Information & Management 55 (2018) 407–421

Contents lists available at ScienceDirect

Information & Management

journal homepage: www.elsevier.com/locate/im

Understanding the role of competition in video gameplay satisfaction

Sepandar Sepehr, Milena Head*

DeGroote School of Business, McMaster University, 1280 Main Street, West Hamilton, Ontario, L8S 4M4, Canada

ARTICLE INFO

Keywords:
Self-determination theory
Theory of flow
Educational video games
Competition
Satisfaction
Game-based learning

ABSTRACT

One of the key elements in many video games is competition. Based on Self-Determination and Flow theories, this paper explores the process through which competition makes a video game satisfying. A structural model that examines the impacts of Situational Competitiveness (manipulated via modes of competition) and Dispositional Competitiveness (as a personality trait) on gameplay experience is proposed and validated. The results show that the perception of video game competitiveness has a strong effect on Flow experience and Satisfaction. While an individual's personality impacts the perception of a game's competitiveness, this perception can also be influenced by the mode of competition.

1. Introduction

Since the 1980s, video games have expanded rapidly and established a massive and growing industry [1]. Video games are pervasive in today's society with reports showing that 63% of U.S. households have at least one person who is a regular video game player [2]. This phenomenon is not restricted to children and teenagers. Statistics show that the average age of video gameplayers is 35 years old and these adults are expected to play video games for the rest of their lives [2,3]. Williams et al. [3] found that in their sample of 7000 massively multiplayer online (MMO) gameplayers, users spend on average of close to 30 h a week playing video games, which is comparable to the amount of time a full-time employee spends at his or her job. While the prevalence and time spent playing video games seems staggering, it is important to note that there is no correlation between time spent playing video games and negative effects such as addiction or poor scholastic performance [4]. In contrast, time loss associated with playing video games can have positive outcomes such as relaxation and escaping from reality [5]. Mental stimulation or education are cited as video game outcomes by 75% of frequent gameplayers [2]. Overall, research studies focused on video gameplaying adults have shown video games to enhance physical and cognitive well-being as well as producing positive emotions through the fostering of relationships/connections [6,7].

As a consequence of this surge of interest in gameplay, schools and workplaces face new challenges to adapt themselves to the gamer generation with its new behaviors and culture [8]. From a learning perspective, instructors are challenged in finding ways to keep students engaged, attentive, involved, and motivated during distinct learning processes at diverse educational levels [9]. For example, Millennials[1]—the demographic cohort with birth years from the early 1980s to the early 2000s—may find traditional school and work environments boring compared to the world they immerse in through playing video games [10], thereby demanding more variety and higher levels of stimulation [11]. This generation, also named "Generation Me" due to its individualistic attitude, exhibits different mindsets and motivations from their predecessors [12]. For this generation that grew up with the Internet, video games are an inseparable communication and learning medium [13] and there is great potential for schools and workplaces to use video games to enhance engagement, creativity, and learning [14,6].

Recently, various disciplines have employed and studied video games for different purposes, including education [15,6]. Game-Based Learning (GBL) is where gameplay is used to "enhance motivation to learn, engage education, or to enhance effectiveness of content transfer or other specific learning outcome" [16], p. 11. Researchers have previously demonstrated the potential positive impacts of GBL. Spanning a 36-year time frame, four major meta-analyses have been conducted that focused on comparing the outcomes of learning in computer/video game-supported environments versus traditional environments (namely, [17–20]. The overall findings from these meta-analyses agree that digital game conditions have more positive learning effective than traditional instructional conditions. In addition to enhancing learning and retention [18,19], video gameplay has the potential to motivate individuals to be engaged and involved in educational settings [17,20]. Engagement and involvement is particularly relevant for Millennial learners, whose "learning style is hands-on and not necessarily linear in

* Corresponding author.
E-mail addresses: sepandar.sepehr@gmail.com (S. Sepehr), headm@mcmaster.ca (M. Head).

[1] Also known as Generation Y, Generation N, or the Net Generation.

http://dx.doi.org/10.1016/j.im.2017.09.007
Received 2 February 2016; Received in revised form 18 March 2017; Accepted 28 September 2017
Available online 07 October 2017
0378-7206/

fashion. Forget instruction manuals, tech tips and lecture-based lessons; this is a generation that plays to learn. Many of today's video games are based upon trial and error and Gen N [aka Millennials] sees it as a metaphor for learning" [9], p. 458.

While extant literature has demonstrated the potential for games to motivate and engage learners, resulting in positive outcomes, there is a lack of understanding on the process through which games create this motivation and engagement. While some researchers have identified elements or traits of "great games" (e.g., [21], they have failed to show how these elements generate gameplayer engagement. Understanding the process or mechanism through which game elements motivate individuals to engage in gameplay can help us to better leverage this popular technology for positive effects in educational and work-related environments [22].

This research seeks to fill this gap by investigating the process by which competition motivates and engages gameplayers. Competition, in this context defined as "the desire to challenge and compete with others" [23], p. 773, is chosen as our game element of interest as it is shared among most existing games and has been identified as a major motivator for playing online video games [23,24]. Reeves and Read [21] identified 10 main elements that every great game entails, and among them is "competition under rules that are explicit and enforced" (p. 80), meaning that for competition to be valued by gameplayers, it should be based on predefined rules that players could perceive and follow to see the result of their actions. Otherwise, if the results of a competitive game were random, players would not perceive the consequence of their actions and would not have any measure to improve their skills, which would discourage people from continuing to play. A game's scoring system, which is a simple reward system, enables gamers and learners to compare their performance to their own previous scores and/or to compare it with their peers, which creates competition [25]. In other words, "good learning in games is a capitalist-driven Darwinian process of selection of the fittest" [14], p. 1.

Given the foregoing discussion, this research seeks to examine the concept of competition in video games in order to understand how competition can be used to engage and satisfy students, the psychological state that is greatly desirable for learning.[2] In particular, what engenders the sense of competitiveness in a gaming environment, and what are the outcomes of this perception? Specifically, the objectives of this research are as follows:

1) To investigate how the Situational Competitiveness of video games result in gameplayer satisfaction.
2) To study how different modes of competition affect players' perceptions;
3) To explore the effect of the personality traits of gameplayers on their perception of competitiveness of video games.

2. Theoretical background

Self-Determination Theory (SDT) [26] and *Flow theory* (Flow) [27] were chosen as the foundational theories for this investigation. While these two theories originated in the field of psychology, they have been studied and tested extensively in various disciplines and have been applied to different contexts [28]. Both SDT and Flow are rooted in the investigation of intrinsic motivation among people in their daily activities. Both of these theories have been used to explain the motivational factors that engage people while playing video games and are well suited for the current investigation. Further details on SDT and Flow are provided below, followed by a discussion of how the two theories are linked and together can provide a deeper understanding of a video game player motivation.

[2] Learning outcome per se is not the focus of this study. Instead, the focus was on measuring engagement, which can be seen as an intermediately state for enhanced learning.

2.1. Self-determination theory

One of the main theories scholars utilize for explaining the formation of individual motivation in various fields is Self-Determination Theory (SDT; [26,29]. SDT is not a single theory, but is an "organismic meta-theory" that frames five mini-theories on intrinsic and extrinsic motivation and related personality and behavior [28]. This theory aims to understand the basic psychological needs that are the roots of intrinsic motivation and, consequently, what conditions support or prevent people from satisfying these needs—and as a result intrinsic motivation. These basic innate needs are competence, autonomy, and relatedness [30,29,31]. The need for competence refers to the desire to feel capable of performing a task. Autonomy is the desire to feel as sense of control over one's actions and see oneself as the locus of causality. Lastly, relatedness is the desire for social connectedness and meaningful interpersonal connection [32,33].

SDT aims to understand social conditions and contexts as well as individual differences that enable motivation among humans as "active organisms" [28]. This theory, therefore, explains why and how various forms and levels of motivation are created in people. SDT-directed research explains the effects of the environment and of personality on motivation [28]. Studies that are based on SDT tend to focus on understanding the implications of different forms of motivation. Since SDT's introduction in 1985, it has been employed in research across various fields and domains, including education, healthcare, organizational behavior, psychotherapy and counseling, sport and physical education, and video games. Within the context of video games, as detailed below, SDT creates the foundation for predicting the motivation of game players in engaging in game-playing activity, which in turn creates the experience of deep engagement (which can be explained through Flow).

2.2. Self-determination theory and competition

Various scholars have studied competition based on SDT. Since competition can be seen in sports, games, education, jobs, and basically everywhere, it has been examined by researchers in diverse fields. Researchers have attempted to understand if competition is a source of intrinsic or extrinsic motivation and how it affects individuals to compete [34]. Extrinsic motivation is often distinguished from intrinsic motivation based on the source or the reward that provokes the motivation. Specifically, "the reward for extrinsically motivated behavior is something that is separate from and follows the behavior" [34], p. 71. Deci et al. [34] have employed a "free-choice time" technique to measure the intrinsic motivation of participants after playing with a puzzle game and concluded that competition, regardless of the impact on performance, changes the nature of motivation from intrinsic to extrinsic. Free-choice time has been used by many other scholars to measure intrinsic motivation (e.g., [35,36], where after the conclusion of experimental tasks, participants are left in the experiment room for a few minutes while being observed to see if they spontaneously continue playing the experimental game. Typically, game players who lost the competition were less likely to return to the game during the "free-choice" period due to the negative effect associated with losing.

In competitive situations, when the focus is on the outcome of a task, the emotion of individuals is defined by the result of the competition, namely winning and losing [37]. As Vallerand et al. [36] have shown, participants who lose in competition perceive their intrinsic motivation lower than their opponents who won. In fact, after losing a competition, people evaluate their performance lower than their expectation for themselves. As a result, their perceived competence (which is a requisite for being intrinsically motivated) decreases [35]. In other words, if competition is understood as a tool to provide extrinsic reward (such as monetary rewards, deadlines, and prizes), it can have a negative effect on intrinsic motivation [38].

Deci and Ryan [26], based on Ross and den Haag's [39] work, present two different forms of competition: direct and indirect. In direct competition, individuals compete against one another, while in indirect competition the focus is on impersonal standards such as external performance metrics (e.g., online score boards). Results of previous studies show that direct competition decreases intrinsic motivation [26]. Indirect competition, on the other hand, can enhance competence and consequently intrinsic motivation if the attention is diverted from winning to improving performance. When the focus is on increasing performance, people who are successful (success as a subjective measure in contrast to an objective measure of winning/losing) in a competitive situation also show higher intrinsic motivation and enjoyment [40].

