S4	I enjoy working with others in a group.	.811							
S1	I find myself having meaningful conversation with other players.	.793							
S8	Friends in the game have offered me support when I had a real-life problem or crisis.	.720							.317
S3	I enjoy getting to know other players.	.713							
S6	I enjoy being part of a friendly, casual guild.	.672							
S11	It is important to have a self sufficient character.	.387							
I3	I often role-play my character.		.774						
A9	I often use a character builder or a template to plan out my character's advancement at an early level.		.671						
I1	I enjoy being immersed in a fantasy world.		.670						
I14	I play to escape from the real world.		.665						.348
I11	I spend a great deal of time customizing my character during character creation.		.641				.505		
I12	It is important that my character's amour/outfit matches in color and style.		.614						
I4	I often play to avoid thinking about some of my real-life problems or worries.		.612				.379		
I10	I often make up stories and histories for my characters.		.504			.322			.363
I2	I often play to relax from the day's work.		.475	.419					
I8	I enjoy exploring every map or zone in the world.			.924					
I6	I enjoy finding quests, NPCs or locations that most people do not know about..			.861					
I9	I enjoy trying out new roles and personalities with my characters.			.839					
A6	It is important to accumulate resources, items or money.			.809					
A11	I enjoy competing with other players.		.328	.461					.367
S5	It is important to help other players.	.382		.441					
A2	It is important to level up my character as fast as possible.				.957				
A3	I enjoy acquiring rare items that most players will never have.				.787				
A1	It is important to be well known in the game.				.756				
A4	It is important that my character is as optimized as possible for their profession/role.				.696				
A5	I like to become powerful.				.483				
A14	I enjoy doing things that annoy other players.					.794			

Variable	Items	Component							
		1	2	3	4	5	6	7	8
A12	I often like to purposefully try to provoke or irritate other players.					.743			
A13	I enjoy dominating/killing other players.				.355	.501			
I7	I enjoy collecting distinctive objects or clothing that have no functional value in the game.							.659	
I13	It is important that my character looks different from other characters.				.364	.372	.559		
S10	It is important that my character can solo well.		.312				.529		
A7	I enjoy being part of a serious, raid/loot-oriented guild.							.690	
A8	I am interested in the precise numbers and percentages underlying the game mechanics.				.349			.676	
A10	It is important to know as much about the game mechanics and rules as possible.					.322	.514		
I5	I enjoy exploring the world just for the sake of exploring it.					-.333	.316	.367	
S7	I talk to my online friends about personal issues.	.409							.657
S9	I find myself soloing a lot.				.373				.643

Note. Factor loadings < .30 were suppressed. S1 to S11 = Socialization subscales; A1 to A14 = Achievement subscales; I1 to I14 = Immersion. subscales.

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