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Parental acceptance of digital game-based learning☆

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ABSTRACT

In research about digital game-based learning, the likely negative perceptions of parents are often enlisted as a barrier toward the adoption of games in classroom settings. Teachers, students and policy makers appear to be influenced by what parents think about games in the classroom. Therefore, it is important to study these parental beliefs about games. The present research develops and validates a path model to explain and predict parental acceptance of video games in the classrooms of their children. The hypothetical model was found reliable and valid, based on a survey of 858 parents with at least one child in secondary education. Overall, the results show that 59% of the variance in parents' preference for video games can be explained by the model comprising hypotheses about learning opportunities, subjective norm, perceived negative effects of gaming, experience with video games, personal innovativeness, and gender.

1. Introduction

A significant body of research links video games with contemporary learning theories and especially insights from cognitive science (Gee, 2003; Paraskeva, Mysirlaki, & Papagianni, 2010). Video games improve student motivation (Burguillo, 2010; Kebritchi, Hirumi, & Bai, 2010; Malone, 1980), stimulate deep learning and creative thinking (Eow, Ali, Mahmud, & Baki, 2009; Papert, 1980), transcend subject boundaries (Squire, 2004) and provide powerful and meaningful contexts for learning (Shaffer, 2006). Based on a review of the literature on "digital game-based learning" (DGBL), Van Eck (2006) distinguishes between three approaches for integrating games into the learning process: "have students build games from scratch; have educators and/or developers build educational games from scratch to teach students; and integrate commercial off-the-shelf (COTS) games into the classroom" (p. 57). However, empirical research concerning the effectiveness of DGBL is scarce, fragmented and often conflicting (Hays, 2005; Papastergiou, 2009; Tobias & Fletcher, 2008). A variety of factors underlie these conflicting findings. Current research emphasizes that most of these factors appear to stem from difficulties with the implementation of games in classroom settings (Egenfeldt-Nielsen, 2004). Therefore, researchers are starting to focus on the different barriers that hinder the straightforward adoption of video games in education. However, a key issue is whether researchers adopt a sufficiently broad approach when studying the key actors in an instructional setting.

Most of these video game implementation studies have centered around two actors that are believed to be key players in the integration process: teachers (Kirriemuir & McFarlane, 2004; Schifter & Ketelhut, 2009; Schrader, Zheng, & Young, 2006) and students (Bourgonjon, Valcke, Soetaert, & Schellens, 2010). So far, little attention has been paid to the position of the parents. Notwithstanding, parents play an important role in the school system. Their involvement ranges from taking on the role of a mere communicative bridge between the school and home environment, over decision making as members of the board of governors, to occasional partnership in the implementation of instructional processes (Epstein, 2001; Kong, 2008; Mooij & Smeets, 2001). It is therefore not surprising that in the meta-analysis overview of Hattie (2009), parental involvement is considered as a critical variable influencing learning performance. Hattie reports – on the base of 716 studies – an average effect size of $d = .51$ (2009, p. 61).

Not much is known about the acceptation of video games by parents, except that parents' beliefs can be very influential at several levels. Firstly, parents' likely negative beliefs are listed as one of the main arguments reported by teachers who do not want to use video games in the classroom (Williamson, 2009). Secondly, parents' beliefs about video games and the rules about playing at home have a profound impact

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on how the students perceive video games in the context of learning and instruction (Scharrer & Leone, 2008). Thirdly, parents' beliefs have served as an argument used by public policy makers for restricting children's access to video games with potentially harmful content (Bijvank, Konijn, Bushman, & Roelofsma, 2009; Kutner, Olson, Warner, & Hertzog, 2008). Therefore it is remarkable that parental acceptance of video games is not higher on the research agenda, certainly in relation to digital game-based education. However, things are starting to change since the 2009 BECTA study "Computer games, schools and young people" marked parental acceptance as an important domain for further educational research (Williamson, 2009).

This article responds to the call for studying parents' beliefs about DGBL, by presenting the results of a cross-sectional survey study among 858 parents of secondary school students about video games in general, and about the use of video games in the classroom in particular. The use of games in the classroom here refers to those approaches within DGBL that concern actually playing video games in the classroom. Based on previously established and validated models, a model for understanding parents' acceptance of game-based learning is proposed. In what follows, the theoretical underpinnings for this model are examined, and the model fit is tested against data that is gathered from the parents.

2. Literature review

2.1. Parents' beliefs about games

Parental beliefs about information technology have almost exclusively been studied in relation to mediation: mostly through surveys, researchers have tried to find out how parenting styles and rules affect media use of children and adolescents (Mesch, 2009; Valcke, Bonte, De Wever, & Rots, 2010). Within this body of research, video games have been analyzed as a special case, partly because games are played rather than watched (Bogost, 2007; Turkle, 1984), and because game experiences are usually shared with peers, rather than with parents. The latter is in contrast with watching television, for example, which more often takes place in a common room (Bickham et al., 2003; Nikken & Jansz, 2006). Given these characteristics, it comes as no surprise that research concludes that parents feel less knowledgeable about video games than about television or other media (Nikken & Jansz, 2006).

Two types of parental beliefs recur in the literature. It appears that parents distinguish between both desirable and undesirable effects of media and video games (Nikken & Jansz, 2006; Skoien & Berthelsen, 1996; Sneed & Runco, 1992). Besides acknowledging that games can have positive effects, like enhanced cognitive thinking skills, parents express concerns about (a) the balance between the children's video game play and other activities, (b) the content of games, (c) the potential harmful effects, and (d) mediation strategies (Kutner et al., 2008). Their strategies to watch over the game playing habits of their children more or less resemble traditional mediation techniques, ranging from downright disapproval and restriction, over rule setting, to co-playing and talking about games (He, Piche, Beynon, & Harris, 2010; Kearney & Pivec, 2007; Kutner et al., 2008; Nikken & Jansz, 2006; Scharrer & Leone, 2008; Skoien & Berthelsen, 1996).

2.2. Parents' beliefs about games in education

In an educational context, research on information technology integration has traditionally considered the home environment as a basis for extending school activities beyond classroom walls (Blanchard & Oliver, 1999; Kong & Li, 2009). However, there is a large difference between teachers' and parents' aspirations on the one hand and the reality on the other hand: "home computers typically service game playing – games that appear to have little connection with the agenda of the school" (Kerawalla & Crook, 2002, p. 753).

Considering the former, this article will focus on parents' beliefs about games in general, and DGBL in particular. The theoretical base builds on two models that help to describe and explain an individual's predisposition toward action: the theory of reasoned action (TRA - Fishbein & Ajzen, 1975) and the technology acceptance model (TAM - Davis, 1989). Over the years, both models have been researched extensively to find reasons for the often-difficult integration of information technology in a variety of domains. The former theory, TRA, states that individuals' intended behavior is predicted by their perception of their own attitude toward that behavior and by the perceived social pressure to act. The latter model, TAM, focuses specifically on the case of information technology. The model explains people's behavioral intentions as a result of two user beliefs: perceived usefulness and perceived ease of use.