Despite the negative effect of losing in competition on intrinsic motivation, the competition context in itself can be a rich tool to create engagement and satisfaction through feedback [35]. Much of the research on the motivational aspects of competition has focused on consequences of losing versus winning a competitive task. In the current research, SDT provides support for the role of competition in creating motivation to participate in an activity via three of its principles: (1) the focus on competition's motivational forces should shift from outcome results to the processes of competition regardless of outcomes; (2) competition should not be seen as a pure extrinsic element; rather, it is best seen as a midpoint of motivation that is valuable in situations where intrinsic motivation does not exist by nature; and (3) different people have different personality traits; thus, individuals may react differently to competition.

2.3. Flow theory

In the past decade, there has been increased focus on hedonic systems and how people interact with them in the field of Information Systems (IS) [41,42]. With this focus on hedonic systems, researchers have developed constructs to measure concepts such as "enjoyment" and "playfulness" [43,44] of systems' use. However, in addition to construct development, there is a need to advance theories in the field of IS to better explain the use of hedonic systems. As Lin and Bhattacherjee [41] illustrate: "prior models of utilitarian system usage provide a limited understanding of one's usage of hedonic systems, given the motivational differences between using these two types of systems" (p. 163). One of the theories that has been used to explain user interaction with hedonic systems is the theory of "Flow" [45], which aims to explain the "optimal holistic experience" [46,47] while performing a task. Flow was initially studied among artists who feel complete involvement in their work [45]. This theory was further expanded to other leisure activities in order to study the engagement of people in what they do [45]. Flow aims to capture the state in which people are highly immersed in their activity and feel intensely involved, which is widely considered as a positive and desirable state [48].

According to Flow theory, the balance between challenge and skill in a task results in a deeply engaging experience [49–51]. Based on this theory, Flow is experienced only when the level of challenge and skill of an activity is higher than normal day-to-day life experiences. Thus, low levels of challenge and skills that result in lower levels of Flow experience would create the feeling of apathy. Deep engagement, arousal, enjoyment, or focused immersion (which are characteristics of the state of Flow) would not be experienced in a state of apathy. As Fig. 1 illustrates, when there is a higher than average level of skills for a low level of challenge, individuals will feel bored (i.e., in a "boredom" state). On the other hand, when people are highly challenged and the level of challenge does not match their potential skills, they will feel anxious (i.e., in an "anxiety" state).

Flow theory has been adapted to the field of IS by Agarwal and Karahanna [52], where it is referred to as "Cognitive Absorption" (CA). CA is defined as a multidimensional construct, which reflects the satisfaction of users with IT systems, and, consequently, their continuing usage intention [52], p. 665. Based on facets of Flow, CA encapsulates

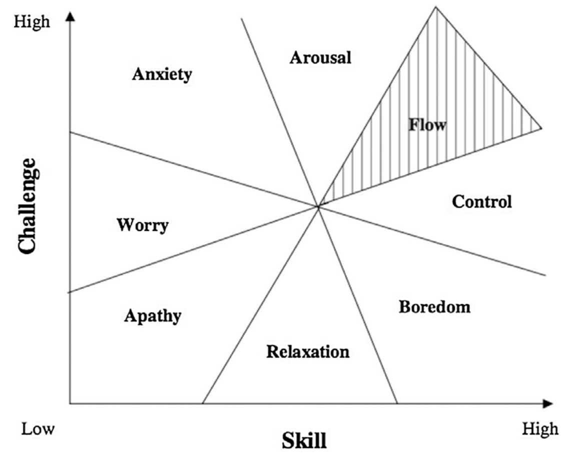


Fig. 1. Eight State Flow Model.

the five dimensions of temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity [53–58].

2.4. Combining SDT and flow

SDT and Flow are seminal theories rooted in the investigation of intrinsic motivation. While both theories have inspired a large body of research to understand what motivates individuals, interestingly there have been few attempts at their theoretical integration [59]. Here we propose to combine SDT and Flow theories through the following motivational sequence identified by Vallerand and Losier [60]: Social Factors → Psychological Mediators → Types of Motivation → Consequences. Fig. 2 presents our overarching theoretical framework where the overlaps and differences between SDT and Flow theories are illustrated to provide a more holistic view of motivation from influencers through to outcomes.

The first stage of the motivational sequence as identified by Vallerand and Losier [60] is social factors that influence motivation through the perceptions of autonomy, competence, and relatedness (basic needs that serve as psychological mediators). The social factor of interest in the present study is competition. Results of previous studies show that direct competition decreases intrinsic motivation [26]. Indirect competition, on the other hand, can enhance competence and consequently intrinsic motivation if the attention is diverted from winning to improving performance. For the current investigation, we seek to study motivation during the competition process prior to knowing the outcome. Motivation during the game is independent of the outcome and is even more important than after the gameplay [35]. This allows for understanding the process that creates engagement in gamers, without bias of outcome. In other words, "effort during competition is not necessarily aligned with post-competition emotional responses" [61]. Based on SDT, people have a tendency to satisfy their basic needs (competence, autonomy, and relatedness). This tendency is stronger prior to receiving the final results (winning or losing) as after knowing the results there is no room to satisfying these needs further and the focus turns to emotional coping (in case of losing). During competition, regardless of the outcome, people engage in the activity in order to achieve competence and autonomy (the two critical needs for self determination), causing them to be motivated [35]. This motivation is not captured in earlier studies through the free-choice approach, as this measurement is gathered once the game is over (e.g., in [36]. We argue that rather than evaluating motivation after a competition is finished (thereby placing emphasis on outcomes), it is more meaningful to focus on the process through which the competitive situation motivates people to pay attention during the task.

Fig. 2 highlights the three basic needs (competence, autonomy, and relatedness) of SDT that serve as psychological mediators between

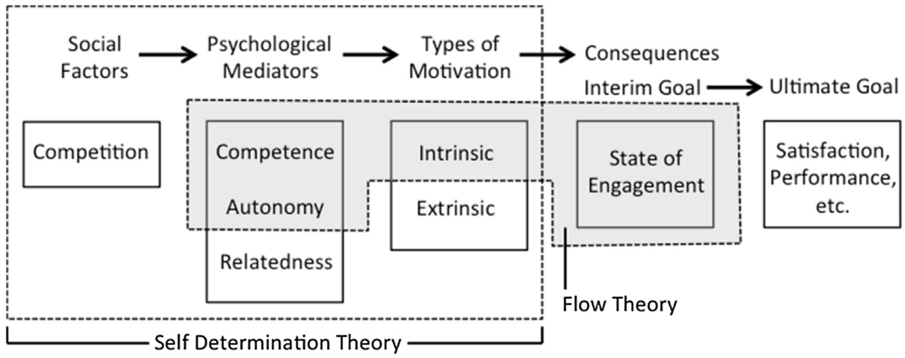


Fig. 2. Overarching Theoretical Framework.

social factors and motivation (intrinsic and extrinsic). Both competence and autonomy are fundamental aspects in Flow theory. As previously mentioned, Flow theory proposes that intrinsically motivating experiences are dependent on a balance of perceived challenges and perceived skills. This is akin to the need for perceived competence in SDT [59]. Similarly, the feeling of control of one's actions and over the demands of the environment has also been identified as an essential component of Flow [27], which is akin to the need for perceived autonomy within SDT. In the context of gaming, autonomy is preserved by avoiding the use of controlling feedback and focusing on informational feedback.[3] Given that autonomy is preserved, the motivation caused by one's evaluation of his or her competence based on informational feedback will lead to the experience of Flow (balance between challenge and skill). Numerous studies have supported the notion of SDT's perceptions of competence and autonomy being related to flow [62,63]. However, Flow theory does not directly speak to the notion of relatedness as a condition for or component of flow. Ryan and Deci [28] suggest that satisfaction of the relatedness need can lead to the intrinsically motivated experience of flow, but is not a necessary condition for flow (unlike competence and autonomy). They recognize that "although people are indeed social animals, they can also have moments of centeredness, excitement, and flow, when engaged in solitary activities" [28], p. 334.

In terms of motivation, research on flow tends to focus on it being an intrinsically motivated optimal experience [64]. However, SDT recognizes a fuller range of motivations. It is interesting to note that while the experience of flow is intrinsic in its nature, it could be triggered by external goals [27]. Engeser and Schiepe-Tiska [64] note that an individual could be assigned a task in a working context (an extrinsic motivation) and experience flow while becoming completely immersed in carrying out this task.

The final stage in the motivational sequence outlined in Fig. 2 is consequences (as per [60]. Here we distinguish between interim and ultimate consequences or goals. And interim goal during the engagement process is the psychological state of engagement (i.e., the flow experience). While SDT recognizes flow as "the archetypal intrinsically motivated experience" [26], p. 155, it is Flow theory that provides a rich understanding of the components of this state. The ultimate consequence or goal is the outcome of the process whereby the individual may have various targets, such as a satisfying experience and high level of performance.

1. In sum, while SDT and Flow theories have some overlaps, together they provide a more holistic understanding of motivation throughout its sequences. More specifically,
2. SDT is able to explain the process through which motivation is distilled for a person.
3. Flow provides a rich understanding of the optimal outcome of this process when individuals reach a state of complete absorption.
4. While competence and autonomy needs are tightly linked to the conditions and components of flow, SDT includes a relatedness need that may contribute to the optimal flow experience.
5. While the flow experience is intrinsically motivated, it may be extrinsically triggered.

The focus of the present study is not on capturing all the dimensions of engagement in video games, but to understand the process by which competition (through different modes of play and influenced by individual personality traits) creates a state of flow among video gamers. The goal is not to evaluate pure intrinsic motivation of gamers, as video games can deploy extrinsic elements that highly engage players. Some authors have mentioned that Flow does not capture all the motivating factors in video games, which can be explained using SDT [65]. As such, using an overarching theoretical framework that combines SDT and Flow theories, we develop and test a research model in the following sections that seeks to provide a rich process view of understanding the role of competition in video game play satisfaction.

3. Proposed research model and hypotheses

In this section, the proposed research model, shown in Fig. 3, and associated 10 hypotheses are presented. Hypotheses are explained from right to left (from H1 to H10), starting with the endogenous variable and its antecedent relationships. H1 to H6 aim to address the first research objective in regards to the effects of Situational Competitiveness. H7, H8, and H9 aim to answer the second research question related to the effects of Competition Mode. Lastly, H10 addresses the third research objective concerning the effect of Dispositional Competitiveness.

