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# What Leads to Player's Enjoyment and Achievement in a Mobile Learning Game?

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**Abstract**

This study investigated students' perceptions of competence and enjoyment of a mobile game within the context of mobile game-based learning. The proposed model showed that perceived competence and game attitude were the main predictors of enjoyment, while no direct relationship was found between perceived competence and achievement. The model simultaneously considered other factors such as prior game experience and intensity of use, and final analysis revealed that these two variables were directly related. Another important finding was the strong impact of prior game experience on perceived competence. Results are interpreted with reference to implications for possible means of improving learning outcomes when using mobile learning games in the academic context.

**Keywords:** enjoyment; perceived competence; game attitude; game experience; intensity of use; Minecraft

## 1. Introduction

Video games have been increasingly regarded as attractive learning tools in recent years due in part to their capacity to engage individuals in learning experiences and their ability to consume user's attention. The rise of edutainment and the popularity of mobile learning games have made it necessary to assess the educational value of these types of games and understand the behaviors involved in gameplay. The notion of playing to learn is not novel (Annetta, 2008). Through play, children can experiment with social experiences and simulate alternative emotional consequences, resulting in feelings of resolution outside the context of play (Erikson, 1977). In essence, play is not only an intrinsically motivating activity for children, it also provides a way for them to construct a different reality through their perceptions (Oerter, 1999). Additionally, play offers a context for children to compensate for real life problems, desires, and pressure that stems from socializing with others (Oerter, 2000).

The unique characteristics of video games, including interactivity of the medium, allow players to participate actively in the narrative, pursue goals, and experience feelings of self-efficacy (Ritterfeld & Weber, 2006). To this date, researchers have described and investigated a wide array of constituents of video game enjoyments, but the experience of self-efficacy remains a fundamental aspect of game enjoyment (Wirth, Ryffel, Von Pape, & Karnowski, 2013). When engaged in video game play, children can develop important competencies that lead to many positive outcomes such as persistence and satisfaction. More importantly, video game experiences provide opportunities for players with to satisfy their curiosity and experience a sense of achievement (Liu & Lin, 2009).

People engage in entertainment activities, including video games, to experience enjoyment above all other outcomes (Shafer, 2013). In fact, enjoyment is not only viewed as the core experience of entertainment (Vorderer, Klimmt, & Ritterfeld, 2004), it results from the experience of playing regardless of the outcome (McGonigal, 2011). However, players can only engage and re-engage in a gaming activity if it is perceived enjoyable. That is, motivation and persistence are less likely to occur unless the activity is enjoyable (Lumby, 2011). Taken in sum, game enjoyment plays an essential role in achievement as it can lead players to learn and master the game (Sansone & Harackiewicz, 2000), while a lack of enjoyment or boredom can result in disengagement and failure in learning (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

In literature, perceived competence is an achievement belief that has received lots of interest. Dweck and Leggett (1988) noted that perceived competence is linked to both implicit theories and achievement goals. In this manner, motivation studies have addressed competence from different perspectives, whether it is a desire to become competent, appear competent, feel competent, or avoid appearing incompetent to others (Urdan & Turner, 2005). When playing video games, individuals are often provided with opportunities to develop their competence through repeated attempts, errors, as well as feedback. Experiencing own competence may also result from when a player attributes success and accomplishment to own efforts and skills (Klimmt, 2003). Empirical research suggests that there is a link between enjoyment and the basic needs in self-determination theory. For example, the research by Tamborini et al. (2010) demonstrated that the satisfaction of autonomy, competence, and relatedness was not only related to enjoyment but also accounted for a considerable amount of variance. Based on their findings, Tamborini et al. broadly defined enjoyment as the satisfaction of intrinsic needs.

To investigate some key factors thought to affect an individual's enjoyment and achievement in a mobile learning game, this study draws on the Cognitive Evaluation Theory (CET), Bandura's Social Cognitive Theory (SCT), and Harter's Theory to develop a conceptual model and research hypotheses. This study makes a contribution to media enjoyment research by integrating key factors such game attitude, prior experience, and intensity of use, which have been overlooked in previous studies and models of enjoyment. It also provides an insight into key relationships and the role they play in both the enjoyment and achievement in the context of game-based learning by investigating the following research question:

**RQ1:** What factors influence enjoyment and achievement in a mobile learning game?

## 2. Literature Review

Self-determination theory (SDT; Ryan & Deci, 2000) defines both intrinsic and extrinsic factors that facilitate or decrease motivation. One mini-theory of SDT, cognitive evaluation theory (CET), suggests that the events and conditions that promote a person's sense of competence and autonomy enhance their intrinsic motivation within a particular activity while diminished feelings of autonomy or competence decrease intrinsic motivation (Ryan et al., 2006). The basic tenets of CET are that one's changes in perceptions of competence directly affect the level of intrinsic motivation, and this, in turn, can produce feelings of enjoyment and interest (Deci & Ryan, 1985). In the contexts of games and sports, intrinsic motivation is unarguably the core type of motivation (Frederick & Ryan, 1995). In fact, unlike many other activities, gaming is not only an intrinsically motivating activity, it provides players with opportunities to satisfy their psychological needs. This satisfaction is evident in how most players do not seek extra-game rewards and how players often pay to be involved in a gaming experience (Ryan et al., 2006). Further, it has also been proposed that individuals who are intrinsically motivated enjoy an activity more when compared to those who are extrinsically motivated (Ryan & Deci, 2000). Using this line of reasoning, it seems reasonable to suggest that people play games to seek intrinsic satisfaction.

In literature, perceived competence has often been used interchangeably with self-efficacy. According to Rodgers et al. (2014), both perceived competence and self-efficacy lead to goal pursuit and promote learning, behavioral engagement, and skills. Perceived competence in SDT has been suggested to be closely related to task efficacy (Rodgers et al., 2014). That is to say, competence goes beyond an individual's ability to conduct a task to also include his or her personal assessment of task importance. Generally, self-efficacy has been suggested as a construct that deals mainly with the cognitive perceptions of competence (Hughes, Galbraith, & White, 2011).