Based on these theories, the research in this article tries to build an eclectic model for predicting and explaining parents' acceptance of video games in the classrooms. Serious adaptations have been made in the present study, not only for matters of consistency (Legris, Ingham, & Collerette, 2003), but also to take into account individual, contextual, technology and task characteristics (Mathieson, Peacock, & Chin, 2001; McFarland & Hamilton, 2006). For example, because the decision to use video games in the classroom is not up to the parents themselves, it was impossible to use the traditional TAM concepts of behavioral intention, usefulness and ease of use. Therefore, the literature uniting game and technology acceptance studies was consulted in order to find an alternative approach (Bourgonjon et al., 2010; Ha, Yoon, & Choi, 2007; Hsu & Lu, 2004; Wu & Liu, 2007).

3. Research model and hypotheses

3.1. Dependent variable: preference for video games (PVG)

A useful concept for studying the acceptance of digital game-based learning in a school context is that of preference for video games (PVG). It is derived from Hsu and Lu (2007), who described preference as a measure of "the degree of users' positive feelings about participating [in online game communities]" (p. 1648). To examine students' acceptance of video games in the classroom, Bourgonjon et al. (2010) added an intended behavior component that refers to the approval of game-based learning. This meets the suggestion of Skoien and Berthelsen (1996) to study whether people are really willing to act upon their beliefs about games. In this article preference for video games can be defined as "positive feelings about games for learning and predicted choice for video games in the classroom" (Bourgonjon et al., 2010, p. 1147).

3.2. Learning opportunities (LO)

Academics and educators consider video games as operational translations of certain contemporary learning theories (Egenfeldt-Nielsen, 2007; Gee, 2003; Papert, 1980; Shaffer, 2006; Squire, 2004). In other words, for academics and educators the main quality of video games is that they foster opportunities for learning. The concept of "perceived learning opportunities" was introduced by Bourgonjon et al. (2010) precisely to study how people think about these process outcomes of using video games in the classroom. The authors compare perceived learning opportunities with perceived usefulness – a concept by Davis (1989) that is focused more on job performance, on the product outcome of using a certain type of technology. In the case of parental acceptance of video games usefulness refers to the potential of video gaming to increase the students' performance (for example, as reflected in the students' grades). Perceived learning opportunities, however, refers to the degree to which parents believe that using video games in the classroom will offer their children opportunities for learning.

Considering both parents' concerns about good education, and their preference for information technologies that explicitly foster learning (Kerawalla & Crook, 2002; Kong, 2008), it follows logically that the degree to which parents believe that using video games in the classroom offer children opportunities for learning will highly correlate with and predict preference for video games (Kong & Li, 2009; Skoien & Berthelsen, 1996).

H1: (Perceived) learning opportunities (LO) positively affects preference for video games (PVG).

3.3. Negative effects of playing video games (NEG)

The value of video games is subject to many debates (McAllister, 2004), in which the popular media play an important role. In the past, media messages about video games have predominantly focused on potential negative effects of gaming, and have eagerly cited studies that hold video games accountable for health issues – ranging from obesity (Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpela, 2005; Stettler, Signer, & Suter, 2004) to injuries inflicted by the use of a game controller (Rushing, Sheehan, & Davis, 2006) – and of course for desensitization and aggressive behavior (Anderson & Bushman, 2002; Anderson & Dill, 2000; Colwell & Payne, 2000; Uhlmann & Swanson, 2004). However, researchers do not agree about the aggressive behavior hypothesis (Freedman, 2001; Goldstein, 2001). The debate seems – dixit *Nature* – "clouded by overheated rhetoric and exaggerated claims" (A calm view of video violence, 2003, p. 355).

Unsurprisingly, parents appear to be alarmed by these media messages, which often directly target parental responsibilities, by pointing out that parents need to watch over the type of games children play. Skoien and Berthelsen (1996) found that the media attention for the potentially harmful effects of playing video games is an important source influencing parental beliefs about games. It follows that their beliefs about the potential negative effects of playing video games (NEG) will have a profound impact on their acceptance of DGBL.

The relationship between parents' beliefs about the negative effects of gaming and their perception about the learning opportunities is less straightforward. Squire (2002) argues, "A fundamental tension facing game studies is that if games do not promote or "teach" violence, then how can researchers claim that they might have a lasting impact on students' cognitive development?" (Unpacking game play, para. 1). Nevertheless, although both constructs might in fact be referring to learning, the beliefs about possible consequences can still be highly contradictory.

H2: Negative effects of playing video games (NEG) negatively affects preference for video games (PVG).

H3: Negative effects of playing video games (NEG) negatively affects learning opportunities (LO).

3.4. Subjective norm (SN)

Both the theory of reasoned action (Fishbein & Ajzen, 1975) and the subsequent theory of planned behavior (Ajzen, 1991) include subjective norm – which is defined by the authors as "a person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302) – as a direct predictor for people's intentions to act. This assumption goes back to the work of Triandis (1971), who stated that people are influenced by messages about what they should or should not do. However, the generic impact of subjective norm has not always been confirmed in the literature. A promising reorientation of the theory is that the impact of subjective norm is more profound in cases of initial acceptance, in situations where people are not yet experienced with the new technology and behavior (Hu, Clark, & Ma, 2003; Triandis, 1971). Video games could be considered an example of such a technology, and as expected, subjective norm appears to be a good predictor for the acceptance of online video gaming (Hsu & Lu, 2004). In addition to the direct effect of subjective norm on people's intentions, it is also likely that an indirect effect exists through personal belief systems. This is suggested by Venkatesh and Davis (2000) who reported that people internalize a referents' beliefs and make it part of their own belief system.

H4: Subjective Norm (SN) positively affects preference for video games (PVG).

H5: Subjective Norm (SN) positively affects learning opportunities (LO).

3.5. Experience

Another crucial factor is the amount of experience parents has with video games. But this variable reintroduces the debate over how to measure experience (Bajaj & Nidumolu, 1998; Thompson, Higgins, & Howell, 1994). Often, the debate centers on the need to transcend frequency of use as a measurement approach. Skoien and Berthelsen (1996), for example, also included the depth of usage in their Parental Experience with Computers scale. Similarly, Bourgonjon et al. (2010) conceptualized experience with video games as a combination of time dedicated to video gaming, playing a diversity of games and identification with game culture.

Based on previous research that found a negative correlation between playing games and concerns about media violence (Nikken & Jansz, 2006), it can be hypothesized that experience with video games will negatively affect the perceived negative effects of playing video games. In addition, experience is expected to lead to a higher valuation of game related learning opportunities (Skoien & Berthelsen, 1996). Furthermore, since mediation research has found that experience might lead to higher levels of involvements (Nikken & Jansz, 2006; Valcke et al., 2010), it can be hypothesized that experience with games will also lead to a preference for using video games in the classroom.

H6: Experience negatively affects perceived negative effects of playing video games (NEG).

H7: Experience positively affects learning opportunities (LO).

H8: Experience positively affects preference for video games (PVG).