Satisfaction has been defined as "a sense of contentment that arises from an actual experience in relation to an *expected* experience" [66], p. 32. Satisfaction with an IT system is an important factor due to its effect on attitude, intention, and continued usage of a technology or service [46,47,67]. The positive impact of satisfaction on attitude and intention to use has been shown in various contexts including continued use of online websites [68,69], customer loyalty [46,47], and online games [70]. In the current investigation, the game that was chosen as the basis of the empirical study was not one that participants would be likely to use in the future. As such, satisfaction with the game was deemed to be a more appropriate indicator of success than intention to use and was chosen as the ultimate endogenous construct of the model.

According to Expectation Confirmation Theory (ECM; [67,71], expectation reflects anticipated behavior, and when a product or service outperforms our expectations, or creates positive disconfirmation for us, we would have satisfaction from using that product or service. The Flow experience during the video gameplay is the result of disconfirmation. This positive disconfirmation, according to ECM, results in satisfaction of the players from playing the video game. Therefore, in alignment with earlier research [70,72,57], it is expected that there will

[3] Controlling feedback is feedback that is "experienced as pressure toward particular outcomes," which imposes control over the activity by an external factor [120]. Informational feedback helps a person to increase his/her competence in the task he/she is competing in without forcing any expected outcome.

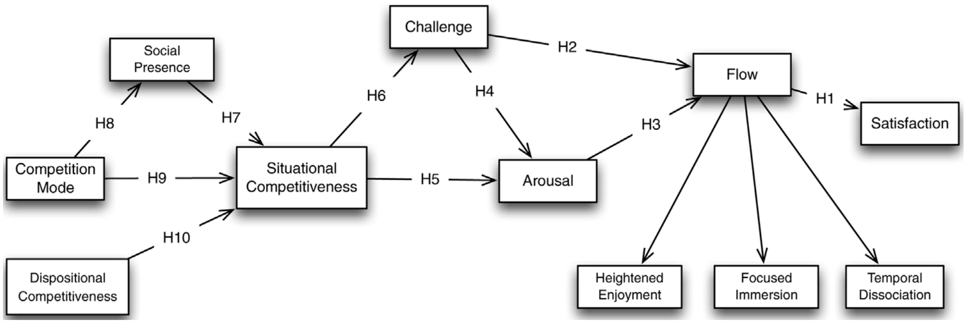


Fig. 3. Proposed Research Model of the Study.

be a direct relationship between Flow and reported Satisfaction of video gameplayers. Thus, it is hypothesized that:

Hypothesis 1. Higher levels of Flow experience of video gameplayers will increase their Satisfaction.

As explained earlier, Flow theory indicates that in order to reach the optimal state of flow, an activity should require skills from the performers that are in balance with the challenge that the activity creates. Shin [57] defines challenge as "the degree to which individuals find it difficult to cope with specific tasks involved" (p. 706). If the level of Perceived Challenge compared to necessary skills in a computer task is too low, the users will lose interest in performing that task and the task becomes boring [73]. Therefore, in order to reach the state of Flow, a video gameplayer should perform a task that requires a balance of challenge and skills [45,49]. In video games, where players learn the skills required for playing the game, increasing the level of challenge can create the balance between challenge and skill in playing the game, which can result in experiencing Flow.

Generally, "along with individual skills, the challenges presented by an activity are the most important predictors of Flow" [74], p. 212. Consistent with Csikszentmihalyi's [27] discussion on the role of challenge, other scholars have also found Perceived Challenge to have the highest effect on engagement in a computer-related activity [73,75]. Thus, in line with extant literature on Flow [73,76,56,77,57], the effect of Challenge on Flow will be measured independent of Skills in this investigation. This approach aligns with our experimental design which does not include a longitudinal component that would allow participants to increase their level of Skill. With a constant level of Skill, by increasing Challenge from low levels, it is hypothesized that Challenge will match the Skill level of video gameplayers and, thus, Flow would increase.[4] Consistent with extant research, we expect to see the same relationship between the perception of Challenge in a video game and experiencing Flow by gameplayers.

Hypothesis 2. Higher levels of Perceived Challenge reported by video gameplayers will lead to higher levels of Flow.

In online gaming, feelings similar to arousal[5] have been identified as an important criterion for engagement [78], which can be associated with the experience of Flow. Extant literature also supports the effect of arousal on attention (an important dimension of Flow) for various tasks and contexts [79,80]. The theory of Optimum Stimulation Level [81] indicates that people prefer and function better in an optimum level of stimulation (arousal). Similarly, in video games, this sensation-seeking behavior can be seen as a core motivation factor for gamers, which influences their intense attention and enjoyment [82].

Pace's [83] grounded theory of Flow of web users shows the effect of challenge in information-seeking tasks on the focused attention on that activity. In the video game context, it is expected that arousal will have a mediating effect on the relationship between challenge and attention. Moreover, Léger et al. [84] have shown that arousal is highly correlated with heightened enjoyment. Higher levels of arousal are often a pleasant experience due to its association with excitement, while lower levels of arousal are unpleasant experiences that are associated with boredom [85]. Tauer and Harackiewicz [35] found that positive affective responses—including arousal—mediate the relationship between competition and task enjoyment. In summary, video gameplayers' arousal during the gameplay affects various dimensions of Flow. Thus, it is hypothesized that:

Hypothesis 3. Higher arousal levels of video gameplayers will increase their Flow experience.

Competition can be conceptualized as an individual personality trait (outlined below in hypothesis 9) or as a characteristic of the environment that an individual perceives. The latter form of competitiveness is known as "*Situational Competitiveness,"* which explains the behavior of people in a competitive context [86]. Individuals can react differently to various contexts—being cooperative in one context and being competitive in another.

When playing a video game that engenders Situational Competitiveness, gamers face various challenges [87] which result in emotional involvement such as arousal [88,89]. The theory of Flow supports this notion by indicating that arousal is experienced when challenge and skill are well balanced [49]. As previously indicated, the current investigation assumes a constant level of skill since there is no longitudinal dimension to allow participants to increase their skill levels. The video game context was carefully chosen to be a simple task within a simple environment where challenge increased to match skill level during gameplay, without exceeding it. Thus, it is hypothesized that:

Hypothesis 4. Higher levels of Perceived video game Challenge will increase gameplayer Arousal.

Little is known about the mechanism through which competitiveness of a video game impacts one's motivation to play and potentially to be addicted. Scholars studying addiction have indicated that gamblers experience feelings similar to being "hyped up," which they refer to as arousal [90]. Arousal has been conceptualized by Holsapple and Wu [43] as "the state of emotional and mental activation or alertness," (p. 87) which is an emotional response during the use of a hedonic IT product. Similar to gambling [90], it is expected that players of competitive video games will experience excitement in anticipation of receiving rewards (often intrinsic) upon winning the game. Ravaja et al. [91] support this claim by expressing that "social-competitive situations" increase arousal. Thus, it is hypothesized that:

Hypothesis 5. Higher Situational Competitiveness of a video game will increase gameplayer Arousal.

Challenge has been closely connected to competition [92], where

[4] The context for the current investigation was carefully chosen so that the Challenge would not be too high for game players whereby Challenge would exceed Skill, resulting in anxiety.

[5] Arousal can be seen as a state of being awake or reactive to stimuli. Koo and Lee [121] identify Arousal as being a positive (energetic) or negative (tense) feeling. Positive Arousal is the focus of investigation in the current study.

creating competitive situations is easily manifested through the creation of challenge [45]. Reeve and Deci's [93] research on the effect of competition on intrinsic motivation showed that proper forms of feedback in competition can create a more challenging environment than when competition involves no feedback. Previous research has also shown that some people tend to search for competitive situations in order to create competition for themselves [94]. Webster and Ho's [75] have used comparison techniques that motivate competitiveness in order to distill the level of challenge among students. In the context of video games, competition can be used to create challenge. Previous studies have shown that "competitive elements" used in video games provide interactivity and clear and immediate feedback, which enables "active engagement" and a sense of challenge [95]. Thus, it is hypothesized that:

Hypothesis 6. Higher Situational Competitiveness of a video game will increase gameplayer Perceived Challenge.

Social presence (the degree to which an individual is aware of another person in a communication interaction) has been studied in various contexts, in particular in website use, where scholars have explained the positive effects of different human-centric features such as "human images" [96,97]. Social Facilitation Theory (SFT) [98] posits that the presence of others triggers the motivation to compete and, consequently, how people evaluate competitiveness of an environment. Moreover, previous research has shown the presence of others to directly affect people's competitive behavior [99], indicating a salient effect of social presence on the perception of competitiveness. In other words, "social comparison processes fuel the motivation to compete" Garcia and Tor [99], p. 5 . Thus,

Hypothesis 7. Higher perceptions of Social Presence will increase Situational Competitiveness of video game experience.

In video gameplay, players can experience various modes of competitive playing. Some games have no explicit goal and provide freedom for players to explore and build new things (e.g., sandbox or open world games such as Mindcraft™). In these types of games, players do not have a means for comparison with other individuals and, thus, provide no medium for competition. In other types of games, which provide competitive elements, competition can be classified into two basic forms. First, games may include intelligent agents that can play sophisticatedly against a human player. Thus, they create a mode of competition against the computer. Second, games can be played with multiple users where players can compete against one another. This form of competition can be further divided into two modes that are defined by the relationship between the players; that is, the mode of competition can be categorized as competition against one's friend or against a stranger.

In addition to the modes mentioned above, one might argue that there exists another mode of competition where the game does not include any explicit form of competition, yet the player is involved in competing against him/herself in order to improve his/her performance. However, this potential competition mode is subjective in nature and cannot be objectively manipulated in the same fashion as the earlier mentioned modes. Competition against one's self cannot be controlled and can only be measured through self-reports or some psychophysiological measures (such as electrodermal activity).

Straub and Karahanna [100] propose that the richer the communication medium between people is, the higher the perceptions of social presence. In the context of video games, this communication medium can include competition mode (communicating/competing with no one, with a computer or with a real person). In situations where gamers are aware of playing against a real person, it has been shown that they report higher levels of presence,[6] Flow, and enjoyment [101]. Similarly, Ravaja et al. [91] have shown that playing video games with human opponents, compared to computer opponents, causes higher levels of emotional involvement, measured by presence, engagement, and arousal (physiological and self-reported). Ravaja et al. [91] also found that playing against friends has a deeper level of emotional involvement compared to playing against strangers. Thus, it is hypothesized that:

Hypothesis 8. Different Competition Modes—no competition, competing against computer, competing against human strangers, and competing against human acquaintances/friends—will yield progressively increased perceived Social Presence in a video games experience.