### 2.1. Prior Game Experience and Perceived Competence

Vandewaetere et al. (2013) contend that prior experiences and sufficiently developed gaming skills-i.e., spatial skills, problem-solving skills, reaction speed, and control accuracy- can largely impact gameplay behaviors and learning outcomes. However, it is important to note that perceived competence is not to be confused with perceived skills. Perceived competence and self-efficacy beliefs are more concerned with one's ability to coordinate a set of skills in challenging and changing situations (Maddux, 2009). This ability to make an impact in the virtual environment, in addition to the element of interactivity, can give players a sense of power, control, and self-efficacy (Klimmt & Vorderer, 2003). Perceived competence for a domain-specific activity is the result of a history of achievements and failures (deAlmeida, Valentini, & Berleze, 2009). Thus, in the context of playing games, it is within reason to suggest that the higher the level of mastery experiences, the more likely will the individual perceive himself or herself as

competent. More importantly, perceived competence is processual in nature in that it is developed over time once individuals are exposed to relevant experiences (Rodgers et al., 2014). Empirically, Fagan, Neill and Wooldridge (2004) found a positive relationship between computer experience and computer self-efficacy. Their study also suggests that individuals with experiences that built mastery of IT applications showed higher levels of computer self-efficacy. Given the lack of empirical evidence that explores the influence of prior experiences on competence perceptions in game-based learning, the current study predicts the following:

**H1:** Prior game experience will be positively related to perceived competence.

### 2.2. Perceived Competence and Game Attitude

Educational research has long considered attitude toward a subject as a good predictor of performance (Liu, Lee, & Chen, 2013). In fact, students' attitudes play a critical role in the achievement of educational objectives. Hence, a successful integration of computer games in educational settings depends significantly on students' attitudes towards them. Such integration requires a continuous monitoring of students' attitudes towards these particular media if computer games are to be used as learning tools. Positive perceptions of competence may encourage players to learn new skills and can result in new intentions to learn about a particular game. According to Liu, Lee, and Chen (2013), attitude is a learned behavior that reflects a personal evaluation of media based on past knowledge and beliefs. From this perspective, we suggest that players with higher competence perceptions may show favorable game attitude if they are willing to accept new challenges and are motivated to acquire new skills using a particular entertainment medium.

To this date, little empirical work has been done to explore the link between perceived competence and game attitude. The study by Bonnano and Kommers (2008) broadly suggested that more competent gamers showed more positive attitudes toward computer games. In a closely-related context, Zhang and Espinoza (1998) found a correlation between computer self-efficacy and attitudes toward computer technology. Building on these findings, the following is proposed:

**H2:** Perceived competence will be positively related to computer game attitude.

### 2.3. Competence Perceived and Intensity of Use

Bandura (1977) postulated that individuals with higher perceived self-efficacy are more active and persistent in their efforts in a given activity. Feelings of game competence can influence intrinsic motivation and judgments of autonomy. Individuals who perceive themselves as competent are more intrinsically motivated to engage in tasks that lead to the attainment of self-referenced goals when experiencing an ideal level of challenge. On the other hand, individuals who feel less competent tend to avoid engaging in such experiences (Deci & Flaste, 1996). From one perspective, intensity of game use represents recurring opportunities for players to experience ideal challenges and strengthen their competence levels. From another perspective, intensity of use can also reflect a player's willingness and continuity to participate, which is the result of feelings of previous achievements experienced within the game environment.

Overall, the relationship between perceived competence and frequency of use has been investigated more in the context computer technologies and less in gaming. For example, the study by Fagan et al. revealed that high computer self-efficacy was positively correlated with computer usage, meaning that individuals with higher perceptions of self-efficacy used computers more frequently. Thus, the present study hypothesized the following:

**H3:** Perceived competence will be positively related to intensity of use.

### 2.4. Perceived Competence and Enjoyment

Competence, described as a need for challenge or feelings of effectance (Deci, 1975), is also a centerpiece in Harter's (1981) theory of competence motivation. This theory contends that successful attempts to master particular skills enhance one's perceived competence, which in turn, leads to increased intrinsic motivation. Evidently, individuals who are intrinsically motivated experience a natural desire to stay involved in the activity. According to Harter, individuals who perceive themselves highly competent in an achievement area will experience more positive effects, and that demonstrating competence leads to joy. Specifically, while it has been highlighted that positive affect increases people's interest and enjoyment in moderately interesting activities (Isen & Reeve, 2005), previous studies

have shown that perceived competence and enjoyment are positively correlated. For instance, in a research study involving primary school children, positive and significant relationships were found between children's perceived competence and enjoyment in physical education (Carroll & Loumidis, 2001). A similar study by Fairclough (2003) also found that secondary students' perceived competence and enjoyment of physical activity were positively correlated. More closely related to the present study, Ryan et al. (2006) investigated undergraduate students' perceived in-game competence and autonomy in a commercially available platform game and found that these two psychological needs were significantly associated with game enjoyment. Therefore, the findings presented lead the present study to assume the following:

**H4**: Perceived competence will be positively related to enjoyment.

### 2.5. Perceived Competence and Achievement

Players who have high perceptions of game competence have the motivation to play and show persistence in the face of failed attempts, which leads to achieving the goals they set for themselves. Above all, these types of players are quick to recover their sense of competence after experiencing a failure or a setback. In a sense, this achievement motivation, also defined as the drive or the need to strive for excellence, is evidenced by individual efforts to persist and tackle difficult tasks (Singh, 2011). When considering video games, achievement motivation represents the internal desire to persist in a task and engage in multiple attempts to master game skills, consequently increasing achievement levels.