3.6. Personal innovativeness in the domain of information technology

In his study about innovation diffusion, Rogers (1995) referred to innovation as a behavior and the time when an individual adopts an innovation, classifying individuals into five categories based on their rate of adoption: innovators, early adopters, early majority, late majority, and laggards. He also revealed that individuals' innovation decisions are partly based on personal characteristics. Innovative people appear to be more curious and risk-taking by nature (Rogers, 1995; Rosen, 2004), making it more likely that they will seek information about a technology (Robinson, Marshall, & Stamps, 2005; van Raaij & Schepers, 2008) and even actually use it (Hartman & Samra, 2008; van Braak, Tondeur, & Valcke, 2004). In order to measure an individual's level of innovativeness based on self-report rather than on observing the time of adoption, Agarwal and Prasad (1998) developed the personal innovativeness in the domain of information technology scale (PIIT) – and defined it as "the willingness of an individual to try out any new information technology" (p. 206). This conceptual definition encompasses both a dispositional, as well as an intentional dimension. A high level of personal innovativeness in the domain of IT has been compared to "a form of openness to change" (van Raaij & Schepers, 2008, p. 841), "pure curiosity and bravery" (Lu, Yao, & Yu, 2005, p. 260), "a tendency to be the first using a new technologies" (Walczuch, Lemmink, & Streukens, 2007, p. 208), and the likely seeking out of "new, mentally, or sensually stimulating experiences" (Tatcher & Perrewé, 2002, p. 385). Based on this theoretical background, it can be hypothesized that a person with a higher level of innovativeness will be more inclined to experiment with new types of technology, and thus – given the many characteristics of video games that make them both cutting edge technology and sensory stimulating – have more experience with video games as well.

H9: Personal innovativeness in the domain of IT (PIIT) positively affects experience.

3.7. Gender

A lot of research on technology integration in teaching practice has centered on gender differences. Information technology use and implementation is often considered a "male domain". For example, male students show more positive attitudes toward computers and report less problems when using IT (Reinen & Plomp, 1997), and male teachers indicate that they integrate the computer more often in their teaching (Tondeur, Valcke, & van Braak, 2008). Although these gender differences might be gradually disappearing for mainstream information technology applications like word processing (Volman & van Eck, 2001; Volman, van Eck, Heemskerk, & Kuiper, 2005), it seems worthwhile to examine potential gender differences in the use of new and unfamiliar types of technology as they seem to persist (Shapka & Ferrari, 2003). A potential explanation can be found within recent research on consumer innovativeness. Several authors present evidence that men generally express higher levels of innovativeness than woman (Tellis, Yin, & Bell, 2009) – with an exception for the dimension of innovativeness targeting functional use (Vandecasteele, 2010).

Studies on video game player behavior have uncovered a trend also found in technology integration research. Despite most studies report that males are more interested in video games, play video games more often and for longer periods, and display a greater diversity in their choice of games (Bonanno & Kommers, 2005; Bonanno & Kommers, 2008; Cassell & Jenkins, 1998; Jean, Upitis, Koch, & Young, 1999), the gender gap is slowly diminishing (Bryce & Rutter, 2002; Hartmann & Klimmt, 2006). A possible explanation for the remaining gender gap is that females dislike both the amount of combat and violence, as well as the stereotypical way woman are portrayed in video games (Boyle & Connolly, 2008; Facer, 2003; Hartmann & Klimmt, 2006). Studies that focus on parents and their regulation of children's media usage reach similar conclusions: mothers display greater support for media regulation than fathers (Rojas, Shah, & Faber, 1996; Scharrer & Leone, 2008).

Based on this theoretical basis, it can be hypothesized that males are more experienced in playing games than females, and that the effect of gender on experience is partly mediated through innovativeness, as video games are a type of technology that is not meant to increase efficiency or effectiveness in functional tasks. Female issues with the – sometimes – violent and stereotypical content of video games, combined with their support for media regulation, lead to the additional hypothesis that gender will affect the perceived negative effects of playing video games.

H10: Being male affects personal innovativeness in the domain of IT (PIIT) positively.

H11: Being male affects experience positively.

H12: Being male affects perceived negative effects of playing video games (NEG) negatively.

3.8. Research model

The research model under study in this article is depicted in Fig. 1.

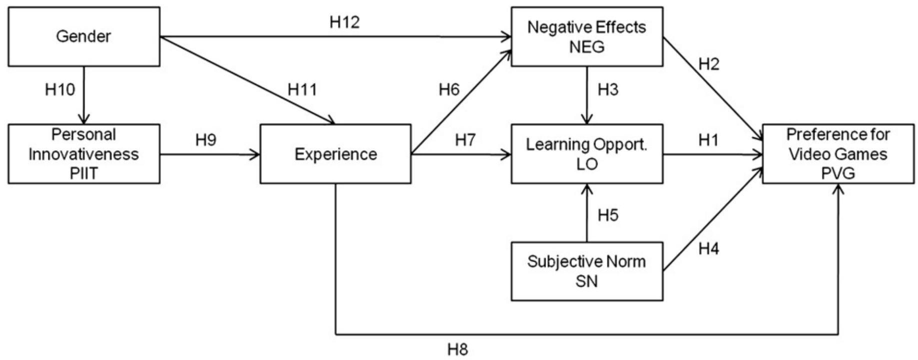

Fig. 1. Hypothetical model.

4. Method

4.1. Research design

Data were gathered with a survey, containing questions focusing on demographics of the parents, and scales measuring the variables in the research model. Firstly, the data from the parents were explored using descriptive statistics. Secondly, structural equation modeling (SEM) was applied to test the research model with latent variables against the observed data, thus providing insight in the interrelations between the different predictors for parents' acceptance of video games.

4.2. Participants

To examine parents' acceptance of video games as teaching and learning tools in their children's classroom, 858 parents of secondary school students (age 12 to 20; at least one currently enrolled) were involved in the study. Trained interviewers visited families with secondary school children in all provinces of Flanders – the Dutch speaking part of Belgium – presenting them a paper questionnaire. The parents were volunteering to participate in research about their educational beliefs. Variety in the following variables was pursued when selecting the families in the convenience sample: the gender of the child, the age, the school type and school grade. In each family, one parent was asked to participate. Informed consent was obtained from all parents, who were promised to remain anonymous. Of the respondents, 61.3% ($n = 526$) was female and 38.7% ($n = 332$) was male. On average, the parents were 46 years old (SD = 4.3). More than 95.3% of the parents hold a diploma equal to or higher than secondary education.

4.3. Measures

Firstly, the respondents filled in questions about demographical information (age, diploma, and gender, coded 0 for female and 1 for male). Secondly, parents responded to the main part of the survey, which consisted of scales measuring the different constructs of the model. The items for preference for video games, learning opportunities, and experience with video games were based on previous research (Bourgonjon et al., 2010). The scale for personal innovativeness in the domain of IT was derived from Agarwal and Prasad (1998). For the concept of subjective norm, an existing scale (Fishbein & Ajzen, 1975) was slightly adapted to account for the specific context of DGBL. Finally, in close collaboration with an expert panel consisting of two independent and experienced researchers and two methodologists, a new scale was constructed to measure parents' perceived negative effects of playing video games. The adapted and new scales can be consulted in Appendix A. Respondents were invited to rate their agreement with a statement in each item on a 5-point Likert scale, ranging from 1 – "Strongly disagree" – to 5 – "Strongly agree".