As previously mentioned (for hypothesis 5), competition can be situational or characterized as a personality trait. Individuals who possess a competitive personality trait or attitude are termed Dispositionally Competitive [86]. Early research has showed that Dispositionally Competitive people are more likely to perceive other people and situations as competitive and elicit competitive behavior [102]. Individuals with higher orientation toward achievement are more intrinsically motivated through competition [35]. Additionally, how people react to the challenge of an IT task is dependent on their personal characteristics and their condition while performing the computer task [73]. Among gamblers, personality traits have an important effect in the level of arousal they seek and enjoy [103], which it is expected to be similar among gamers. Williams et al. [3] further explain: "a player seeking to achieve and compete might process stimuli or model behaviors differently than someone interested in role play and immersion" (p. 1008). Previous research has also shown that people's motivation to compete significantly predicts how competitive they perceive a game to be [92]. On the other hand, Situational Competitiveness (introduced in H2) is affected by various contextual criteria. Based on Social Comparison Theory [104], an important contextual criterion is comparison with other people. It is expected that, in a social setting, the closer the relationship among participants in a competitive task is, the greater the comparison and perceptions of competition. Thus:

Hypothesis 9. Different Competition Modes—no competition, competing against computer, competing against human strangers, and competing against human acquaintances/friends—will yield progressively increased Situational Competitiveness in a video game experience.

Hypothesis 10. Individuals with higher levels of Dispositional Competitiveness will experience higher Situational Competitiveness in a video game environment.

4. Research methodology

4.1. Data collection procedure

An experiment was designed to examine the manipulation of four competition modes: (1) no competition, (2) competition with the computer, (3) competition with a human stranger opponent, and (4) competition with a human friend. Participants were recruited from the student population of a major Canadian university.[7] Students are a suitable sample for this study as they have significant interest and experience in gaming [105], and they represent the Millennial generation that is the focus of this research investigation.

The study was advertised within multiple undergraduate classes (more than 1800 students) in person and via emails. Potential participants could choose a time slot and register with one of their friends, or register for any of the other time slots. In the latter situation, participants were randomly assigned to one of the two individual modes

[6] In this research, in the context of videogames, the focus of presence is on social presence, rather than a sense of presence in the environment (physical presence).

[7] Participants were given Table 65 gift card for university's bookstore as a compensation for their time.

(competing with computer and no competition) or competing against a stranger mode. For the competing against a stranger mode, verification was made at the end of the experiment to ensure that they did not know the other person they were competing with.

During the experiment, participants were asked to play a simple video game with educational content. The video game that was chosen for the experiment was TypeRacer™,[8] which is a simple typing game that is used to increase one's typing speed through a simulated multi-player car racing game. TypeRacer™ provides a simple environment and a simple task (typing) that everyone can relate to. It also enabled the creation of the four manipulation competition modes that this experiment required. In TypeRacer™, players have to type a (randomly assigned) text paragraph without any mistakes (refer to Appendix A for an example of the game). As players advance in the selected text, their racing car advances in the field toward the finish line relative to the length of the text. If the player makes a mistake while typing the text, the car would stop and the text would turn red. At any moment, the player can see how fast they are typing by reading the quantified number of WPM (words per minute).

For competition against another human (a stranger or a friend), the participants sat in two separate rooms with one experimental facilitator per room. After reading and signing the consent form, participants were given a personality and general demographics questionnaire before playing the video game. Each participant was then introduced to the environment of the game and had a chance to practice it twice before the experiment began. The purpose of these practice rounds was to ensure that participants had a high level of master of the game's interface before proceeding to the main gameplay. After the practice rounds, we explained the mode of game they were assigned to play. If they were playing against a human player, we verified that whether they did or did not know their opponent matched the mode they were assigned to. For the experiment, each participant played five rounds of the game and after each round was asked to complete a mini-survey that briefly asked them about their experience and challenge level. After completing the third round of the game, the participants were asked to complete a survey based on the measurement items of the proposed model. The third round was chosen for survey administration as per a pilot study that showed that the outcome of the game was still unknown after the third level and was most likely the peak Flow point of the game. As such, players would not bias their responses based on game results but rather focus their responses on the gameplay experience.

4.2. Participant demographics, sample size, and control variables

In addition to the variables in the proposed model, general demographic information was gathered from participants. Out of the 114 participants, 65 (57%) were female and 49 (43%) were male. Participant ages ranged from 17 to 46, with the average age of 20.66 (SD = 4.74). The sample is skewed toward a younger population, which is the main target of this research. Based on the random assignment, 22 of the participants were assigned to treatment 1 (no competition), 24 to treatment 2 (competing against computer), 30 to treatment 3 (competing against human strangers), and 38 of the participants to treatment 4 (competing against human acquaintances/friends).

Chin [106] and Gefen et al. [107] advise that the minimum sample size for a partial least squares (PLS) analysis should be the larger of (i) 10 times the number of items for the most complex construct; or (ii) 10 times the largest number of independent variables impacting a dependent variable. In our model, the most complex construct has five items and the largest number of independent variables estimated for a dependent variable is three (for Situational Competitiveness). Using a more stringent approach to estimate sample size, following Roldán and Sánchez-Franco [108], the minimum sample size to detect a medium effect size of 0.80 and alpha of 0.05 is 91 cases for our model. Thus, the 114 sample size for this study is more than adequate for PLS estimation procedures.

In addition to age, demographic variables of education, ethnicity, and first language were asked from the participants. The majority of the participants finished high school, since all were recruited from undergraduate and graduate classes at a large Canadian university. Most of the participants were white or Asian/Pacific Islanders. With respect to the first language of participants, even though the majority spoke English as their first language, 37% of participants spoke English as their second language. These demographic variables were examined for any potential influence on the proposed research model.

Additionally, participants were asked about their previous experiences with computers, the Internet, and video games. Participants indicated that they were comfortable with using computers and the Internet and their video-gaming experience was normally distributed around average levels. The majority of participants did not consider themselves as serious video gameplayers or competitors. Thus, it can be concluded that the majority of the participants would not have an advantage due to their gaming experience.

4.3. Instrument and model validation

With the exception of Competition Mode, all the constructs that were used in this study came from extant literature where their items have been found to be reliable and valid. However, since each study had its own context and focus, we do not assume these measures to be reliable and valid for the context of the current investigation. As such, the below results include validation of the constructs employed. The constructs that are extracted from the extant literature and adapted to reflect the context of this research, in the order that appeared on the survey, are shown in Appendix A.

For Competition Mode, we employed an incremental approach where the modes were ordered by their hypothesized effects on its dependent constructs. For example, competition mode 3 was hypothesized to have a greater effect on Social Presence and Situational Competitiveness than competition modes 1 and 2, but less than competition mode 4. This incremental approach and operationalization of a manipulated independent variable is in alignment with other researchers (e.g., [109] and [110].

5. Data analysis and results

5.1. Research model validation

The proposed research model was measured and validated through a couple of steps. First, standard tests were employed to assess construct reliability and convergent and discriminant validity. Then, to validate the proposed model, Structural Equation Modeling (SEM) was used. Since the model includes a second-order construct (Flow), PLS, in particular *SmartPLS* software was used. PLS also allows for both exploratory and confirmatory assessments and inclusion of second-order constructs.

All the constructs that are used in the model are reflective constructs. In order to test the construct reliability of the deployed constructs, Cronbach Alpha, composite reliability, and Average Variance Extracted (AVE) were calculated. The only item out of the 43 measured items that was problematic was the reversed coded item in the Focused Immersion dimension of Flow (i.e., "While playing the game, I was able to block out most other distractions") that lowered the reliability of this construct significantly. Therefore, for the rest of the analysis this item was removed, making Focused Immersion a two-item construct. As shown in Table 1, all of the constructs have higher than the suggested critical value of 0.7 for Cronbach Alpha [111]. In addition, Composite

[8] http://play.typeracer.com/.

Table 1
Construct Reliability of the Constructs in the Model.

Construct	Number of items	Mean	SD	AVE	Composite Reliability	Cronbach Alpha
Mode	1	N/A	N/A	1.000	1.000	1.000
Dispositional Competitiveness	5	4.643	1.067	0.541	0.853	0.805
Social Presence	5	3.458	1.266	0.617	0.889	0.848
Situational (Perceived) Competitiveness	4	4.725	1.319	0.734	0.917	0.879
Challenge	3	5.312	1.134	0.735	0.892	0.826
Arousal	5	5.177	0.911	0.594	0.876	0.819
Flow	9	5.121	0.674	0.470	0.869	0.825
Focused Immersion	2	5.426	0.838	0.767	0.868	0.698
Heightened Enjoyment	4	5.004	0.881	0.667	0.870	0.783
Temporal Dissociation	3	4.973	1.123	0.700	0.875	0.792
Satisfaction	2	5.478	0.930	0.919	0.958	0.912

Reliability and AVE are higher than 0.8 and 0.5, respectively, as recommended by previous scholars [106,112,111]. The only construct that has a slightly lower AVE is Flow, which is a second-order construct where it was not expected to see similar behavior to the first-order constructs [113]). In fact, the AVE for a second-order construct can be calculated "by averaging the squared multiple correlations for the first-order sub-dimensions (or averaging the square of each sub-dimension's completely standardized loading on the second-order construct)" [113], p. 313. As such, the AVE of Flow construct equals 0.47 with the given dataset, showing that the majority of variance in the second-order latent construct is shared with its first-order dimensions.

Fornell and Larcker [112] explain that if a construct meets these requirements for reliability, it can be concluded that the construct has convergent validity. Therefore, it can be said that each of the items in the proposed model loads on its own latent construct strongly, indicating high convergent validity.

Discriminant validity enables us to check whether the items of a construct are only related to that construct and no other construct in the model. In order to test the discriminant validity of the evaluated constructs, a confirmatory factor analysis (CFA) was conducted to generate a matrix of loadings and cross-loadings. Each item was carefully examined and confirmed to load on its corresponding construct (bolded in Table 2) stronger than other constructs as per the Gefen and Straub's [114] guideline of testing for CFA. The only item that seems to be problematic is Heightened Enjoyment 1 (HE1: "Playing the game bored me"), which had to be removed from the rest of the analysis as its loading on the HE construct was not at least one order of magnitude larger than its cross-loading on other constructs (Table 2).

An additional test for discriminant validity was conducted whereby a correlation matrix was generated with the square root of AVE values of each construct on the diagonal cells. It can be seen in Table 3 that the square root of AVE for all constructs is significantly higher than the correlations with the other constructs (numbers in their corresponding row and column). As a result, and since all AVEs are higher than 0.5 it can be concluded that the proposed model's constructs demonstrated discriminant validity [106].

Table 2
Cross-Loadings Matrix for all First-Order Constructs (Significant at 0.001).