Past empirical investigations have demonstrated a link between perceived competence and achievement, particularly in educational settings. For instance, Yeun, Craven, and Kaur (2014) found a very strong link between perceived competence and achievement outcomes in reading and math. The results of another study (Leondari & Gialamas, 2002) showed that achievement goals and perceived competence predicted school achievement and that the relationship between achievement goals and achievement is moderated by perceived competence. Thus, the evidence presented leads the present study to hypothesize that:

**H5:** Perceived competence will be positively related to achievement.

### 2.6. Computer Game Attitude and Enjoyment

In literature, Nabi and Krcmar (2004) proposed media enjoyment as an attitude and suggested cognitive, affective, and behavioral reactions to game enjoyment. In other words, the type of attitude an individual shows a particular media offering can be a very strong indicator of the extent to which the media have been enjoyed. In previous attitude studies, enjoyment was used in computer users' attitudes as a variable (Christensen & Knezek, 2001; Knezek, Christensen, & Tyler-Wood, 2011). Other empirical studies have supported a positive relationship between perceived enjoyment and attitude towards the use of technology (Lee, 2009; Wu & Liu, 2007). For example, Wu and Liu (2007) found that online gaming enjoyment was a good predictor of attitude. In another study (Chinomona, 2013), it was shown that mobile gaming perceived enjoyment had a direct positive effect on attitude towards mobile gaming intention. Extending on past research and literature, the present study hypothesized the following:

**H6**: Computer game attitude will be positively related to game enjoyment.

### 2.7. Enjoyment and Intensity of Use and Their Relationships to Achievement

Shernoff, Knauth, and Makris (2000) contend that flow experiences play a significant role in helping students learn to enjoy the challenges and eventually achieve their goals. Since enjoyment triggers positive behaviors such as motivation and persistence, high achievement is more likely to occur. Low achievement, on other hand, is considered a risk factor for the enjoyment of learning (Hagenauer & Hascher, 2014). Empirically, students' enjoyment was found to be correlated with effort and performance (Schukajlow & Krug, 2014) and was also shown to predict self-regulation skills and academic achievements (Ahmed, Van der Werf, Kuyper, & Minnaert, 2013). Additionally, Shafer (2014) proposed and tested a model of factors that impact suspense and enjoyment and found that enjoyment significantly influenced the game outcome, with the latter being an objective measure of the score at the end of the game (i.e. achievement).

With regard to intensity of use, Lei and Zhao (2007) argue that frequency of technology use does not equate to constructive and meaningful use of technology for educational purposes. That is to say, the use of technology should focus not only on quality but also on connecting with practical problems and achieving specific goals. Considering the nature of video gameplay, players who frequently play games are provided with repeated attempts to learn new skills and strategies, which may lead to better goal achievements. In the academic context, empirical investigations have shown that computer use can have a positive impact on academic achievement in general areas such as science, mathematics, and reading (House, 2010; Junco, 2012; Wit, Heerwegh, & Verhoeven, 2012). To investigate this relationship in game-based learning setting and while considering the hypothesized link between enjoyment and achievement discussed previously, the following hypotheses are proposed:

**H7**: Intensity of use will be positively related to achievement.

**H8**: Enjoyment will be positively related to achievement.

## 3. Material and Methods

### 3.1. Research Model and Hypotheses

Based on the hypothesized relationships mentioned previously, the following model was constructed to illustrate the assumed interrelationships of the variables studied. First, prior game experience was predicted to be positively related to perceived competence, which in turn, is assumed to predict game attitude, enjoyment, intensity of use, and achievement. Lastly, the present model predicts that achievement, as a final outcome, will be directly influenced by enjoyment and intensity of use.