4.4. Psychometric quality of the instrument

An examination of the psychometric quality of the research instrument was necessary, because the questionnaire comprised of (a) existing scales that were used with a different target group, and (b) an adapted and newly constructed scale. A split sample approach was adopted, by performing exploratory factor analysis (EFA) on the first split-half dataset ($n = 429$) and confirmatory factor analysis on the second dataset ($n = 429$). The subject to item ratio for both split-half samples was 15:1.

4.4.1. Exploratory factor analysis

Exploratory factor analysis was performed on the first split-half dataset to examine whether these data reflect the suggested factor structure. With a large enough sample size, a Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy of .899 and the Bartlett's test of sphericity being significant ($p < .0001$), the data proved suitable for factor analysis. Principal axis factoring with oblique rotation was performed (Conway & Huffcutt, 2003; Costello & Osborne, 2005; Fabrigar, Wegener, MacCallum, & Strahan, 1999). The results depicted in Appendix B show that the theoretical six-factor structure could be reconstructed. In total, the six factors explain more than 70% of the variance among the items. In addition, the item factor loadings all exceed the criterion of .40 (Stevens, 1992). None of the items reflected high factor loadings on a second or additional other factor. Intercorrelations between factors are reported in Appendix C.

4.4.2. Confirmatory factor analysis

The stability of the factor structure was confirmed by CFA (in AMOS 17 - AMOS Development Corporation, 1983–2008). As presented in Appendix D, fit measures that are the least affected by large sample sizes (see for example RMSEA and CFI) meet the requirements for good

Table 1
Descriptive statistics and one sample *t*-test comparing the means against the scale midpoint.

Construct	Descriptives			Students' *t*-test	
	M (SD)	Skewness (SD)	Kurtosis (SD)	*t*	d*f*
Experience	1.59 (.74)	1.45 (.08)	1.68 (.17)	−55.91***	855
PIIT	2.30 (.89)	.63 (.08)	.14 (.17)	−23.17***	856
SN	2.98 (.82)	−.38(.08)	.01 (.17)	−.60	855
LO	3.30 (.73)	−.55(.08)	.61 (.17)	12.03***	854
NEG	3.31 (.81)	−.30(.08)	.03 (.17)	11.37***	857
PVG	2.67 (1.01)	−.14(.08)	−.86(.17)	−9.59***	855

Note: PIIT = personal innovativeness in the domain of information technology; SN = subjective norm; LO = learning opportunities; NEG = negative effects of playing video games; PVG = preference for video games.
***$p < .001$.

fit (Fan, Thompson, & Wang, 1999), while the other fit indices are acceptable (Byrne, 2001; Garson, 2009), indicating a reasonable match between the data model and the theoretical model. In addition, all items load sufficiently high on the latent variables, with pattern coefficients between .67 and .91. Two exceptions are found, the items NEG 5 and PIIT 3, loading .42 and .53 respectively. It was decided to remove the NEG 5 item, as it was not validated in previous research, but to maintain the PIIT 3 item, in order to preserve the original scale of personal innovativeness in the domain of IT (Agarwal & Prasad, 1998 - in which PIIT 3 loaded .63).

4.4.3. Reliability analysis

As a final step in the validation procedure, reliability analysis was performed, building on the data of the entire sample ($N = 858$), to examine the internal consistency of the scales. The results indicate that all scales exhibit high internal reliability: learning opportunities ($\alpha = .91$), experience ($\alpha = .89$), personal innovativeness in the domain of IT ($\alpha = .82$), negative effects of playing video games ($\alpha = .85$), subjective norm ($\alpha = .83$), and preference for video games ($\alpha = .91$).

5. Results

5.1. Descriptive statistics

From the descriptive statistics (Table 1), it is clear that the majority of the parents has no experience with video games. The mean score on each of the five items measuring experience is lower than 2 (on a 5-point Likert scale). Only 119 parents (13.9%) like to play video games. No correlation was found between experience and age ($r = -.076$, $p < .05$).

Parents believe in both the negative and positive effects of playing video games. Based on an analysis of the different items measuring the negative effects of playing video games, it appears that parent believe that there is some truth in the many media messages about the potential danger of gaming. However, parents feel displeased with the content of certain video games, rather than with the potential negative outcome. Also, they believe that gaming offers learning opportunities, except for critical thinking ($M = 3.05$, SD = .92, $t = 1.70$, d$f = 857$, $p = .089$). It is remarkable that beliefs of mothers and fathers only differ from one another in relation to the level of innovativeness and their experience with video games. No significant differences are found in their beliefs about the effects of video games (see Table 2).

Considering digital game-based learning, parents believe that their children are in favor of the idea of using games in the classroom ($M = 3.17$, SD = 1.06, $t = 4.83$, d$f = 857$, $p < .001$), but that teachers would not support this idea ($M = 2.74$, SD = .88, $t = -8.80$, d$f = 857$, $p < .001$). The responses concerning the expert opinions did not differ significantly from 3. Overall, parent scores reflecting their preference for video games scale are low. But, men are found to be slightly more enthusiastic about the idea of using games in the classroom than woman ($t = -2.24$, d$f = 855$, $p < .05$).

5.2. Model testing

Since the preliminary analyses pointed out that the instruments are valid and reliable, the hypothetical model could be tested against the model reflected in the data. Structural equation modeling was conducted in AMOS 17. The results show an acceptable fit between the data and the hypothesized relationships between the different variables (Table 3). A graphical representation of the model including the path coefficients and percentage of explained variance is depicted in Fig. 2. This model explains 59% of the variance in the dependent variable: preference for video games. In addition, all hypotheses were confirmed (Table 4).

Table 2
Compare means between female and male parents.

Construct	Mean			Students' *t*-test		
	Male (SD)	Female (SD)	Difference	*t*	d*f*	Cohen's *d*
Experience	1.74 (.81)	1.49 (.67)	.25	4.69**	605	.34
PIIT	2.67 (.94)	2.06 (.77)	.61	9.98**	603	.71
SN	3.00 (.82)	2.97 (.82)	.03	.47	854	
LO	3.34 (.73)	3.28 (.73)	.07	1.27	853	
NEG	3.28 (.79)	3.36 (.84)	−.08	1.47	856	
PVG	2.78 (1.01)	2.60 (1.01)	.18	2.55*	854	.18

Note: PIIT = personal innovativeness in the domain of information technology; SN = subjective norm; LO = learning opportunities; NEG = negative effects of playing video games; PVG = preference for video games.
*$p < .05$; **$p < .01$.

Table 3
Goodness-of-fit indices for the total Sample ($N = 858$).

	$\chi^2(df)$	χ^2/df	p	RMSEA	GFI	aGFI	NFI	CFI	TLI	SRMR
Sample	21.517(9)	2.390	.011	.061	.984	.950	.968	.981	.955	.063

Note: RMSE = root mean square error of approximation; GFI = goodness-of-fit index; aGFI = adjusted goodness-of-fit index; NFI = normed fit index; CFI = comparative fit index; TLI = non-normed fit index; SRMR = standardized root mean square residual.