	DCompt	SP	SCompt	Ch	AR	FI	HE	TD	SA
DCompt1	**0.583**	0.052	0.181	0.054	0.167	0.066	0.142	0.084	0.249
DCompt2	**0.823**	0.089	0.243	0.140	0.166	0.049	0.223	0.060	0.111
DCompt3	**0.717**	0.146	0.154	0.066	0.112	0.039	0.127	0.076	−0.043
DCompt4	**0.669**	0.034	0.097	0.094	0.066	0.029	0.259	0.046	0.058
DCompt5	**0.852**	0.105	0.402	0.267	0.112	0.072	0.144	0.059	0.158
SP1	0.104	**0.816**	0.415	0.168	0.185	−0.055	0.270	0.326	0.209
SP2	0.082	**0.731**	0.307	0.203	0.126	−0.073	0.140	0.131	0.146
SP3	−0.004	**0.783**	0.375	0.152	0.185	0.023	0.186	0.224	0.124
SP4	0.179	**0.788**	0.281	0.137	0.148	−0.101	0.147	0.206	0.131
SP5	0.154	**0.757**	0.260	0.074	0.048	−0.199	0.076	0.200	0.083
SCompt1	0.305	0.478	**0.869**	0.363	0.330	0.084	0.337	0.270	0.350
SCompt2	0.349	0.297	**0.836**	0.402	0.387	0.084	0.363	0.317	0.405
SCompt3	0.279	0.369	**0.847**	0.464	0.359	0.021	0.259	0.201	0.280
SCompt4	0.268	0.350	**0.887**	0.468	0.359	0.090	0.292	0.194	0.272
CH1	0.217	0.160	0.526	**0.901**	0.440	0.273	0.329	0.301	0.490
CH2	0.156	0.146	0.351	**0.839**	0.197	0.166	0.162	0.150	0.326
CH3	0.142	0.201	0.343	**0.839**	0.280	0.136	0.253	0.261	0.402
AR1	0.156	0.161	0.297	0.305	**0.786**	0.290	0.493	0.267	0.487
AR2	0.123	0.154	0.319	0.313	**0.896**	0.359	0.614	0.397	0.573
AR3	0.088	0.150	0.347	0.340	**0.851**	0.318	0.565	0.337	0.580
AR4	0.115	0.051	0.272	0.254	**0.500**	0.194	0.281	0.250	0.358
AR5	0.177	0.193	0.370	0.266	**0.773**	0.240	0.593	0.331	0.457
FI1	0.054	−0.056	0.085	0.158	0.321	**0.900**	0.331	0.236	0.264
FI3	0.081	−0.103	0.058	0.267	0.331	**0.868**	0.219	0.258	0.325
HE1	0.116	−0.032	−0.121	−0.163	0.048	0.134	**0.206**	−0.022	−0.021
HE2	0.233	0.257	0.425	0.321	0.690	0.253	**0.919**	0.445	0.667
HE3	0.213	0.168	0.329	0.305	0.608	0.324	**0.951**	0.439	0.639
HE4	0.167	0.225	0.295	0.261	0.614	0.295	**0.940**	0.454	0.603
TD1	0.097	0.230	0.178	0.172	0.450	0.370	0.546	**0.851**	0.404
TD2	0.005	0.238	0.302	0.251	0.176	0.123	0.200	**0.797**	0.196
TD3	0.091	0.274	0.269	0.330	0.357	0.151	0.362	**0.873**	0.315
SA1	0.139	0.160	0.347	0.473	0.576	0.299	0.646	0.363	**0.958**
SA2	0.175	0.197	0.378	0.460	0.655	0.335	0.642	0.367	**0.959**

Table 3
Discriminant Validity Assessment Table using Construct Correlation Matrix and Square Root of AVE.

	Mode	DCompt	SP	SCompt	CH	AR	FI	HE	TD	SA
Mode	1.000									
DCompt	0.016	**0.736**								
SP	0.365	0.072	**0.785**							
SCompt	0.531	0.306	0.436	**0.857**						
CH	0.123	0.235	0.163	0.459	**0.857**					
AR	−0.002	0.177	0.172	0.398	0.384	**0.771**				
FI	−0.004	0.068	−0.063	0.077	0.228	0.362	**0.876**			
HE	0.086	0.205	0.213	0.372	0.307	0.671	0.304	**0.938**		
TD	0.177	0.069	0.265	0.291	0.274	0.404	0.262	0.482	**0.837**	
SA	0.019	0.171	0.145	0.367	0.481	0.636	0.304	0.672	0.385	**0.959**

Note: the square root of AVE is written in the bolded diagonal cells for the corresponding construct.

5.2. *The structural model evaluation*

SmartPLS was used to test the structural equation model using the cross-sectional data gathered throughout the experiments. The results of the PLS analysis are presented in Fig. 4. The level of significance for each relationship is calculated based on the *t*-statistics of the bootstrapping process with 500 resampling cases. All the relationships in the model were significant, except the relationship between Challenge and Flow. This may be due to the fact that Arousal mediates the relationship between Challenge and Flow (further examined below). In addition, the variances explained for the endogenous variables are all above 10% as per Falk and Miller's [115] recommendation. The variance explained of the last endogenous construct (Satisfaction) is $R^2 = 0.43$ further supporting the validity of the proposed model. Additionally, a Goodness-of-Fit (GoF) assessment of the model was performed using the Wetzels et al. [116] approach. The GoF for the proposed model is 0.52, which is significantly higher than the recommended threshold of 0.36 [116]. This result also supports the validity of the proposed model and shows that the collected data fit the proposed model very well. A summary of the hypothesis findings is provided in Table 4.

Table 4
Summary of Findings for Supporting the Proposed Hypotheses.

Hypothesis	Path	Path Coefficient	*t*-Statistic	Sig. Level	Validation
H1	Flow → SA	0.65	9.93	0.000	Supported
H2	CH → Flow	0.12	1.23	0.104	Not Supported
H3	AR → Flow	0.63	6.66	0.000	Supported
H4	CH → AR	0.26	2.69	0.003	Supported
H5	SCompt → AR	0.28	2.44	0.008	Supported
H6	SCompt → CH	0.46	6.71	0.000	Supported
H7	SP → SCompt	0.26	3.30	0.000	Supported
H8	Mode → SP	0.37	4.06	0.000	Supported
H9	Mode → SCompt	0.43	5.55	0.000	Supported
H10	DCompt → SCompt	0.28	3.63	0.000	Supported

5.2.1. *Mediation test (Challenge → Arousal → Flow)*

Based on the theory of Flow, it was expected that there would be a significant relationship between Challenge and Flow. However, the only non-significant relationship in the model was for the hypothesis of the effect of Challenge on Flow (H2). As such, it is likely that Arousal is fully mediating the relationship between Challenge and Flow. In order to test for mediation effect of Arousal on the relationship between Challenge and Flow, the following analysis steps were taken:

1. Flow was regressed on Challenge
2. Arousal was regressed on Challenge
3. Flow was regressed on Arousal and Challenge at the same time

The results of both steps 1 and 2 were significant at $p < 0.01$ with standardized coefficient (Beta) value of 0.275 and $p < 0.001$ with Beta value of 0.357, respectively. Step 3 showed that when both variables are used together in a multiple regression on Flow, the effect of Arousal on Flow is high and significant ($B.562 = 0.562$ for $p < 0.001$) while the effect of Challenge on Flow is 0 and not significant at any level. This analysis indicates that despite the effect of Challenge on Flow, Arousal fully mediates the relationship between these two variables.

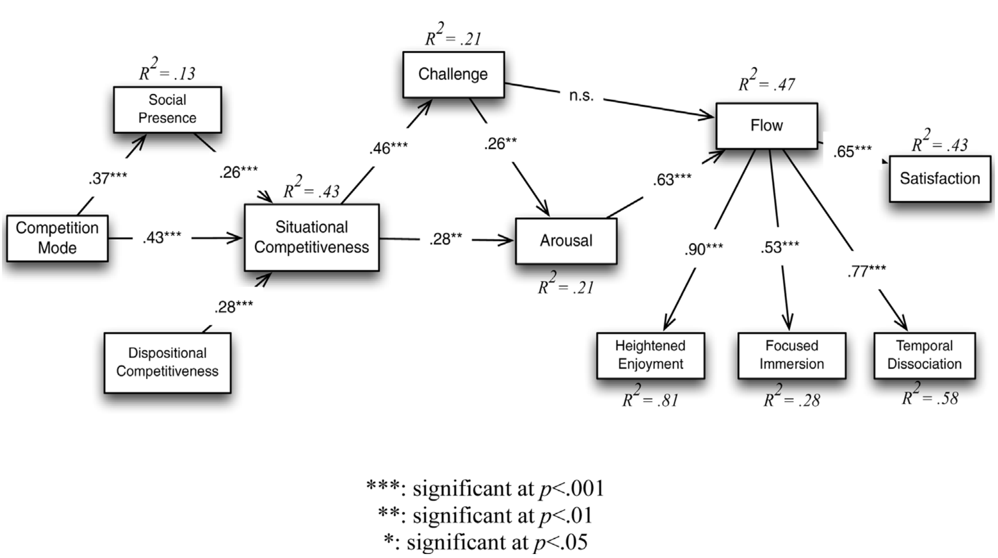


Fig. 4. Result of PLS Analysis of the Proposed Structural Equation Model.

Table 5
Direct Relationships' Effect Sizes (α = 0.05).

	SP	SCompt	AR	CH	Flow	SA
DCompt		0.281				
SP		0.257				
SCompt			0.398	0.459		
AR					0.630	
CH			0.256		0.277	
Flow						0.653
Mode	0.365	0.527				

5.2.2. Effect sizes

Effect size can be used to identify the impact of an independent variable on a dependent variable. Using Cohen's Cohen, 1998 f^2 approach to measuring effect sizes, Table 5 shows the direct effect sizes of independent variables on dependent variables. Based on Cohen's [117] criteria, six out of 10 effect sizes can be considered large (above 0.35) and the other four are of medium size (above 0.15).

5.2.3. Common method bias (CMB)

Cross-sectional study with self-reported data poses a threat to biases due to various factors such as social desirability and bias due to the method of the experiment. As such, common method bias should be tested in order to make sure that such biases do not exist or are not severe in the collected data. In order to assess common method bias, Harman's one-factor test [118] was conducted, which showed that nine factors were extracted from the items of the model based on the survey data. These factors together explained less than 26% of the variance in the dataset and no one factor can explain the majority of variance in data, indicating that CMB is not likely present in this dataset. In fact, all of the predictive variances were below the threshold of 34% that has been proposed in previous studies [119]. Moreover, all of the nine extracted factors had eigenvalues of greater than one, which further supports the independence of these factors from one another.