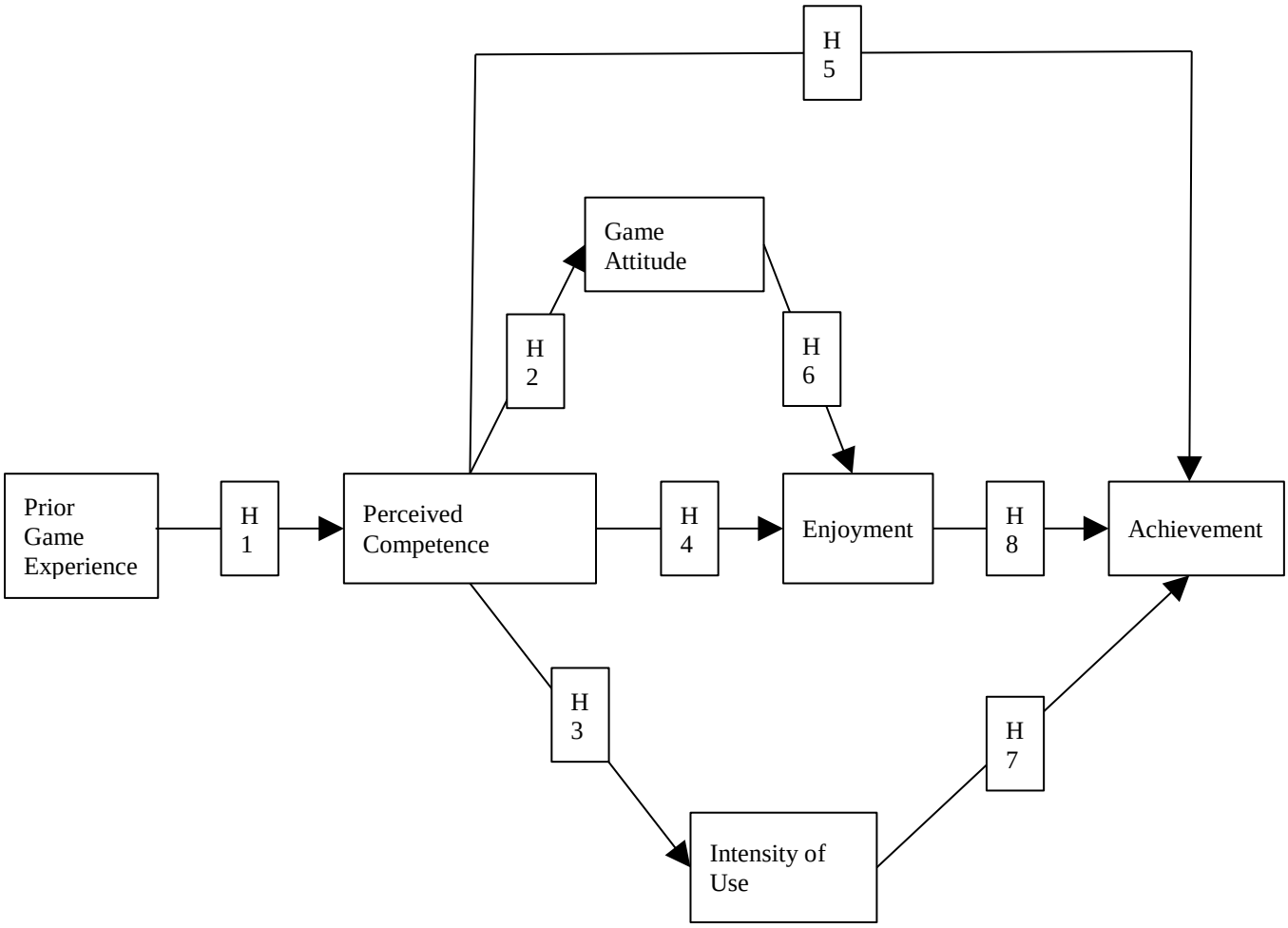


**Figure 1.** Hypothesized model

### 3.2. Participants

A total of 164 students (97 boys and 67 girls) aged between 12 and 13 years, from two mid-size elementary schools in South Korea, participated voluntarily in this study. Participants were recruited via in-person announcements in classrooms. Initially, when asked about their gaming skills in Minecraft, 75 participants rated their Minecraft skills as high, 86 students rated their skills as moderate, while only three students rated themselves as beginners.

### 3.3. Procedure and Data Collection

Participants played the mobile version of Minecraft every day after school on their own initiative for three weeks. They were given two tasks for their game play: one was to replicate a maze of their choice in Minecraft from three levels of difficulty (figure 2), and the other was to build their school's main building with a playground.

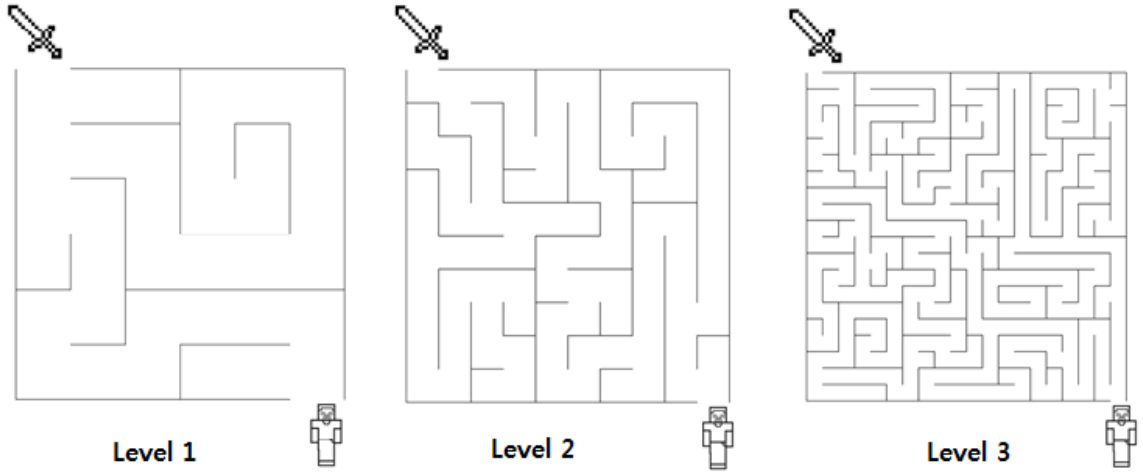


**Figure 2.** Difficulty levels of maze

Three students were assigned in a group, resulting in twenty-two groups from the first school and thirty-three groups from the second school (only one group had two members). For about twenty minutes every day before their individual gameplay, students engaged in group discussions about strategies to improve their skills to achieve game related tasks and solve any problems collaboratively.

On the first day, the Computer Game Attitude Scale was administered as a pre-test. Minecraft tasks and the evaluation criteria were thoroughly explained to participants.

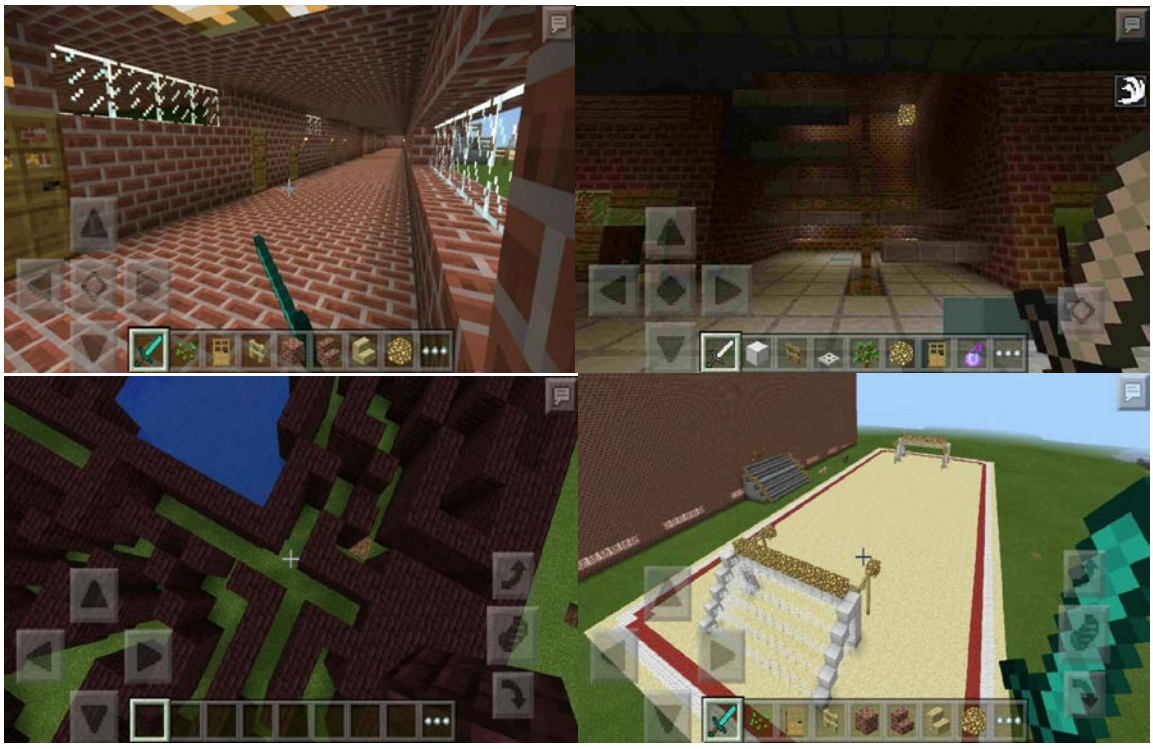

**Figure 3.** Maze, school building, and playground

After three weeks of gameplay, students were given the Enjoyment Test and Perceived Competence Test, which is a subcategory of the Intrinsic Motivation Inventory.

## 3.4. Psychometric Properties of Measures

### *3.4.1. Enjoyment*

Enjoyment was measured using the instrument developed by Fang, Chan, Brzezinski, and Nair (2010). The 11-item scale measures three dimensions of enjoyment of computer game: affective (α = .73), cognitive (α = .77), and behavioral reactions (α = .83). The affect dimension of the instrument contains five items of which four are reversed items that focus on negative affect during gameplay (I feel unhappy/I feel exhausted/ I feel worried/I feel miserable then playing this game). The three items on behavior aim to assess the player's viewing intent and behaviors while the three items on cognition focus on judgments of characters' actions during the gameplay (Fang et al., 2010).

### *3.4.2. Computer Game Attitude Scale (CGAS)*

Computer game attitude was measured using the Computer Game Attitude scale (CGAS) by Liu, Kuo, and Chang (2014). The instrument comprises 17 items and measures three dimensions: cognition (α = .882), affection (α = .748), and behavior (α = .754). The questions were answered on a five-point-Likert scale items (5= Strongly Agree; 1= Strongly Disagree).

The cognition subscale includes two factors- confidence and learning-, and each factor contains four items to measure users' confidence and positive impact when playing a computer game in learning. The affection subscale contains four items to examine the liking factor or perceived enjoyment for playing computer games. The third subscale, behavior, includes five items that aim to measure the leisure factor or how players perceive computer games as leisure activities.

### *3.4.3. Perceived Competence*

Perceived competence was measured using the perceived competence subscale of the Intrinsic Motivation Inventory (IMI) which was used in previous studies related to intrinsic motivation (Ryan, 1982; Ryan, Mims, & Koestner, 1983; Ryan, Koestner, & Deci, 1991). This measure includes 6 items, such as "I think I am pretty good in this activity," and one negative item, "This was an activity that I couldn't do very well." Each item was assessed using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The scale has been shown to be reliable and valid (McAuley, Duncan, & Tammen, 1989). Cronbach's alpha for the subscale was strong, $\alpha = .80$.

### *3.4.4. Achievement*

Two game tasks were given to participants. One was to build a maze and the other was to create a Minecraft replica of the school building where students were located. The first task consisted of creating an avatar, creating a sword at the destination point, building two layers of the wall, and allowing the avatar to successfully pass through the maze to reach the destination. The task had three levels of difficulty based on complexity of the maze, as shown in Figure 1. Participants' final mazes were assigned a total score of 100 points using the following criteria: a) 10 points for creating two layers of the wall, b) 10 points for the accuracy of replicating the model mazes, c) 30 points for the overall structure, d) 30 points for choice of a difficulty level (i.e. 10 points for level 1 maze, 20 points for level 2 maze, and 30 points for level 3 maze), e) 10 points for having a mobile avatar that successfully navigated to the end point, and f) 10 points for the existence of an avatar in the game environment.

The second task consisted of creating a game replica of the main school building, which had two stories and a playground with one track. The main building also had windows and a stairway leading upstairs. Similar to task one, the second task was assigned a 100 points, distributed as follows: a) 15 points for the balance between school building and playground, b) 15 points for building the playground and its track, c) 25 points for accuracy or closeness to reality, d) 10 points for including windows, e) 10 points for replicating the objects in both floors, and f) 25 points for including the stairway to the upstairs level. Lastly, each student's final game product was evaluated and scored by two peers using rubrics created by study researchers. An average score from both task 1 and 2 was used as a final score to reflect student's achievement in Minecraft.

### *3.4.5. Prior Experience and Intensity of Use*

To determine students' prior experience in gaming, two questions were administered. Participants were asked the following two questions: a) 'How do you rate your gaming experience level in general?' and b) 'How do you rate your Minecraft experience level?'. Participants responded to each question on a scale of 1-5 according to their gaming levels. Consequently, a possible score from 1 to 5 for each question resulted in a total score from 2 to 10 for the two questions. This total point was then used as an indicator of participants' prior game experience.

For the entire duration of this study, participants were asked to keep track and record their total play time in minutes. On average, participants reported approximately 729 minutes of play time, as shown in Table 1.

**Table 1.**
*Prior experience and intensity of use of participants*

| | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| Intensity of Use | 164 | 100 | 2100 | 728.66 | 408.463 |
| Prior Game Experience | 164 | 2.0 | 10.0 | 6.396 | 2.539 |

## 4. Results

### 4.1. Methodological Rationale

Path analysis is appropriate for testing model fitness and in other conditions where common sense or existent findings point to probable relationships (Cook & Campbell, 1979). It is a comprehensive methodology, which is appropriate for investigating achievements, self-concepts, and self-efficacy among other phenomenon (Suhr, 2008). The model used in this study focuses on examining direct effects between an *exogenous variable* (prior game experience) and five *endogenous variables* (perceived competence, intensity of use, game attitude, enjoyment, and achievement). Exogenous variables are not influenced by other variables in the model, so prior game experience is the only variable without observed influences. Lastly, the sample size (n=164) satisfies the criteria for the lower bounds of sample size for any type of SEM (Structural Equation Modeling). According to Anderson and Gerbing (1988), the threshold is approximately 150 participants for models that are comprised of three to four indicators.

### 4.2. Path Analysis

To check that there are no questionable relationships between the variables presented in the model, a Pearson Correlation analysis was conducted. Results show that intensity of use was not significantly correlated to achievement (table 2). This link was later dropped from the model as discussed in the next section.

A path analysis was conducted to investigate the relationships depicted in the hypothesized model. At first, the model showed poor fit $\chi 2$ (df = 5, N =164) = 22.47, $p < .001$; RMSEA = 0.116; AGFI = .869; NFI = .963. The model also showed that the paths from perceived competence to achievement ($\beta$= -.040, p=.782) and from intensity of use to achievement ($\beta$= .083, p= .508) were insignificant. Consequently, these two paths were dropped from the model. Additionally, modification indices suggested that a path from prior game experience to intensity of use would significantly improve model fit, thus this path was added and the model was re-analyzed.

The second path analysis results indicated that the model was a fit to the data, $\chi 2$ (df = 8, N =164) = 4.38, p = .821. The fit indexes were excellent (RMSEA = 0.00; AGFI = .977; NFI = .993); 90% Confidence Interval (CI) for RMSEA: (0.00; 0.056), pClose =.935. All paths in this revised model were significant (see figure 4.).

### 4.3. Multiple Regression

In addition to path analysis, a series of multiple regression was conducted to explore the relationships depicted in the proposed and revised models. It was found that prior game experience ($\beta = .347$, $p < 0.05$), and perceived competence ($\beta = .830$, $p < 0.01$) were significant predictors of intensity of use. Similar to the results of path analysis, perceived competence ($\beta = .023$, $p = 0.873$) and intensity of use ($\beta = .009$, $p = 0.867$) were not significant predictors of achievement. All other relationships in the model were significant (table 4).

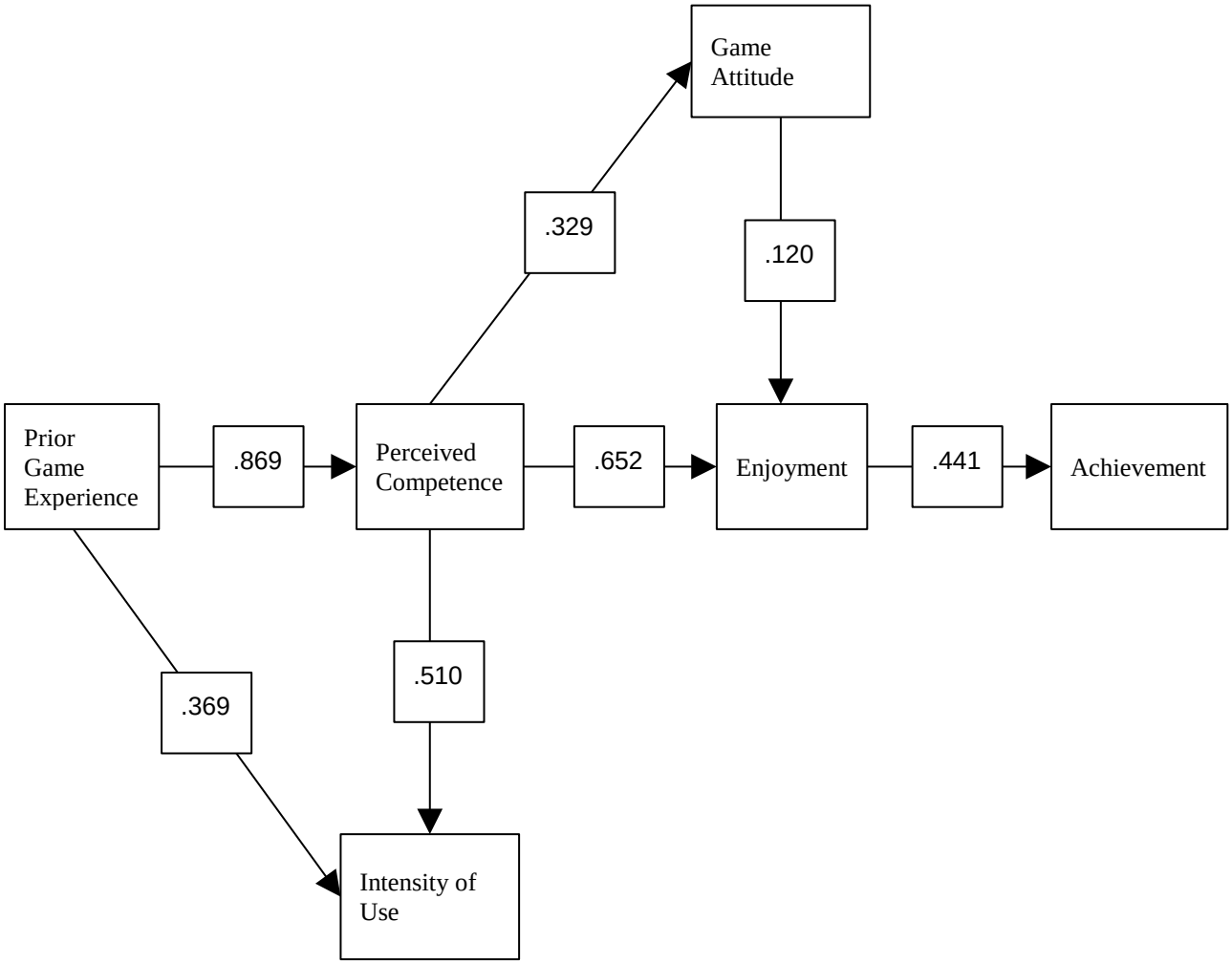


**Figure 4.** The final path model

**Table 2**.
*Correlation Matrix*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Prior Game Experience | - | .869** | .811** | .320** | .587** | .252* |
| 2. Perceived Competence | .869** | - | .829** | .324** | .666** | .288* |
| 3. Intensity of Use | .811** | .829** | - | .315* | .607** | .267* |
| 4. Game Attitude | .320** | .324** | .315* | - | .336** | .155 |
| 5. Enjoyment | .587** | .666** | .607** | .336** | - | .405** |
| 6. Achievement | .252* | .288* | .267* | .155 | .405** | - |

Note: *p < .05, two-tailed. **p <0.01, two-tailed. N=164

**Table 3**
*Goodness-of-fit indices for the total sample (N= 164)*

| Fit Statistics | | | | | | |
|---|---|---|---|---|---|---|
| $\chi 2$ | df | RMSEA | GFI | AGFI | TLI | CFI |
| 4.382 | 8 | 0.00 | .991 | .977 | 1.0 | 1.0 |

| Path | Path estimates |
|---|---|
| Prior Game Experience →Perceived Competence | .869** |
| Perceived Competence → Game Attitude | .329** |
| Game Attitude → Enjoyment | .120* |
| Perceived competence → Enjoyment | .652** |
| Prior Game Experience → Intensity of Use | .369** |
| Intensity of Use → Achievement | .083 n.s. |
| Perceived Competence → Achievement | -.040 n.s. |
| Perceived Competence → Intensity of Use | .510** |
| Enjoyment → Achievement | .441** |

Note: *p < .05; **p <0.01; n.s.= not significant

**Table 4**
*Multiple regression analysis*

| Predictor(s) | Dependent Variable | B | SE B | β | t |
|---|---|---|---|---|---|
| 1. Prior Game Experience | Perceived Competence | 3.281 | .147 | .868** | 22.291 |
| 1. Prior Game Experience | Intensity of Use | .559 | .392 | .347* | 1.425 |
| 2. Perceived Competence | | .221 | .055 | .830** | 4.016 |
| 1. Perceived Competence | Game Attitude | .469 | .098 | .353** | 4.796 |
| 1. Perceived Competence | Enjoyment | .576 | .053 | .652** | 10.926 |
| 2. Game Attitude | | .082 | .040 | .123* | 2.058 |
| 1. Perceived competence | Achievement | .066 | .414 | .023 | .160 |
| 2. Intensity of Use | | .002 | .009 | .022 | .168 |
| 3. enjoyment | | 1.227 | .337 | .370** | 3.636 |

**p < 0.01, *<0.05, N=164

### 4.4. Hypothesis Testing

First, to address the research question stated earlier, which inquired about the factors that influence both enjoyment and achievement, final analysis has shown that enjoyment was significantly influenced by game attitude and perceived competence, with the latter factor having a much stronger influence on enjoyment. Achievement, however, was only directly influenced by enjoyment, while perceived competence and intensity of use having no direct influence on achievement.

As shown in table 3, six of the hypotheses presented in this study were supported. The model shows that the relationship between prior game experience and perceived competence was the strongest in the model. Thus, H1 is supported. Additionally, H2, H3, H4, and H5 predicted that perceived competence will positively affect to game attitude, intensity of use, enjoyment, and achievement respectively. The model shows that perceived competence was positively affect to game attitude, intensity of use, and enjoyment. In fact, the relationship between perceived competence and enjoyment emerged as the strongest among these three relationships. Thus, H2, H3, and H4 are supported. However, results show no evidence to suggest a positive and direct relationship between perceived competence and achievement and therefore, H5 is not supported.

Hypothesis 6 predicted that game attitude will positively affect enjoyment. This relationship was present despite being the weakest in the model. Thus, H6 is supported. Lastly, H7 and H8 predicted that intensity of use and enjoyment will positively affect achievement. While the model shows a moderately strong relationship between enjoyment and achievement, which supports H8, the results show no evidence to suggest that intensity of use is linked to achievement and therefore, H7 is not supported. As mentioned previously, a significant relationship between prior game experience and intensity of use emerged in the model. This finding will be discussed further in the next section.

## 5. Discussion

This study developed a conceptual model based upon the Cognitive Evaluation Theory (CET), Bandura's Social Cognitive Theory (SCT), and Harter's theory to investigate how enjoyment and achievement in a mobile learning can be predicted by an individual's perceptions of competence. The model also integrated other factors such as prior gaming experience, intensity of use, and game attitudes, which were all found to be significantly related to a player's perceived competence. The concept of media enjoyment is a complex process (Vorderer, Klimmt, and Ritterfeld,

2004). As such, the purpose of our model is not to suggest a process of enjoyment but to highlight important constituents of game enjoyment, particularly the combined effect of perceived competence and computer game attitude. The model also shows how achievement, which is a crucial component in the learning environment, can be directly related to enjoyment. Moreover, the findings presented in this study represent an empirical application of the conceptualization of enjoyment as an attitude (Nabi & Krcmar, 2004). This conceptualization suggests that enjoyment is determined by a combination of cognitive, affective, and behavioral information.

As expected, the model presented in this study supports the strong link between prior gaming experience and perceived competence. In fact, this emerged as the strongest relationship in the proposed model. As pointed out earlier, the majority of participants rated their Minecraft skills as high or moderate. This finding is in line with literature in that students had strong beliefs in their abilities to coordinate a set of skills that they acquired through past gaming experiences. An important implication of this finding is that educators must pay close attention to students' prior experiences with specific types and genres of commercially available games before their implementation in educational settings. That is to say, the more experience students have with a game, the higher levels of perceived competence they are more likely to experience.

Another relationship the model intended to explore was between perceived competence and game attitude. The results demonstrated that the two variables were directly and positively related. In other words, students with higher perceived competence showed more favorable attitudes toward the game. This finding echoes previous research (Bonnano & Kommers, 2008), which also found that more competent gamers had more positive attitudes toward computer games. Furthermore, As results show, students with more positive attitudes toward computer games experienced higher levels of enjoyment. This is in line with earlier findings (Lee, 2009; Wu & Liu, 2007), which found a positive relationship between enjoyment and attitude towards the use of technology. Additionally, our findings complement past research (Chinomona, 2013; Wu & Liu, 2007) and demonstrate that computer game attitude can, in turn, predict the level of enjoyment, indicating a reciprocal effect between attitude and enjoyment. More importantly, this significant correlation provides empirical evidence of the conceptualization of enjoyment as an attitude as proposed by Nabi and Krcmar (2004), which suggests cognitive, affective, and behavioral reactions to enjoyment. These three dimensions have also been addressed by the scale used in the present study to measure participants' attitudes towards games.

Regarding the relationship between perceived competence and intensity of use, the results were consistent with our prediction and literature. Participants who perceived themselves highly competent had played the game more frequently. More precisely, as Bandura's social cognitive theory suggests, individuals with higher perceptions of self-efficacy show a more active and persistent behavior in a given activity. In the context of the present study, the intensity of use or the hours of play that students committed to the game reflect their willingness to tackle relatively difficult challenges that are not beyond their capacities and persist in achieving outlined goals.This finding is in line with the research by Fagan, Neill and Wooldridge (2004) who also found a positive relationship between computer self-efficacy and computer use. Our data confirm and validate this concept within the context of mobile game-based learning.

As shown in the model, perceived competence is strongly and directly related to enjoyment. This is consistent with Harter's contention that when people perceive themselves highly competent in an achievement area, they are likely to experience more positive effects and feelings of joy. The findings highlight the role of perceived competence as a fundamental determinant of game enjoyment. However, it is important to also point out the role of autonomy in the process. In other words, the strong association between perceived competence and enjoyment is more evident during self-directed tasks where students have more control over the activity. In a sense, autonomy (or self-directed play) that places students at the heart of the learning process may also promote their perceptions of competence and can determine individual preferences to engage in future play (see Ryan et al., 2006).

Results of this study do not support the conclusion that higher perceptions of competence are directly linked to achievement. One possible explanation resides in the current research design. As discussed earlier, given the open-ended nature of Minecraft, researchers used grading rubrics to assess gaming outcomes. Specifically, students who chose more difficult challenges (i.e. reproducing more complex mazes in Minecraft) were rewarded with more points. The most logical argument we can present is that the use of grade points as representations of the level of quality achievement has introduced an extrinsic incentive that may have a negative effect on intrinsic interest and student's choice of task difficulty level. In fact, a past experiment by Maehr and Stallings (1972) found that students consistently selected easier tasks to complete when being graded by the teacher. Building on this line of reasoning, extrinsically

motivated players may tend to gravitate toward easier tasks in a game-based learning environment. With that being said, we believe that this finding and interpretation may have implications for future use of Minecraft or similar genres as educational games. Educators should carefully choose assessment strategies and reward systems that use grades as a reflection of learning and mastery rather than having students anticipate grades as an extrinsic incentive. Similar to other learning settings, students' interest in a game-based environment should be at the center of learning. Once students perceive themselves as causal agents in the game-based environment and engage in a more risk-taking behavior, achievements may increase.

Furthermore, a significant finding in this study was how enjoyment was related to achievement. As expected, enjoyment of a gaming activity would usually lead players to make more efforts to learn and master the game, which could eventually result in better achievements. This finding is also consistent with past research (Liu & Johnson, 1998) that also found that enjoyment contributed to computer achievement. Clearly, one of the goals of implementing games in educational settings is to replicate certain behaviors commonly observed in entertainment games and that includes mastery and higher engagement. However, game developers are still faced with the challenges of how to effectively combine fun with learning in educational games, especially with learning being perceived as a serious undertaking. As such, future research should clearly pay more attention to investigating specific play characteristics that motivate students to learn and which also create an enjoyable experience in educational games.

An unpredicted relationship in the present study was the direct and positive link between prior gaming experience and intensity of use. While prior gaming experience is a construct that embodies both the level of game knowledge and previous frequency of use, we turn to literature to argue that intensity of use in our study context is a behavior that is the product of gaming habits. According to Kim, Malhotra, and Narasimhan (2005), a habitual behavior represents a linkage between beliefs and intentions. In video games, this means that individuals begin to process their beliefs and form their intentions to use the game much faster over a period of time as the result of repeated actions and behavioral history. In retrospect, the link between prior game experience and use makes sense in light of the application the concept of habitual behavior to video game play. Lastly, the lack of a direct relationship between intensity of use and achievement in the present study implies that students' abilities to use their knowledge and skills of the game were the controlling and dominating factor in terms of how to perform and achieve the game tasks. As a result, we argue that intensity of use may have played a minimal role in the process when compared to skills and knowledge.

## 6. Contribution and Implications of the Study

This study examined determinants of enjoyment and achievements (i.e., prior game experience, intensity of use, game attitude, and perceived competence), which we believe are important dimensions in learning with video games. The study sought to generate a model that could facilitate creating and simulating well-received, learning oriented games for mobile devices.

First, one of the highlights of our findings is that educators should carefully consider students' past experiences and students' familiarity with a specific learning game. An implementation of a game in a curricular activity should also involve a thorough assessment of students' attitudes towards it. As suggested by our findings, prior experience and attitude are key determinants of competence. A student who perceives himself or herself as a competent gamer is more likely to spend more time playing the game to achieve learning goals and experience more enjoyment out of the learning experience.

The present study suggests that an educational mobile game can indeed be an effective means for creating conditions of enjoyable learning and heightened interest in achieving learning goals. The present study also contributes to the body of literature that seeks to define the concept of media enjoyment. While previous studies sought to explore media enjoyment in the context of games used for entertainment, we explored the determinants of enjoyment in the learning context using mobile games. Our study also provides empirical evidence for the conceptualization of enjoyment as an attitude, which was put forward by Nabi and Krcmar (2004).

Since it is challenging to create and develop games that can educate and entertain at the same time, the open-ended nature of Minecraft provides teachers with the opportunity to design and customize the challenge of the learning activities. That way, students are able to choose their challenges based on their feelings about their ability to accomplish them, while the consistent accomplishment of learning goals increases their competence to take on future goals. Overall, we maintain that the success of Minecraft in creating an enjoyable learning experience is due mainly

to students' positive attitudes towards it. Prior to this experiment, students had known and used Minecraft for entertainment. As such, in the quest to assist with design of educational games that are enjoyable as well as educational, game developers should focus on the commercially popular games that are designed for entertainment and customize them for classroom use. A good example is Minecraftedu, which is the educational version of Minecraft. This gives students the advantage of familiarity with the game features and may potentially increase feelings of self-efficacy and competence among students, which are at the core of game enjoyment as we have shown in this study. Another important element in the design of educational game is allowing teachers the freedom to create and design activities within the game that meet the curricular requirements.

In drawing these conclusions, it is important to acknowledge this study's limitations. First, we must be cautious and note that findings from this study involve only one type of mobile video game. Thus, it is not clear whether the relationships noted in this study can be extended to other genres. Moreover, the nature of the sample also puts some limitations on the generalization and significance of these findings. Students who participated in this research came from two elementary schools in South Korea; that is to say, the findings may solely represent perceptions and impressions of this specific population. Lastly, another important limitation is the fact that participants' nationality and cultural characteristics may have influenced their level of competitiveness and collaboration in this research study. As such, it is possible that certain aspects such as collaboration and motivation may change according to participants' nationalities and cultural backgrounds.

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