6. Discussion

The results of the descriptive statistics show that a minority of the parents has experience with playing video games. The findings complement a large body of studies about parental regulation of children's media usage that report a lack of knowledge about video games (Byron, 2008; Kearney & Pivec, 2007; Subrahmanyam, Kraut, Greenfield, & Gross, 2000), but at the same time, these self-reported figures contradict the often made suggestion that the majority of gamers are middle aged woman playing games on the internet (Gee, 2003). One explanation was given by Gee (2003) himself, who pointed out that this group does not consider itself as gamers. De Schutter and Vanden Abeele (2010) confirmed these findings for elderly people. Other possible explanations are that parents differ from non-parents (Sneed & Runco, 1992), or that the respondents had problems with the interpretation of the concept "video games". The instruction given to the parents when filling in the survey, was to think of video games "in general". It is therefore possible that parents mainly thought about video games that received a lot of media attention, such as video games with a deviating content. It could be interesting, in a follow up study, to consider the potential effect of motion sensor based gaming (such as Nintendo's Wii, Sony Playstation's Move and Microsoft's Kinect) – consumer market products geared toward large audiences, and focusing more on social gaming – on both parents' experience with and beliefs about games (Olson, 2010) as it has been shown that providing teachers with a Wii can alter their attitude toward game-based learning (Kenny & McDaniel, 2009).

The descriptive statistics also show that parents express rather negative beliefs about video games and are reluctant when it comes to using video gaming in educational settings. The parents indicate that they are indeed influenced by the negative image of video games as portrayed in the popular media and while they do consider some of the advantages (learning opportunities), their preference for video games remains low. These mixed feelings toward the effects of video games are in line with previous research (Nikken & Jansz, 2006; Skoien & Berthelsen, 1996; Sneed & Runco, 1992). It is important to point out that the parents filled in the questionnaire, when thinking about their own adolescent children, since Sneed and Runco (1992) found that parents think more negatively about the effects of games when they focus on their own children.

The current results present empirical grounds that the fear of teachers concerning parental acceptance of DGBL is real. However, the path model also helps to find directions to do something about this. For example, offering parents hands-on experiences with video games could be a useful approach to reorient their beliefs about the negative effects, as there is a clear negative effect from experience on the perceived negative effects from video gaming. While it appears that the common belief that negative media messages hinder the acceptance of digital game-based learning holds true (Byron, 2008), the perspectives about "learning opportunities" seem to be the single best predictor of parents' preference for video games. When parents accept that video games foster learning opportunities, like experimenting with knowledge, they adopt a more positive attitude toward the use of video games in the classroom. These findings support the idea that parents could benefit from projects that raise awareness about games in general, and DGBL in particular (Byron, 2008; Funk, Brouwer, Curtiss, & McBroom, 2009). Recent research has started focusing on the development of frameworks to aid parents in selecting age and learning appropriate video games (Hong, Cheng, Hwang, Lee, & Chang, 2009), however, in order to effectively correct certain biased perspectives, training in media and game literacy could be necessary as well (Byron, 2008).

The model shows that parents are not indifferent to what other people think about gaming. Their perception about the learning opportunities offered by video games is strongly affected by what others give as advice (e.g., school teachers and experts). Subjective norm was found to be the best predictor for learning opportunities, explaining a larger proportion as compared to the impact of negative media messages or their own experiences with video games. These findings about the subjective norm extend the research that attributes major importance to the visibility of DGBL and its enthusiastic forerunners (Williamson, 2009) to the case of parental acceptation of school-based learning with video games.

Despite the fact that several authors suggest that subjective norm only affects behavioral intention in formal and mandatory settings (Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003), the results of the present study underpin the importance of subjective norm in parents' acceptance of video games in the classroom. Earlier research has shown that subjective norm often is a significant driving force for acceptance of technology when the latter is perceived as innovative (Hsu & Lu, 2007). Therefore, it is likely that the effect found in this study will diminish as soon as parents are more acquainted and more experienced with video games (Hu et al., 2003).

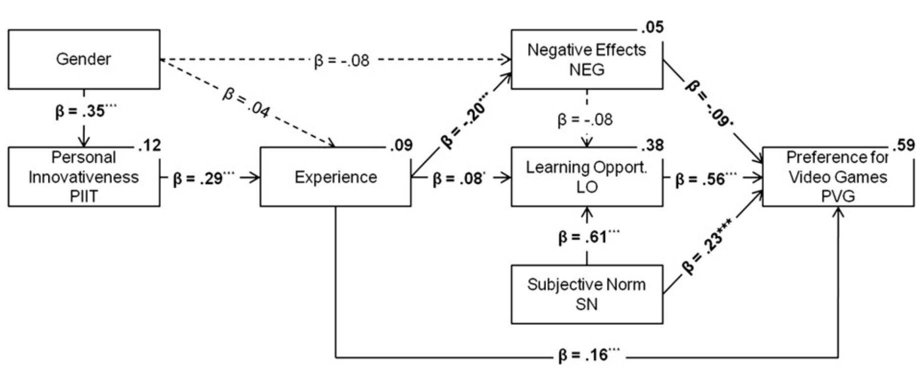

Fig. 2. Final model.

Table 4
Testing the hypotheses.

Hypotheses	Effect	Coefficient	S.E.	*p*
H1	Learning opportunities → preference for video games	.561	.026	***
H2	Negative effects of playing video games → preference for video games	−.087	.031	*
H3	Negative effects of playing video games → learning opportunities	−.080	.061	.055
H4	Subjective norm → preference for video games	.233	.055	***
H5	Subjective norm → learning opportunities	.607	.086	***
H6	Experience → negative effects of playing video games	−.196	.044	***
H7	Experience → learning opportunities	.082	.053	*
H8	Experience → preference for video games	.155	.027	***
H9	Personal innovativeness in the domain of IT → experience	.288	.057	***
H10	Gender → personal innovativeness in the domain of IT	.347	.351	***
H11	Gender → experience	.037	.413	.480
H12	Gender → negative effects of playing video games	−.080	.348	.114

*$p < .05$; **$p < .01$; ***$p < .001$.

The results of the path analysis tests showed that gender did not affect parents' experience with commercial video games in a direct way. Rather, an indirect effect was found via innovativeness. Fathers report to be more innovative than mothers, which is in line with the result of numerous other studies focusing on gender differences in technology use (Venkatesh & Morris, 2000). Considering the research that shows that gender does affect the game playing experience in students (Bourgonjon et al., 2010), we have to consider the hypothesis that the importance of gender diminishes with the age of the respondents (Morris, Venkatesh, & Ackerman, 2005).

7. Limitations and conclusions

This article builds and elucidates a model to describe and explain parental DGBL acceptance. Based on a survey of 858 parents with at least one child in secondary education (age 12–20), it was found that this model is reliable and valid for explaining parental beliefs about games and DGBL. The model helped to test 12 hypotheses about the interrelation between gender, personal innovativeness in the domain of information technology, game experience, negative effects, learning opportunities and subjective norm. The model explained 59% of the variance in parental preference for video games.

While the descriptive results depict a very pessimistic picture about parental support for digital game-based learning, the model also points out that parents could benefit from receiving specific information. The latter can be derived from the fact that parents base their acceptance decisions mainly on their evaluation of the game related learning opportunities. The latter evaluation is, in turn, influenced by opinions of their children, the teachers and experts. In addition, it might be valid to give parents hands-on experiences with computer games. This is expected to correct rather single-sided negative perceptions about video games and develop a better understanding of the potential learning opportunities that are linked to using games in the classroom.

Nevertheless, the results of the present study should be treated with some caution due to a number of limitations. First, a cross-sectional approach was adopted, based on a semi-stratified convenience sample. Therefore, caution is advised when trying to generalize these findings to a broader population. Second, the survey builds on self-report instruments to study behavior, attitudes and beliefs. Third, the study focused both on general video game acceptance and digital game-based learning. This might have introduced response bias. A number of parents indicated that it was not always easy to think of video games "in general". Therefore, future research could focus on specific beliefs concerning specific types of video games. Conducting this kind of research across the different types of video games would most likely provide a more fine-grained analysis of what constitutes parental acceptance of DGBL. More background information of the parents and their families could also be considered (number of children, gender of the children, parental involvement in the child's schooling). In addition, the data for this study was gathered in Flanders only. It might be worth exploring whether measurable differences in parental perceptions on the use of games in education exist based on location and society values as well (for example differences between European, North American and Asian parents).

Appendix A. Items by construct (the items are translated out of Dutch)

Negative effects of playing video games – Incidents of gun violence in our country, as well as abroad, have started a debate about violence in video games. According to popular media, the offenders were influenced by video games. For example, the two boys that caused a massacre in Columbine by the games Doom and Counter-Strike, and Hans Van Themsche by Grand Theft Auto… What do you think about these media messages?

What do you think about these media messages?

NEG1	I think there is truth in these messages.
NEG2	This type of video games should be censured or banned.
NEG3	I believe in the negative messages about computer games.
NEG4	Playing computer games causes negative effects (violent behavior, laziness, dumbness, intolerance…).
NEG5	I am disturbed by the content of computer games (too violent, sexually loaded, stereotypes…).

How do other people think about using computer games in the classroom?

SN1	My children think it is a good idea to use computer games in the classroom.
SN2	Teachers think it is a good idea to use computer games in the classroom.
SN3	Experts think it is a good idea to use computer games in the classroom.

Appendix B

Principal axis factoring - oblimin rotation ($n = 429$).

Item	Factor					
	1	2	3	4	5	6
LO 4	**.804**	−.022	.055	−.053	.039	.000
LO 5	**.788**	.003	−.011	.032	.024	.146
LO 3	**.749**	.023	−.090	−.011	−.065	−.145
LO 6	**.722**	.005	.012	.072	−.027	−.040
LO 2	**.686**	−.038	−.011	−.014	.048	−.096
LO 1	**.601**	−.066	−.048	−.018	.147	−.076
LO 7	**.514**	.014	.055	−.053	.091	−.262
Experience 2	−.022	**−.890**	−.002	−.082	−.049	−.046
Experience 5	.015	**−.800**	.074	.055	.041	.029
Experience 1	.007	**−.772**	−.036	−.017	−.062	−.153
Experience 3	.044	**−.765**	−.006	.025	.015	.048
Experience 4	−.022	**−.691**	−.055	.046	.051	.078
NEG 3	.036	−.050	**.895**	−.010	−.021	−.005
NEG 1	−.009	−.001	**.798**	−.013	−.009	−.066
NEG 2	.065	.045	**.742**	−.036	−.034	.017
NEG 4	−.088	−.043	**.703**	.041	.001	.014
NEG 5	−.002	.058	**.553**	−.002	.044	.034
PIIT 2	.030	−.062	.044	**.858**	.011	.017
PIIT 4	.023	.028	.005	**.851**	.004	−.054
PIIT 1	.041	.015	.007	**.813**	.019	−.015
PIIT 3	−.051	.000	−.038	**.471**	−.027	.003
SN 2	.004	−.015	.004	.010	**.830**	.037
SN 3	.034	.016	−.015	.003	**.777**	.025
SN 1	.007	−.018	.004	−.036	**.594**	−.205
PVG 2	.088	.013	−.028	.048	.121	**−.815**
PVG 1	.114	−.122	−.017	.085	.042	**−.704**
PVG 3	.190	−.034	−.079	.049	.234	**−.550**

Note: LO = learning opportunities; NEG = negative effects of playing video games; PIIT = personal innovativeness in the domain of IT; SN = subjective norm; PVG = preference for video games. Factor loadings exceeding the threshold of .40 are highlighted in bold.

Appendix C

Factor correlation matrix ($n = 429$).

Factor	LO	Experience	NEG	PIIT	SN	PVG
LO	1.000	−.193	−.138	.113	.655	−.628
Experience		1.000	.223	−.321	−.173	.253
NEG			1.000	−.220	−.064	.170
PIIT				1.000	.040	−.126
SN					1.000	−.502
PVG						1.000

Note: LO = learning opportunities; NEG = negative effects of playing video games; PIIT = personal innovativeness in the domain of IT; SN = subjective norm; PVG = preference for video games.

Appendix D

Goodness-of-fit indices for the $n = 429$ sample.

	X^2(d*f*)	X^2/d*f*	*p*	RMSEA	GFI	aGFI	NFI	CFI	TLI	SRMR
Sample	626.40(309)	2.03	.000	.050	.903	.882	.912	.953	.946	.045

Note: RMSE = root mean square error of approximation; GFI = goodness-of-fit index; aGFI = adjusted goodness-of-fit index; NFI = normed fit index; CFI = comparative fit index; TLI = non-normed fit index; SRMR = standardized root mean square residual.

References

A calm view of video violence. (2003). *Nature, 424*(6947), 355.

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research, 9*(2), 204–215.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

AMOS Development Corporation. (1983–2008). *AMOS 17.0*. Chicago, IL: SPSS Inc.

Anderson, C., & Bushman, B. (2002). The general aggression model: an integrated social-cognitive model of human aggression. *Annual Review of Psychology, 53*, 27–51.

Anderson, C., & Dill, K. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *Journal of Personality and Social Psychology, 78*(4), 772–790.

Bajaj, A., & Nidumolu, S. R. (1998). A feedback model to understand information system usage. *Information & Management, 33*(4), 213–224.

Bickham, D. S., Vandewater, E. A., Huston, A. C., Lee, J. H., Caplovitz, A. G., & Wright, J. C. (2003). Predictors of children's electronic media use: an examination of three ethnic groups. *Media Psychology, 5*(2), 107–137.

Bijvank, M. N., Konijn, E. A., Bushman, B. J., & Roelofsma, P. (2009). Age and violent-content labels make video games forbidden fruits for youth. *Pediatrics, 123*(3), 870–876.

Blanchard, J., & Oliver, J. (1999). The family-school connection – possibilities for technology. *Computers in the Schools, 15*(1), 65–72.

Bogost, I. (2007). *Persuasive games: The expressive power of videogames*. Cambridge: The MIT Press.

Bonanno, P., & Kommers, P. A. M. (2005). Gender differences and styles in the use of digital games. *Educational Psychology, 25*(1), 13–41.