5.2.4. Control variables effects

As previously mentioned, some demographics, individual characteristics, and control variable information were gathered from participants. In order to test the effects of these variables on the model, the effect of each of them individually on all the latent constructs in the model was evaluated using SmartPLS, as shown in Table 6.

As Table 6 shows, 12 out of the 42 relationships were significant. In order to test the effect of control variables on the model, one PLS model was developed for each variable, having relationships with all the latent constructs in the model. To test the variables' effect, first the level of significance of each relationship of the control variable with other latent constructs was tested. In order to further test the predictive power of the control variables, statistical power of their relationships can be measured through their effect sizes [122]. From this analysis, two control variables had a medium size effect while five others had a small effect size. For medium effect sizes, age had a significant effect on the level of Challenge and Arousal (older participants reported being more challenged, and more significantly aroused and excited) and education also had a considerable effect on the level of arousal of the participants, which can be correlated with the age of the more educated population. Additionally, the participants who did not speak English as their first language were more likely to perceive the experiment as competitive. They also reported their level of Flow experience to be higher compared to the participants who spoke English as their first language. These perceptions could be attributed to cultural differences rather than a language barrier since no considerable effect on Challenge was observed as a result of language difference. Moreover, higher Internet Experience could affect being in a Flow state. This relationship can be a result of having more experience with similar online environments, and therefore reducing the distracting factors of a new environment, making it easier for the participants with more experience to focus on the game tasks and engage better. Finally, higher levels of Gaming Experience affected participants' perceptions of challenge. It makes sense that experienced video gameplayers would be more interested in playing games and would be more easily challenged and motivated to win a video game.

6. Discussion

This section reviews the three research questions posed at the beginning of this manuscript, providing answers and insights from the current investigation.

6.1. Research objective 1: the role of situational competitiveness

The results supported the expectation confirmation theory in this context regarding the role of satisfaction of video gameplayers (H1, Flow → Satisfaction with a *t*-statistic value of 9.93, significant at $p < 0.001$). That is, experiencing Flow confirms or positively disconfirms players' expectations and creates a sense of satisfaction from playing the video game. In the validated research model, Flow was the only antecedent modeled to impact Satisfaction and accounted for 43% of the explained variance of this endogenous variable. Flow was found to be a strong predictor of Satisfaction, which is in line with extant literature (e.g., [70,72,57].

Flow was proposed to be impacted by Situational Competitiveness via the mediating variables of Challenge and Arousal. Flow theory

Table 6
Impact of Control Variables on Model's Latent Constructs.

		DCompt	SP	SCompt	CH	AR	Flow	SA
Age	β				0.22	0.213		
	$p <$	n.s.	n.s.	n.s.	0.05	0.01	n.s.	n.s.
Gender	β							
	$p <$	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Education	β				0.198	0.211	−0.13	
	$p <$	n.s.	n.s.	n.s.	0.01	0.01	0.05	n.s.
Ethnicity	β							
	$p <$	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Language (1 = English, 2 = Not English)	β			−0.15			−0.184	
	$p <$	n.s.	n.s.	0.05	n.s.	n.s.	0.05	n.s.
Computer Experience	β						0.14	
	$p <$	n.s.	n.s.	n.s.	n.s.	n.s.	0.05	n.s.
Internet Experience	β						0.162	
	$p <$	n.s.	n.s.	n.s.	n.s.	n.s.	0.05	n.s.
Gaming Experience	β		−0.173		−0.211		−0.042	
	$p <$	n.s.	0.05	n.s.	0.01	n.s.	0.05	n.s.

explains that the state of optimal experience can be achieved through any task that enables the person to practice their skills by challenging them to the extent that they have the required skills for performing well in the activity. That is, the balance of skill and challenge in a task makes it more engaging, creating the state of Flow. It was expected that this study's experiment would create this balance of challenge and skill for players by increasing the challenge of an activity (i.e., learning to type faster) that is not inherently challenging. However, it was found that Challenge did not have a significant effect on Flow (H2, Challenge → Flow with a *t*-statistic value of 1.23).

A possible explanation of this non-significant relationship could be attributed to the mediating role of Arousal in the context of video gameplaying. A review of extant literature shows that no other study has tested Arousal, Challenge, and Flow in one structural model. As mentioned earlier, Tauer and Harackiewicz [35] showed that Arousal mediates the relationship between competition and some of the dimensions of Flow, but these authors did not include the construct of Challenge in their model. Thus, it is possible that Arousal fully mediated the relationship between Challenge and Flow. The results of the mediation test further supported this claim, showing that Challenge does not have a direct effect on Flow in the model, but its effect through Arousal on Flow is highly significant.

As expected, Arousal appeared to be an important mediator for the relationship between Situational Competitiveness and Flow (H3, Arousal → Flow with a *t*-statistic value of 6.66, significant at $p < 0.001$). Emotional Arousal influences how much individuals pay attention to an activity, making them more engaged and facilitating Flow experience during that activity.

As hypothesized, Arousal was predicted by the level of Perceived Challenge (H4 with *t*-statistic value of 2.69, significant at $p < 0.01$). As Flow theory explains, being emotionally excited and aroused is a positive consequence of having balance between the level of Challenge and skill [49]. In fact, in the context of educational video gameplaying, increasing the level of Challenge as perceived by the learners results in the balance of Challenge and skill that is required for being engaged in the task and experiencing the state of Flow.

The hypotheses that examined the relationships between Situational Competitiveness on Arousal (H5) and Challenge (H6) were both supported (with *t*-statistic value of 2.44, significant at $p < 0.01$ for H5 and *t*-statistic value of 6.71, significant at $p < 0.001$ for H6). Participants who perceived the video games to be more competitive were more excited about the game and reported their emotional Arousal level to be higher. Based on SDT, intrinsic rewards create motivation by making a task more exciting for a person. It is speculated that video gameplayers of more competitive modes were directed toward the goal of receiving rewards from winning the game. This reward was implicit in achieving higher ego-based satisfaction due to the feeling of having performed better than someone else. This type of goal can increase the sense of competence that is at the center of SDT. This sense of competence makes the game more exciting and, as a result, participants report higher levels of Arousal. In addition, more competitive situations challenge players to perform better in order to achieve the goal of winning and receiving self-directed rewards in an intrinsically motivating environment. In more competitive situations, players wish to avoid the negative feelings associated with losing and strive to reach positive effects that are linked with winning the game.

6.2. Research objective 2: the role of competition mode

Perception of Social Presence was hypothesized to have an important role in the relationship between the mode of competition and the extent to which players perceive the video game to be competitive. This was supported in empirical findings of this research, where the relationships between Social Presence and Situational Competitiveness (H7) and Competition Mode and Social Presence (H8) were highly significant (with *t*-statistic value of 3.30 for H7 and with *t*-statistic value of 4.06 for H8, both significant at $p < 0.001$). People tend to compare themselves to one another, which is more noticeable when they are in the presence of other people, even through an IT medium such as a video game. Moreover, the mode of competition in a video game has a defining role in the reported level of Social Presence. Playing against a person who is familiar to the player creates the highest level of Social Presence. This mode of the game can provide the feeling of having a richer communication medium, thus, experiencing higher Social Presence compared to the situation in which one plays against a stranger or a computer. As predicted, competing against a computer resulted in the lowest levels of Social Presence. In line with extant literature [91,101], playing against a stranger, playing against a computer, and no competition modes had progressively lower effect on the level of Social Presence.

Different modes of competition were also shown to have a significant direct effect on the level of Situational Competitiveness during video gameplaying (H9, Mode → Situational Competiveness with *t*-statistic of 5.55, significant at $p < 0.001$). As hypothesized, the mode of competition in a video game is a situational variable that can be manipulated to influence the perception of competition among video gameplayers. As Social Comparison Theory [104] explains, comparison is a strong contextual criterion, which the results of this research have shown to be influenced by the conditions of the competition (i.e., playing against a human being or a computer). Playing against a friend has an increased effect on this comparison by furthering the perception of competitiveness.

6.3. Research objective 3: the role of personality traits

The last tested hypothesis in the proposed model addressed the other type of competition that can be associated with individual personality traits. This study's findings show that Dispositional Competitiveness has a significant effect on Situational Competitiveness (H10 with *t*-statistic value of 3.63, significant at $p < 0.001$). This indicates that the reactions of video gameplayers are a function of both situational factors (offering of various competition modes) as well as individual personality (the innate competitiveness of the individual). Participants who reported higher levels of Dispositional Competitiveness perceived the game to be more competitive. In alignment with extant literature [86,102,35], the higher Dispositionally Competitive an individual is, the more intrinsically motivated he/she will be during the video gameplay—regardless of the mode of the game—and perceived the video game to be more competitive.

7. Contributions

From a theoretical perspective, this research contributes to the IS body of literature by incorporating various theoretical lenses from different disciplines such as psychology, marketing, and education. This research provides a framework for integrating two well-known theories of motivation (i.e., SDT and Flow theory) together. Various studies have utilized the explanatory power of these theories separately within the video game engagement context. This integration opens the door for researchers to achieve greater synergies by bringing together the findings of studies that are based on these two theories in answering new research questions. Additionally, this research furthers our understanding of the impact that a particular social context has on experiences of users.

Recent studies have touched on the role of competition in video games [61,24,101]. However, to the best of our knowledge, the current investigation provides the first theoretical model for explaining how Situational and Dispositional Competitiveness can contribute to the experience of Flow and Satisfaction of video games. As Graziano et al. [86] discussed, competitiveness should be analyzed based on various levels of personality, perception, and behavior. This research enabled this analysis by showing the relationships and effects of the two competitiveness aspects, which have not been previously investigated together in the context of video gaming.

In addition to the core objectives of the main study mentioned earlier, this research examined how the construct of Flow could be modeled as a second-order reflective construct. As earlier research suggests, Flow is a second-order construct and should be modeled as a reflective construct that includes a subset of original Flow theory dimensions, which are relevant to the context that it is being used in [123]. These findings provide researchers further guidance on how to operationalize this complex concept.

From a practitioner's perspective, designers of educational video games for schools and organizations can benefit by obtaining a richer understanding of the factors that can lead to deep involvement of learners or employees. This research showed that competition can enhance existing systems and create the Flow experience for learners. It is important for the designers of such systems to limit the effect of extrinsic rewards in order to avoid the creation of excessive extrinsic motivation, thus limiting the intrinsic interest of students and employees to succeed in a competitive activity. As earlier research has shown, if the effect of extrinsic rewards (such as financial or promotional incentives) increases, the intrinsic value of video games that creates Flow and Satisfaction would decrease [34].

Moreover, this research showed that by manipulating the mode of competition in educational video games and Gamified work-related systems, practitioners can create more Situational Competitiveness, excitement, and ultimately more Flow experience and Satisfaction. The findings of this research showed that the element of competition can be more effective if the mode of competition is designed in such a way that players can compare their performance to their friends and colleagues and therefore compete with them. Even though playing against a computer does not create the same level of excitement and Flow as competing against a human, it allows for the creation of an adaptive system that increases the Challenge as the player develops new sets of skills. In conjunction with human-operated opponents, these adaptive systems can be used for training and learning, which can be used prior to matching players to compete with one another.

8. Limitations and future research

As with most empirical studies, some limitations for this research are acknowledged. First, self-reported surveys were used to test the hypotheses and structural model. Common method variance test was conducted to eliminate the potentiality of any bias as a result of the cross-sectional design of the research. Even though the results of the common method variance analysis indicated that there was no likely potential bias, it is advisable to use alternative and complementary approaches to measure the constructs and triangulate with the self-reported data. For example, Arousal can also be measured through physiological measures such as EEG (electroencephalogram), GSR (galvanic skin response), or heart rate. Challenge could also be manipulated by researchers rather than using a self-report measure, similar to Abuhamdeh and Csikszentmihalyi's [124] research design. Engagement can be measured in a longitudinal study where the continuing usage of players is observed throughout a period of time.

Second, the study was conducted among North American students, which limits the generalizability of the results to other countries. The majority of the participants were undergraduate students aged between 17 and 23. Despite the fact that Millennial students represent an appropriate sample for this context, in order to generalize the findings of this study's results, non-Canadians, non-students, and diverse age groups should be investigated.

The analysis of control variables revealed some interesting results. It was found that previous experiences (Internet, Computer, and Gaming), first gaming experience as well as education and age play a role in how much people perceive a video game to be challenging or exciting or how much they engage in the game. As such, future research can probe further into the role these variables play in understanding video game experiences.

Finally, video game addiction was not investigated in this research. Despite the evidence that engagement and addiction are separate constructs [78], recent studies have shown that engagement could be a stepping stone for addiction [125]. Future studies should examine in depth the dual perspective of engagement/addiction, in the context of video games. It is important to understand how various elements, such as competition, can play a role in engaging or enabling problematic behavior among video gameplayers. Various environmental and personal factors such as the ones proposed in other works [126] could be included in such studies.

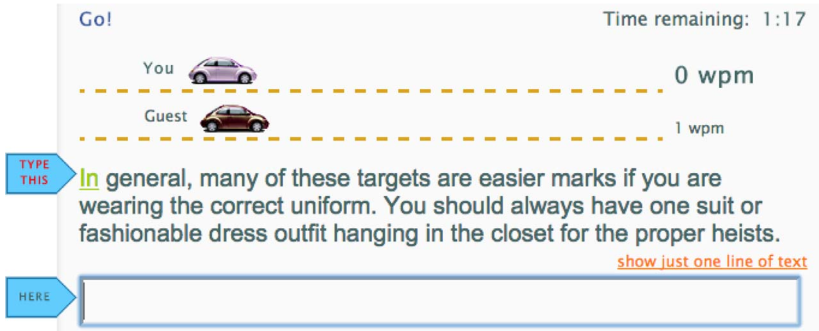
9. Conclusion

The main objective of this research was to study the role of competition in video games, which could be used for engaging students and employees for learning and work-related outcomes. As younger generations are playing more and more video games, it becomes increasingly important for schools and workplaces to harness this technology to help achieve positive outcomes. This study investigated the importance of competition elements in engaging students in an educational video game by validating the proposed model of competitive video gameplaying through an extensive laboratory experiment involving 114 participants. The findings of the main study supported the significant effect of competition on experiencing Flow and feeling satisfied from the video gameplaying experience. Situational Competitiveness increased the chance of being in a state of Flow by influencing the level of Challenge of the video game and Arousal or excitement during the game. This research also aimed to analyze the various effects of situational and personal differences on the level of Situational Competitiveness. The experiment's data supported the hypotheses that various levels of Dispositional Competitiveness and various modes of Competition (i.e., no competition, competing against a computer, competing against a stranger, and competing against a familiar person in increasing order) have increasing positive effects on Situational Competitiveness of a video game. Social Presence also mediated the relationship between competition mode and Situational Competitiveness.

Overall, this research showed the importance of competition as a driver of video game engagement and satisfaction. This work offered some insights for other hedonic IS and provided guidelines and possible avenues for future IS research in this area. Even though the process through which competition enables video gameplayers to experience Flow was critically examined and accounted for, there is much more to discover in the increasingly relevant area of educational and work-related video games.

Appendix A. Experimental Game

During the experiment, participants were asked to play a simple video game with educational content. The video game that was chosen for the experiment was TypeRacer™ (http://play.typeracer.com/), which is a simple typing game that is used to increase one's typing speed. As players advance in the selected text, their racing car advances in the field toward the finish line relative to the length of the text. If the player makes a mistake while typing the text, the car would stop and the text would turn red. A screen shot of this game is shown below.



Appendix B. Measurement Scales

Constructs and the references for the items are outlined in the following table. All the items are measured using a seven-point Likert scale anchored at 1 (Strongly disagree) and 7 (Strongly agree), except for the Situational Competitiveness construct that was anchored at 1 (Rarely) and 7 (Often).

Construct	Reference	Items
Dispositional Competitiveness (Personality)	[127]	1. I enjoy working in situations involving competition with others.
		2. It is important to me to perform better than others on a task.
		3. In general, I feel that winning is important.
		4. It annoys me when other people perform better than I do.
		5. I try harder when I'm in competition with other people.
Social Presence	[128]	1. There is a sense of human contact in the game.
		2. There is a sense of personalness in the game.
		3. There is a sense of sociability in the game.
		4. There is a sense of human warmth in the game.
		5. There is a sense of human sensitivity in the game.
Situational Competitiveness	[129]	1. To what extent did you feel like you were competing with someone else.
		2. How hard were you trying to win the game.
		3. How competitive was this video game
		4. To what extent did this video game involve competition.
Arousal	[121]	1. When I was playing the game, I felt (acted) …
		1. Active
		2. Energetic
		3. Vigorous
		4. Sleepy (R)
		5. Excited
Challenge	[56]	1. Playing the TypeRacer game challenges me to perform to the best of my ability.
		2. Playing the TypeRacer game provides a good test of my skills.
		3. I find that playing the TypeRacer game stretches my capabilities to my limits.
Flow: Focused Immersion	[52]	1. While playing the game, I am able to block out most other distractions.
		2. While playing the game, I am absorbed in what I am doing.
		3. While playing the game, I am immersed in the task I am performing.
		4. When playing the game, I get distracted by other attentions very easily.
		5. While playing the game, my attention does not get diverted very easily.
Flow: Heightened Enjoyment		1. I have fun playing the game.
		2. Playing the game provides me with a lot of enjoyment.
		3. I enjoy playing the game.
		4. Playing the game bores me. (R)
Flow: Temporal Dissociation		1. Time appears to go by very quickly when I am playing the game.
		2. Sometimes I lose track of time when I am playing the game.
		3. Time flies when I am playing the game.
		4. Most times when I play video games, I end up spending more time than I had planned.
		5. I often spend more time playing video games than I had intended.
Satisfaction	[130]	1. All things considered, I am very satisfied with the TypeRacer Game.
		2. Overall, my interaction with the TypeRacer game is very satisfying.

References

[1] G. de Prato, C. Feijoo, J.P. Simon, Innovations in the video game industry: changing global markets, Commun. Strateg. (2014) 17.

[2] Entertainment Software Association, Essential Facts About the Computer and Video Game Industry: 2016 Sales, Demographic, and Usage Data, (2016) http://essentialfacts.theesa.com/Essential-Facts-2016.pdf.

[3] D. Williams, N. Yee, S.E. Caplan, Who plays, how much, and why? Debunking the stereotypical gamer profile, J. Comput.-Mediated Commun. 13 (4) (2008) 993–1018.

[4] M.M. Skoric, L.L.C. Teo, R.L. Neo, Children and video games: addiction, engagement, and scholastic achievement, Cyberpsychol. Behav.: Impact Internet Multimedia Virt. Real. Behav. Soc. 12 (5) (2009) 567–572.

[5] R.T.a. Wood, M.D. Griffiths, A. Parke, Experiences of time loss among videogame players: an empirical study, Cyberpsychol. Behav.: Impact Internet Multimedia Virt. Real. Behav. Soc. 10 (1) (2007) 38–44.

[6] I. Granic, A. Lobel, R.C. Engels, The benefits of playing video games, Am. Psychol. 69 (1) (2014) 66–78.

[7] S. Osmanovic, L. Pecchioni, Beyond entertainment: motivations and outcomes of video game playing by older adults and their younger family members, Games Cult. 11 (1–2) (2016) 130–149.

[8] J.C. Beck, M. Wade, Got Game: How the Gamer Generation Is Reshaping Business Forever, Harvard Business Press, 2004.

[9] J. Feiertag, Z.L. Berge, Training generation N: how educators should approach the net generation, Educ. Train. 50 (6) (2008) 457–464.

[10] A. Collins, R. Halverson, Rethinking Education in the Age of Technology: The Digital Revolution and the Schools, Teachers College, New York, 2009.

[11] C.S. Wiseman, S. McConnell, The value of collaboration and game play, Asian J. Educ. e-Learn. 4 (3) (2016) 104–119.

[12] J.M. Twenge, Simon and Schuster (Ed.), Generation Me: Why Today's Young Americans Are More Confident, Assertive, Entitled–and More Miserable than Ever Before, Free Press, 2006.

[13] D. Edery, E. Mollick, Changing the Game: How Video Games Are Transforming the Future of Business, Ft Pr, (2009).

[14] J.P. Gee, What video games have to teach us about learning and literacy, Comput. Entertain. 1 (1) (2003) 20.

[15] D.-J. van der Zee, B. Holkenborg, S. Robinson, Conceptual modeling for simulation-based serious gaming, Decis. Support Syst. 54 (1) (2012) 33–45.

[16] B. Sawyer, P. Smith, Serious games taxonomy, Slides from the Serious Games Summit at the Game Developers Conference (2008).

[17] J.J. Vogel, D.S. Vogel, J. Cannon-Bowers, C.A. Bowers, K. Muse, M. Wright, Computer gaming and interactive simulations for learning: a meta-analysis, J. Educ. Comput. Res. 34 (2006) 229–243.

[18] T. Sitzmann, A meta-analytic examination of the instructional effectiveness of computer-based simulation games, Personn. Psychol. 64 (2) (2011) 489–528.

[19] P. Wouters, C. van Nimwegen, H. van Oostendorp, E.D. van der Spek, A meta-analysis of the cognitive and motivational effects of serious games, J. Educ. Psychol. 105 (2013) 249–265.

[20] D.B. Clark, E.E. Tanner-Smith, S.S. Killingsworth, Digital games, design, and learning: a systematic review and meta-analysis, Rev. Educ. Res. 86 (1) (2016) 79–122.

[21] B. Reeves, J.L. Read, Total Engagement: Using Games and Virtual Worlds to Change the Way People Work and Businesses Compete, Harvard Business School Press, 2009.

[22] S. Sephr, M. Head, The role of competitiveness in the cognitive absorption of video games, Proceedings of the 10th Pre-ICIS HCI Research in MIS Workshop, Shanghai, China, 2011.

[23] N. Yee, Motivations for play in online games, Cyberpsychol. Behav.: Impact Internet Multimedia Virt. Real. Behav. Soc. 9 (6) (2006) 772–775.

[24] H. Song, J. Kim, K.E. Tenzek, K.M. Lee, The effects of competition and competitiveness upon intrinsic motivation in exergames, Comput. Human Behav. 29 (4) (2013) 1702–1708.

[25] S. Kelle, S. SigurÐarson, W. Westera, M. Specht, Game-Based life-Long learning, E-Infrastructures and Technologies for Lifelong Learning: Next Generation Environments, IGI Global, 2010.

[26] E.L. Deci, R.M. Ryan, Intrinsic Motivation and Self-determination in Human Behavior, Springer, 1985.

[27] M. Csikszentmihalyi, Beyond Boredom and Anxiety, Jossey-Bass Publishers, San Francisco, CA, 1975.

[28] R.M. Ryan, E.L. Deci, Intrinsic and extrinsic motivations: classic definitions and new directions, Contemp. Educ. Psychol. 25 (1) (2000) 54–67.

[29] E.L. Deci, R.M. Ryan, A motivational approach to self: integration in personality, Nebraska Symposium on Motivation 38 (1991) 237–288.

[30] E.L. Deci, R.M. Ryan, The empirical exploration of intrinsic motivational processes, Adv. Exp. Soc. Psychol. 13 (1980) 39–80.

[31] E.L. Deci, R.M. Ryan, The 'What' and 'Why' of goal pursuits: human needs and the self-determination of behavior, Psychol. Inq. 11 (4) (2000) 227–268.

[32] E.L. Deci, R.M. Ryan, Handbook of Self-determination Research, University Rochester Press, 2002.

[33] J. Schüler, V. Brandstätter, How basic need satisfaction and dispositional motives interact in predicting flow experience in sport, J. Appl. Soc. Psychol. 43 (4) (2013) 687–705.

[34] E.L. Deci, G. Betley, J. Kahle, L. Abrams, J. Porac, When trying to win: competition and intrinsic motivation, Pers. Soc. Psychol. Bull. 7 (1) (1981) 79–83.

[35] J.M. Tauer, J.M. Harackiewicz, Winning isn't everything: competition, achievement orientation, and intrinsic motivation•, J. Exp. Soc. Psychol. 35 (3) (1999) 209–238.

[36] R.J. Vallerand, L.I. Gauvin, W.R. Halliwell, Negative effects of competition on children's intrinsic motivation, Soc. Psychol. 126 (5) (1986) 649–656.

[37] R.S. Weinberg, A. Jackson, Competition and extrinsic rewards: effect on intrinsic motivation and attribution, Res. Q. 50 (3) (1979) 494–502.

[38] E.L. Deci, R. Koestner, R.M. Ryan, A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation, Psychol. Bull. 125 (6) (1999) 627–700.

[39] R.G. Ross, E. den Haag, The Fabric of Society, Harcourt, Brace & Company, 1957.

[40] E. McAuley, V.V. Tammen, The effects of subjective and objective competitive outcomes on intrinsic motivation, J. Sport Exerc. Psychol. 11 (1) (1989) 84–93.

[41] C.-P. Lin, A. Bhattacherjee, Extending technology usage models to interactive hedonic technologies: a theoretical model and empirical test, Inf. Syst. J. 20 (2) (2010) 163–181.

[42] J. Wu, X. Lu, Effects of extrinsic and intrinsic motivators on using utilitarian, hedonic, and dual-purposed information systems: a meta-analysis, J. Assoc. Inf. Syst. 14 (3) (2013) 153–191.

[43] C.W. Holsapple, J. Wu, User acceptance of virtual worlds: the Hedonic framework, ACM SIGMIS Database 38 (4) (2007) 86–89. ACM.

[44] J. Moon, Extending the TAM for a World-Wide-Web context, Inf. Manage. 38 (4) (2001) 217–230.

[45] M. Csikszentmihalyi, Flow: The Psychology of Optimal Experience: Steps Toward Enhancing the Quality of Life, Harper Collins Publishers, 1991.

[46] L. Deng, D.E. Turner, R. Gehling, B. Prince, User experience, satisfaction, and continual usage intention of IT, Eur. J. Inf. Syst. 19 (1) (2010) 60–75.

[47] Z. Deng, Y. Lu, K.K. Wei, J. Zhang, Understanding customer satisfaction and loyalty: an empirical study of mobile instant messages in China, Int. J. Inf. Manage. 30 (4) (2010) 289–300.

[48] M. Csikszentmihalyi, J. LeFevre, Optimal experience in work and leisure, J. Pers. Soc. Psychol. 56 (5) (1989) 815–822.

[49] M. Csikszentmihalyi, Finding Flow: The Psychology of Engagement with Everyday Life, Basic Books, 1997.

[50] G.D. Ellis, J.E. Voelkl, C. Morris, Measurement and analysis issues with explanation of variance in daily experience using the flow model, J. Leis. Res. 26 (4) (1994) 337–356.

[51] F. Massimini, M. Carli, The systematic assessment of flow in daily experience, in: Csikszentmihalyi & Csikszentmihalyi (Ed.), Optimal Experience: Psychological Studies of Flow in Consciousness, Cambridge University Press, New York, NY, US, 1988, pp. 266–287.

[52] R. Agarwal, E. Karahanna, Time flies when you're having fun: cognitive absorption and beliefs about information technology usage 1, MIS Q. 24 (4) (2000) 665–694.

[53] D. Choi, J. Kim, S. Kim, ERP training with a web-based electronic learning system: the flow theory perspective, Int. J. Hum. Comput. Stud. 65 (3) (2007) 223–243.

[54] T.-J. Chou, C.-C. Ting, The role of flow experience in cyber-game addiction, Cyberpsychol. Behav.: Impact Internet Multimedia Virt. Real. Behav. Soc. 6 (6) (2003) 663–675.

[55] M.L. Korzaan, Going with the flow: predicting online purchase intentions, J. Comput. Inf. Syst. 43 (4) (2003) 25–31.

[56] T.P. Novak, D.L. Hoffman, Y.F. Yung, Measuring the customer experience in online environments: a structural modeling approach, Market. Sci. 19 (1) (2000) 22–42.

[57] N. Shin, Online learner's 'flow' experience: an empirical study, Brit. J. Educ. Technol. 37 (5) (2006) 705–720.

[58] Y. Xia Skadberg, J.R. Kimmel, Visitors' flow experience while browsing a web site: its measurement, contributing factors and consequences, Comput. Human Behav. 20 (3) (2004) 403–422.

[59] S. Abuhamdeh, A conceptual framework for the integration of flow theory and cognitive evaluation theory, Advances in Flow Research, Springer, New York, 2012, pp. 109–121.

[60] R.J. Vallerand, G.F. Losier, An integrative analysis of intrinsic and extrinsic motivation in sport, J. Appl. Sport Psychol. 11 (1) (1999) 142–169.

[61] D. Liu, X. Li, R. Santhanam, Digital games and beyond: what happens when players compete, MIS Q. 37 (1) (2013) 111–124.

[62] J. Kowal, M.S. Fortier, Motivational determinants of flow: contributions from self-determination theory, J. Soc. Psychol. 139 (3) (1999) 355–368.

[63] M.J. Mills, C.J. Fullagar, Motivation and flow: toward an understanding of the dynamics of the relation in architecture students, J. Psychol. 142 (5) (2008) 533–556.

[64] S. Engeser, A. Schiepe-Tiska, Historical lines and an overview of current research on flow, Advances in Flow Research, Springer, New York, 2012, pp. 1–22.

[65] C.S. Rigby, a.K. Przybylski, Virtual worlds and the learner hero: how today's video games can inform tomorrow's digital learning environments, Theory Res. Educ. 7 (2) (2009) 214–223.

[66] P. Hernon, J.R. Whitman, Delivering Satisfaction and Service Quality: A Customer-based Approach for Libraries, American Library Association, 2001.

[67] R.L. Oliver, Effect of expectation and disconfirmation on postexposure product evaluations: an alternative interpretation, J. Appl. Psychol. 62 (4) (1977) 480–486.

[68] C.-L. Hsu, C.-C. Yu, C.-C. Wu, Exploring the continuance intention of social networking websites: an empirical research, Inf. Syst. E-Bus. Manage. 12 (2) (2014) 139–163.

[69] Y.S. Kang, H. Lee, Understanding the role of an IT artifact in online service continuance: an extended perspective of user satisfaction, Comput. Human Behav. 26 (3) (2010) 353–364.

[70] C.-C. Chang, 'Examining users' intention to continue using social network games: a flow experience perspective, Telemat. Inform. 30 (4) (2013) 311–321.

[71] R.L. Oliver, A cognitive model of the antecedents and consequences of satisfaction decisions, J. Mark. Res. 17 (4) (1980) 460–469.
[72] C.-L. Hsu, Exploring the player flow experience in E-game playing, Int. J. Technol. Hum. Interact. 6 (2) (2010) 47–64.
[73] J.A. Ghani, S.P. Deshpande, Task characteristics and the experience of optimal flow in human—computer interaction, J. Psychol. 128 (4) (1994) 381–391.
[74] M. Koufaris, Applying the technology acceptance model and flow theory to online consumer behavior, Inf. Syst. Res. 13 (2) (2002) 205–223.
[75] J. Webster, H. Ho, Audience engagement in multimedia presentations, ACM SIGMIS Database 28 (2) (1997) 63–77.
[76] D.L. Hoffman, T.P. Novak, Marketing in hypermedia computer-Mediated environments: conceptual foundations, J. Mark. 60 (3) (1996) 50.
[77] J.M. Pearce, M. Ainley, S. Howard, The ebb and flow of online learning, