Children and Video Games: Addiction, Engagement, and Scholastic Achievement

Marko M. Skoric, Ph.D.,1 Linda Lay Ching Teo, M.M.C.,2 and Rachel Lijie Neo, B.A.1

Abstract

The aim of this study is to assess the relationship between video gaming habits and elementary school students’ academic performance. More specifically, we seek to examine the usefulness of a distinction between addiction and high engagement and assess the predictive validity of these concepts in the context of scholastic achievement. Three hundred thirty-three children ages 8 to 12 years from two primary schools in Singapore were selected to participate in this study. A survey utilizing Danforth’s Engagement-Addiction (II) scale and questions from DSM-IV was used to collect information from the schoolchildren, while their grades were obtained directly from their teachers. The findings indicate that addiction tendencies are consistently negatively related to scholastic performance, while no such relationship is found for either time spent playing games or for video game engagement. The implications of these findings are discussed.

Introduction

Video games are unarguably becoming one of the dominant forms of electronic entertainment for both adults and children around the world. In the United States, video game sales witnessed a phenomenal 43% increase from US$12.5 billion in 2006 to a $18.8 billion in 2007.1 People are exposed to many different video gaming platforms ranging from gaming consoles attached to television sets to portable devices such as mobile phones and Palm Pilots.2 Video games have certain distinct characteristics that set them apart from other types of games. One such hallmark is the interactive, mediated environment of the video gaming world.3 The constant exchanges of messages between game and gamer, the succession of the roles between observer and participant, and the options of testing a variety of realities highlight the nature of gaming as play.3 Gaming narratives constantly incentivize children with gaming points, “lives,” new weapons, and so forth, for mastering new skills.4 Consequently, children invest a lot of time and effort to acquire such gaming knowledge and skills.5,6

Unsurprisingly, these developments have led to concerns from many parents, educators, and policymakers that the excessive amount of time spent by children on video games may result in the development of addictive tendencies among children video gamers.7 Numerous research studies have shown a significant negative relationship between academic performance and the severity of addictive tendencies among video gamers.8–15

However, people who devote a lot of time to video game play may not necessarily suffer the negative ramifications of gaming addiction.16 Instead, they might perceive video game play to be a highly engaging activity. Such engagement tendencies derived from video game play could potentially even have ameliorative effects on schoolwork and academic performance.16

While many previous studies have investigated the relationship between video gaming addiction/engagement and scholastic achievement among university students and adolescents, there has been a paucity of studies done specifically on elementary school children. According to an Annenberg Public Policy Survey of children’s media consumption habits, the vast majority of elementary school children (74%) have video gaming equipment at home and spend almost as much time as teenagers playing video games daily. Parents of elementary school children have expressed significantly greater consternation about the effects of video and computer games than parents of preschoolers and teenagers.17

In Singapore, the high household broadband penetration rate of 95%,18 and the rising proportion of the populace that owns computers and gaming devices have served as catalysts for the rapid growth of the local electronic gaming market.19 A nationwide representative survey commissioned by Singapore’s InfoComm Development Authority (IDA) showed

1Division of Communication Research, Wee Kim Wee School of Communication & Information, Nanyang Technological University, Singapore.
2Brand Manager, Shriro Singapore Pte Ltd, Singapore.
that elementary school−aged children were the most likely to download or play video games.\textsuperscript{18} Furthermore, Singapore is a meritocratic Asian society that places great emphasis on a person’s academic credentials.\textsuperscript{20} Predictably, parents have expressed a lot of concern about the effects of video game play on their children’s scholastic achievement.\textsuperscript{7} Thus, this study uses the Singapore context to examine the usefulness of a distinction between addiction and high engagement and assess the predictive validity of both of these concepts in the context of scholastic achievement.

**Literature Review**

**Time spent playing video games and scholastic performance**

Many Singaporean parents and educators have expressed consternation that their children’s academic results will be adversely affected by the amount of time spent playing video games. One parent even told the local broadsheet *The Straits Times* that controlling the amount of time spent playing video games is more important than regulating the type of video games children play.\textsuperscript{7}

Previous research findings on the relationship between the amount of time spent playing video games and academic performance have been mixed. Some video gaming effect studies have shown that scholastic achievement is inversely related to the amount of time spent playing video games\textsuperscript{9,14,16} whereas other studies have found no significant association between the amount of video game play and academic performance.\textsuperscript{15,21–23}

On the one hand, it has been argued that the more time a child spends playing video games, the less time he or she can afford to spend on scholastic activities such as reading or doing homework, causing academic performance to suffer.\textsuperscript{9}