Bonanno, P., & Kommers, P. A. M. (2008). Exploring the influence of gender and gaming competence on attitudes towards using instructional games. *British Journal of Educational Technology, 39*(1), 97–109.

Boyle, E., & Connolly, T. (2008). Games for learning: does gender make a difference?. In *2nd European conference on games based learning* (pp. 69–76).

Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in education. *Computers & Education, 54*(4), 1145–1156.

Bryce, J., & Rutter, J. (2002). Killing like a girl: Gendered gaming and girl gamers' visibility. In F. Mäyrä (Ed.), *Computer games and digital cultures* (pp. 243–255).

van Braak, J., Tondeur, J., & Valcke, M. (2004). Explaining different types of computer use among primary school teachers. *European Journal of Psychology of Education, 19*(4), 407–422.

Burguillo, J. C. (2010). Using game theory and competition-based learning to stimulate student motivation and performance. *Computers & Education, 55*(2), 566–575.

Byrne, B. M. (2001). *Structural equation modeling with AMOS. Basic concepts, applications, and programming*. Mahwah, NJ: Lawrence Erlbaum Associates.

Byron, T. (2008). *Safer children in a digital world. The report of the Byron review*. Nottingham: UK Department for Children, Schools and Families.

Cassell, J., & Jenkins, H. (1998). *From Barbie to mortal Kombat. Gender and computer games*. Cambridge, MA: MIT Press.

Colwell, J., & Payne, J. (2000). Negative correlates of computer game play in adolescents. *British Journal of Psychology, 91*, 295–310.

Conway, J. M., & Huffcutt, A. I. (2003). A review and evaluation of exploratory factor analysis practices in organizational research. *Organizational Research Methods, 6*(2), 147–168.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7).

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly, 13*(3), 319–340.

De Schutter, B., & Vanden Abeele, V. (2010). Designing meaningful play within the psycho-social context of older adults. In *Paper presented at the 3rd international conference on fun and games*.

Egenfeldt-Nielsen, S. (2004). Practical barriers in using educational computer games. *On the Horizon, 12*(1), 18–21.

Egenfeldt-Nielsen, S. (2007). *Beyond edutainment: The educational potential of computer games*. Continuum Press.

Eow, Y. L., Ali, W. Z.b. W., Mahmud, R.b., & Baki, R. (2009). Form one students' engagement with computer games and its effect on their academic achievement in a Malaysian secondary school. *Computers & Education, 53*(4), 1082–1091.

Epstein, J. L. (2001). *School, family, and community partnerships: Preparing educators and improving schools*. Boulder, CO: Westview.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*(3), 272–299.

Facer, K. (2003). *Computer games and learning. Why do we think it's worth talking about computer games and learning in the same breath?* Bristol: Futurelab.

Fan, X., Thompson, B., & Wang, L. (1999). Effects of sample size, estimation method, and model specification on structural equation modeling fit indexes. *Structural Equation Modeling, 6*, 56–83.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Freedman, J. (2001). Evaluating the research on violent video games. Retrieved from *Paper presented at the playing by the rules: The cultural policy challenges of video games*. http://culturalpolicy.uchicago.edu/conf2001/papers/freedman.html.

Funk, J. B., Brouwer, J., Curtiss, K., & McBroom, E. (2009). Parents of preschoolers: expert media recommendations and ratings knowledge, media-effects beliefs, and monitoring practices. *Pediatrics, 123*(3), 981–988.

Garson, D. (2009). *Structural equation modeling. Statnotes: Topics in multivariate analysis*. Retrieved from. http://faculty.chass.ncsu.edu/garson/pa765/statnote.htm.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Goldstein, J. (2001). Does playing violent video games cause aggressive behavior?. Retrieved from *Paper presented at playing by the rules: The cultural policy challenges of video games*. http://culturalpolicy.uchicago.edu/conf2001/papers/goldstein.html.

Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management, 44*(3), 276–286.

Hartman, J. B., & Samra, Y. M. (2008). Impact of personal values and innovativeness on hedonic and utilitarian aspects of web use: an empirical study among United States teenagers. *International Journal of Management, 25*(1), 77–94.

Hartmann, T., & Klimmt, C. (2006). Gender and computer games: exploring females' dislikes. *Journal of Computer-Mediated Communication, 11*(4), 910–931.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.

Hays, R. T. (2005). *The effectiveness of instructional games: Literature review*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

He, M. Z., Piche, L., Beynon, C., & Harris, S. (2010). Screen-related sedentary behaviors: children's and parents' attitudes, motivations, and practices. *Journal of Nutrition Education and Behavior, 42*(1), 17–25.

Hong, J. C., Cheng, C. L., Hwang, M. Y., Lee, C. K., & Chang, H. Y. (2009). Assessing the educational values of digital games. *Journal of Computer Assisted Learning, 25*(5), 423–437.

Hsu, C. L., & Lu, H. P. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management, 41*(7), 853–868.

Hsu, C. L., & Lu, H. P. (2007). Consumer behavior in online game communities: a motivational factor perspective. *Computers in Human Behavior, 23*(3), 1642–1659.

Hu, P. J. H., Clark, T. H. K., & Ma, W. W. (2003). Examining technology acceptance by school teachers: a longitudinal study. *Information & Management, 41*(2), 227–241.

Jean, J. D., Upitis, R., Koch, C., & Young, J. (1999). The story of phoenix quest: how girls respond to a prototype language and mathematics computer game. *Gender and Education, 11*(2), 207–223.

Kautiainen, S., Koivusilta, L., Lintonen, T., Virtanen, S. M., & Rimpela, A. (2005). Use of information and communication technology and prevalence of overweight and obesity among adolescents. *International Journal of Obesity, 29*(8), 925–933.

Kearney, P., & Pivec, M. (2007). Sex, lies and video games. *British Journal of Educational Technology, 38*(3), 489–501.

Kebritchi, M., Hirumi, A., & Bai, H. Y. (2010). The effects of modern mathematics computer games on mathematics achievement and class motivation. *Computers & Education, 55*(2), 427–443.

Kenny, R. E., & McDaniel, R. (2009). The role teachers' expectations and value assessments of video games play in their adopting and integrating them into their classrooms. *British Journal of Educational Technology*, (Online first).

Kerawalla, L., & Crook, C. (2002). Children's computer use at home and at school: context and continuity. *British Educational Research Journal, 28*(6), 751–771.

Kirriemuir, J., & McFarlane, A. (2004). *Literature review in games and learning*. Bristol: Nesta Futurelab Series.

Kong, S. C., & Li, K. M. (2009). Collaboration between school and parents to foster information literacy: learning in the information society. *Computers & Education, 52*(2), 275–282.

Kong, S. C. (2008). A curriculum framework for implementing information technology in school education to foster information literacy. *Computers & Education, 51*(1), 129–141.

Kutner, L., Olson, C., Warner, D., & Hertzog, S. (2008). Parents' and sons' perspectives on video game play – a qualitative study. *Journal of Adolescent Research, 23*(1), 76–96.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191–204.

Lu, J., Yao, J. E., & Yu, C.-S. (2005). Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology. *The Journal of Strategic Information Systems, 14*(3), 245–268.

Malone, T. W. (1980). What makes things fun to learn? Heuristics for designing instructional computer games. In *Paper presented at the 3rd ACM SIGSMALL symposium and the first SIGPC symposium on small systems*.

Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: the influence of perceived user resources. *SIGMIS Database, 32*(3), 86–112.

McAllister, K. S. (2004). *Game work. Language, power, and computer game culture*. Tuscaloosa: The University of Alabama Press.

McFarland, D. J., & Hamilton, D. (2006). Adding contextual specificity to the technology acceptance model. *Computers in Human Behavior, 22*(3), 427–447.

Mesch, G. S. (2009). Parental mediation, online activities, and cyberbullying. *Cyberpsychology & Behavior, 12*(4), 387–393.

Mooij, T., & Smeets, E. (2001). Modelling and supporting ICT implementation in secondary schools. *Computers & Education, 36*(3), 265–281.

Morris, M. G., Venkatesh, V., & Ackerman, P. L. (2005). Gender and age differences in employee decisions about new technology: an extension to the theory of planned behavior. *IEEE Transactions on Engineering Management, 52*(1), 69–84.
Nikken, P., & Jansz, J. (2006). Parental mediation of children's videogame playing: a comparison of the reports by parents and children. *Learning, Media and Technology, 31*(2), 181–202.
Olson, C. K. (2010). Children's motivations for video game play in the context of normal development. *Review of General Psychology, 14*(2), 180–187.
Papastergiou, M. (2009). Exploring the potential of computer and video games for health and physical education: a literature review. *Computers & Education, 53*(2), 603–622.
Papert, S. (1980). *Mindstorms: Children, computers and powerful ideas*. New York: Basic Books.
Paraskeva, F., Mysirlaki, S., & Papagianni, A. (2010). Multiplayer online games as educational tools: facing new challenges in learning. *Computers & Education, 54*(2), 498–505.
van Raaij, E. M., & Schepers, J. J. L. (2008). The acceptance and use of a virtual learning environment in China. *Computers & Education, 50*(3), 838–852.
Reinen, I. J., & Plomp, T. (1997). Information technology and gender equality: a contradiction in terminis? *Computers & Education, 28*(2), 65–78.
Robinson, L., Marshall, G. W., & Stamps, M. B. (2005). Sales force use of technology: antecedents to technology acceptance. *Journal of Business Research, 58*(12), 1623–1631.
Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.
Rojas, H., Shah, D. V., & Faber, R. J. (1996). For the good of others: censorship and the third-person effect. *International Journal of Public Opinion Research, 8*, 163–186.
Rosen, P. A. (2004). The effect of personal innovativeness in the domain of information technology (PIIT) on the acceptance and use of technology: a working paper. In *Paper presented at the 35th annual meeting of the decision sciences institute*.
Rushing, M. E., Sheehan, D. J., & Davis, L. S. (2006). Video game induced knuckle pad. *Pediatric Dermatology, 23*(5), 455–457.
Scharrer, E., & Leone, R. (2008). First-person shooters and the third-person effect. *Human Communication Research, 34*(2), 210–U215.
Schifter, C., & Ketelhut, D. (2009). Teacher acceptance of game-based learning in K-12: the case of River City. In *Paper presented at the society for information technology & teacher education international conference 2009, Charleston, SC, USA*.
Schrader, P. G., Zheng, D., & Young, M. (2006). Teachers' perceptions of video games: MMOGs and the future of preservice teacher education. *Innovate: Journal of Online Education, 2*(3).
Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers & Education, 46*(3), 223–234.
Shapka, J. D., & Ferrari, M. (2003). Computer-related attitudes and actions of teacher candidates. *Computers in Human Behavior, 19*(3), 319–334.
Skoien, P., & Berthelsen, D. (1996). *Video games: Parental beliefs and practices*. Retrieved from. http://www.aifs.org.au/institute/afrcpapers/skoien.html.
Sneed, C., & Runco, M. A. (1992). The beliefs adults and children hold about television and video games. *Journal of Psychology, 126*(3), 273–284.
Squire, K. D. (2002). Game studies. *The International Journal of Computer Game Research*.
Squire, K. D. (2004). *Replaying history: Learning world history through playing civilization III*. Unpublished Doctoral Dissertation, Indiana.
Stettler, N., Signer, T. M., & Suter, P. M. (2004). Electronic games and environmental factors associated with childhood obesity in Switzerland. *Obesity Research, 12*(6), 896–903.
Stevens, J. (1992). *Applied multivariate statistics for the social sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
Subrahmanyam, K., Kraut, R., Greenfield, P., & Gross, E. (2000). The impact of home computer use on children's activities and development. The future of children. *Children and Computer Technology, 10*(2), 123–144.
Tatcher, J. B., & Perrewé, P. L. (2002). An empirical examination of individual traits as antecedents to computer anxiety and computer self-efficacy. *Management Information Systems Quarterly, 26*(4), 381–396.
Tellis, G. J., Yin, E., & Bell, S. (2009). Global consumer innovativeness: cross-country differences and demographic commonalities. *Journal of International Marketing, 17*(2), 1–22.
Thompson, R. L., Higgins, C. A., & Howell, J. M. (1994). Personal computing – toward a conceptual-model of utilization. *Management Information Systems Quarterly, 15*(1), 125–143.
Tobias, S., & Fletcher, J. D. (2008). What do we know about the learning effectiveness of computer games?. In *Paper presented at the AERA 2008 conference*.
Tondeur, J., Valcke, M., & van Braak, J. (2008). A multidimensional approach to determinants of computer use in primary education: teacher and school characteristics. *Journal of Computer Assisted Learning, 24*(6), 494–506.
Triandis, H. C. (1971). *Attitude and attitude change*. New York: John Wiley.
Turkle, S. (1984). *The second self. Computers and the human spirit*. New York: Simon & Schuster.
Uhlmann, E., & Swanson, J. (2004). Exposure to violent video games increases automatic aggressiveness. *Journal of Adolescence, 27*(1), 41–52.
Valcke, M., Bonte, S., De Wever, B., & Rots, I. (2010). Internet parenting styles and the impact on Internet use of primary school children. *Computers & Education, 55*(2), 454–464.
Van Eck, R. (2006). Digital game-based learning. It's not just the digital natives who are restless. *EDUCAUSE Review, 41*(2), 55–63.
Vandecasteele, B. (2010). *Innovative consumers: Who, why, and how to target?* Unpublished Doctoral Dissertation, Ghent University, Ghent.
Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science, 46*(2), 186–204.
Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *Management Information Systems Quarterly, 24*(1), 115–139.
Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *Management Information Systems Quarterly, 27*(3), 425–478.
Volman, M., & van Eck, E. (2001). Gender equity and information technology in education: the second decade. *Review of Educational Research, 71*(4), 613–634.
Volman, M., van Eck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers & Education, 45*(1), 35–55.
Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & Management, 44*(2), 206–215.
Williamson, B. (2009). *Computer games, schools, and young people. A report for educators on using games for learning*. Futurelab, Becta.
Wu, J., & Liu, D. (2007). The effects of trust and enjoyment on intention to play online games. *Journal of Electronic Commerce Research, 8*(2), 128–140.