On the other hand, other scholars have contended that the proportion of time spent by a typical child on video game play is not sufficiently large enough to have any deleterious effect on scholastic performance.\textsuperscript{24} Hence, we pose the following research question:

**RQ1:** Will the amount of time spent playing video games be associated with scholastic achievement?

**Video game addiction, engagement, and scholastic performance**

Although numerous studies have been done on video game addiction, there is still no standardized definition of the concept. Nevertheless, scholars concur that addiction of any kind is usually associated with an uncontrollable urge, often accompanied by a loss of control, a preoccupation with use, and a desire to continue with the activity even though it creates problems.\textsuperscript{25} One of the most popular tools for determining video gaming addiction was developed by Brown,\textsuperscript{26,27} who based his video gaming addiction criteria on the Diagnostic and Statistical Manual of Mental Disorders (DSM)’s description of addictive tendencies.\textsuperscript{27} His criteria comprised six measures: *tolerance*—occurs when people engaging in video game play gradually spend increasing amounts of time to achieve certain desired effects; *mood modification*—engaging in video game play as a coping mechanism (e.g., to escape from reality); *salience*—happens when video game play dominates a person’s thoughts and behavior such that he or she is unable to stop playing; *conflict*—video game play that culminates in either internal or external arguments; *withdrawal symptoms*—moodiness, irritability, and so on, that take place when video game play is suddenly stopped; and *relapse and reinstatement*—the inability to completely stop video game play.\textsuperscript{26,27}

To date, many video gaming scholars have utilized Brown’s\textsuperscript{26,27} criteria to examine addictive tendencies among video gamers.\textsuperscript{4,9} However, other scholars have challenged the assumption that all of the six criteria form part of the video gaming addiction construct.\textsuperscript{16} Drawing mainly on Brown’s definitions of behavioral addiction,\textsuperscript{26,27} Charlton synthesized a theoretical construct, the Engagement-Addiction scale, to differentiate high engagement from video game addiction.\textsuperscript{16} A factor analysis of the questionnaire items revealed that only part of Brown’s criteria for behavioral addiction (i.e., behavioral salience, conflict (both internal and external), relapse and reinstatement, and withdrawal, fell under the dimension of computer addiction. However, the rest of Brown’s\textsuperscript{26,27} criteria (tolerance, euphoria, and cognitive salience) loaded under the engagement dimension,\textsuperscript{16,30} implying that these “addiction” criteria were not indicative of dysfunctional video gaming patterns but rather a form of “intense, but benign, engagement.”\textsuperscript{30(p9)} Charlton’s findings were further validated by Danforth’s,\textsuperscript{30} subsequent study on online gaming addiction.

Both Charlton and Danforth argued that using such peripheral criteria to identify video game addiction could potentially result in a significant overestimation of the prevalence of video gaming addiction.\textsuperscript{16,30–32} Furthermore, they suggested that those criteria relating to high levels of engagement cannot be considered as properties that identify addictive behavior patterns and are aspects of “normal” play. Thus, it is important to distinguish between harmful addictive behaviors and benign video gaming engagement.\textsuperscript{16,31}

With specific regard to the relationship between addictive tendencies and school performance, several researchers have found that addicted adolescents had lower school grades than their nonaddicted peers.\textsuperscript{4,8,10,33}

However, the relationship between engagement tendencies and academic performance remains relatively unexplored. Some scholars have contended that high computer engagement is an indicator of high computer usage that is non-pathological and does not have negative consequences on individuals.\textsuperscript{31,32} Reddy argues that video gaming engagement tendencies, such as a desire to devote ever longer periods of time to an activity, euphoric feelings while gaming, or a cognitive fixation with gaming, are all perfectly rational responses to an enjoyable hobby.\textsuperscript{35} Indeed, Shotton’s study of individuals with “highly zealous computing” behavior reported positive cognitive outcomes, such as improved analytical and reasoning skills, and higher personal development, such as greater confidence and self-esteem.\textsuperscript{36,37} However, in an interpretive qualitative analysis of responses from 12 video gamers who played EverQuest, findings suggested that both adult and adolescent players who were highly engaged by video game play appear to experience negative life consequences to a certain degree.\textsuperscript{38}

To date, previous studies have mostly focused on establishing the factorial validity of the engagement-addiction construct.\textsuperscript{32,39} However, it is also equally important to gauge if the respective addiction and engagement constructs have predictive validity with variables such as socio-academic
functioning. Hence, the following hypothesis and research question are proposed:

**H1:** Addictive tendencies will have a negative association with scholastic achievement.

**RQ2:** What is the relationship between engagement and scholastic achievement?

### Methodology

#### Participants

The study was conducted on 333 elementary school video gamers ages 8 to 12 (M = 10.00, SD = 1.08) from two public schools that were reflective of Singapore’s diverse demographics. First and second graders were excluded because the schools felt that these students may face difficulty comprehending the survey questions. The sample consisted of 54% boys and 46% girls; 57.4% were Chinese, 33.5% were Malay, 7.6% were Indian, and the remaining 1.5% were from other ethnic backgrounds.

#### Measures

**Amount of time spent playing video games.** Participants were asked to indicate the amount of time spent playing video games on a typical school day and typical weekend day (in the morning, afternoon and evening). Their overall scores were summed up and then recoded into a 4-point scale ranging from A little time to A lot of time spent playing video games for weekdays (M = 2.53, SD = 1.07) and weekends (M = 2.54, SD = 0.99).

**Assessment of addiction tendencies.** Respondents were asked to complete a series of 11 statements about computer/video game play, which were measured on a 6-point Likert scale (1, strongly disagree, to 6, strongly agree). These questions were based on three of the six dimensions of Brown’s video gaming addiction criteria, namely, behavioral salience (e.g., “I find that I need to spend more and more money on computer/video games in order to feel good”), conflict (e.g., “Arguments have arisen at home because of the time I spend on computer/video games”), and withdrawal symptoms (e.g., “When I am not playing computer/video games, I feel restless or irritable”), which loaded under the addiction factor in Danforth’s study. Three questions were added based on DSM-IV, pretested and modified so that they were applicable to the young participants. These 11 statements were simplified and pretested on 8 to 12 year olds prior to conducting this study. There was good internal reliability in the addictive tendencies scale with an alpha of 0.75 (M = 26.16, SD = 10.03).

**Assessment of engagement tendencies.** Eight questions were used to measure video gaming engagement among elementary school students. These questions were adapted from the three dimensions of Brown’s criteria for video gaming addiction: tolerance (e.g., “I find that I need to spend more and more time on computer/video games in order to feel good”), euphoria (e.g., “I feel happy when I think of playing computer/video games”), and cognitive salience (e.g., “I find that I am thinking of computer/video games all the time”), which loaded under the engagement factor in Danforth’s study. These eight items were summed up to form an index with a Cronbach’s alpha of 0.79 (M = 26.89, SD = 9.59).

**Assessment of school grades.** The participants’ school grades on their midyear (May) exams were obtained for three subjects: English (M = 64.87, SD = 13.44), mathematics (M = 62.12, SD = 23.37), and science (M = 63.56, SD = 14.74). Also, their scores for English (M = 64.87, SD = 13.44), mathematics (M = 62.12, SD = 23.37), and science (M = 63.56, SD = 14.74) were obtained from their year-end (November) exams.

Preliminary independent sample t tests showed that the raw exam scores differed significantly by grade level and school type. These discrepancies occurred because students who came from different grade levels and schools obviously took dissimilar exams. Hence, we standardized the scores of the students’ exam grades on each of these three subjects by classifying the students according to their year of study and the school they came from. These standardized scores for the May and November exams were summed up, and the average z scores were obtained for English, mathematics, and science grades respectively.

**Demographic variables.** Lastly, a series of standard demographic variables pertaining to respondents’ age, gender, level of study, and race were asked.

### Results

In order to test RQ1, RQ2, and H1, three sets of hierarchical regressions were run with the average standardized English, mathematics, and science scores as the respective criterion variables. For each of these hierarchical regressions, race and gender were entered into the first block as demographic control variables because they were significantly correlated with the criterion variables. In the second block, the amount of time spent playing video games on weekdays and weekends served as time usage predictor variables. Video game addiction and engagement tendencies were added in the third and final block.

With regard to RQ1, the amount of time spent playing video games on weekdays showed a significant positive association with English test scores (β = 0.19, p < 0.05). The more time spent playing video games on weekdays, the more likely an elementary school child is to fare better for English. However, the amount of time spent playing video games on weekdays did not show a significant association with mathematics and science test scores. Also, the amount of time spent playing video games on weekends showed no significant association with any of the three subject test scores (see Table 1).

**Discussion**

In general, the amount of time spent playing video games did not show any significant association with any of the three
subject test scores. These largely nonsignificant findings are congruent with findings from previous studies. It is possible that children who spend a lot of time playing video games also devote a substantial proportion of time to doing their homework, thus enabling them to maintain their grades.

However, there was a significant positive association between the amount of time spent playing video games on weekdays and English test scores, which runs counter to the findings of previous studies. Because video games require players to successfully understand the language used in the gaming narrative to navigate the gaming environment properly, it is possible that children who spend more time playing video games on weekdays have a better command of the English language. However, some video games require significantly greater levels of linguistic competency to master than others. Thus, future research might want to examine if preferred video game type has any association with English language test scores.

Conversely, video gaming addiction showed a consistent negative association with academic performance. These significant negative associations between gaming addiction and scholastic achievement are consistent with findings from previous gaming addiction studies done on adolescents and college student samples, indicating that elementary school children are likewise not exempt from the negative ramifications of video game addiction.

Unlike addictive tendencies, video gaming engagement showed no significant association with academic performance in elementary school children. These findings fill up a very crucial gap in the video gaming literature by providing empirical support for the distinction between high engagement and pathological addiction in predicting negative life outcomes, in this case, academic performance among elementary school children. While addiction can pose significant problems to children’s lives by affecting their academic performance, children who are simply highly engaged with video games are unlikely to develop negative consequences. Future studies should focus on teenage and college student populations to see if similar conclusions can be made about these segments of the population.

<table>
<thead>
<tr>
<th>Demographic control variables</th>
<th>Average standardized English scores (N = 262)</th>
<th>Average standardized mathematics scores (N = 263)</th>
<th>Average standardized science scores (N = 262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (0 = male, 1 = female)</td>
<td>0.14*</td>
<td>-0.12*</td>
<td>-0.14*</td>
</tr>
<tr>
<td>Race (0 = Chinese, 1 = non-Chinese)</td>
<td>-0.01</td>
<td>-0.35***</td>
<td>-0.21***</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.02*</td>
<td>0.13***</td>
<td>0.06***</td>
</tr>
<tr>
<td>Time spent playing video games</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On weekdays</td>
<td>0.19*</td>
<td>-0.11</td>
<td>0.05</td>
</tr>
<tr>
<td>On weekends</td>
<td>-0.08</td>
<td>0.07</td>
<td>-0.05</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.02</td>
<td>0.14</td>
<td>0.06</td>
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<tr>
<td>Predictor variable</td>
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<td></td>
<td></td>
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<tr>
<td>Addiction tendencies</td>
<td>-0.33***</td>
<td>-0.20**</td>
<td>-0.23**</td>
</tr>
<tr>
<td>Engagement tendencies</td>
<td>0.14</td>
<td>0.13</td>
<td>0.10</td>
</tr>
<tr>
<td>Total adjusted $R^2$</td>
<td>0.08***</td>
<td>0.16*</td>
<td>0.09**</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01; ***p < 0.001. 

Performance, future research can investigate the relationship that engagement and addiction have with other forms of negative life outcomes, such as maladaptive psychosocial functioning.

Nevertheless, clear classification procedures for the clean delineation between engagement and addiction have yet to be determined. It is imperative for future research to come up with a clear set of criteria to demarcate the boundary between nonpathological and pathological video gaming engagement. Furthermore, researchers would benefit from validating The Addiction-Engagement scales on younger populations such as elementary school children.

There are several limitations to this study. Due to its correlational nature, inferences about causal relationships should be viewed with some caution. However, the school grades used as a measure of scholastic achievement in this study were obtained from two time periods: midyear exams and end-of-year exams. Our survey was conducted in between these periods, making our data not purely cross-sectional in nature. Still, a longitudinal design would be preferred for establishing causal relationships between the predictor and criterion variables tested in this study.

Furthermore, in this study, we did not control for family income because we believed that children would not be able to accurately answer questions about their family finances. Future studies examining the difference between gaming addiction and engagement should try to find ways to assess family income of young participants and use it as a control variable.

Lastly, despite simplifying the questions, some children still had difficulties comprehending the definitions of certain words such as addiction. We are also unsure of whether some of the youngest respondents were able to give accurate responses on the 6-point Likert scales used in this study. Their difficulty in responding to survey questions was also evident in the case when they estimated the amount of time spent playing games; thus, instead of reporting raw number of hours, we had to recode their responses into a 4-point scale. Still, we argue that similar surveys could be used in future studies involving children as young as 8 or 9 years if the instrument has been simplified and extensively pretested.
Acknowledgments

We thank The Singapore Children Society for funding this project. Also, we are extremely grateful to Dr. Angeline Khoo and her team from National Institute of Education (Singapore) for allowing us to adapt some of their survey questions for this study. Lastly, we thank Dr. Douglas Gentile for helping us improve the addiction scale used in this study.

Disclosure Statement

No competing financial interests exist.

References


Address correspondence to:
Dr. Marko M. Skoric
Division of Communication Research
Wee Kim Wee School of Communication & Information
Nanyang Technological University
31 Nanyang Link
Singapore, 637819
E-mail: marko@ntu.edu.sg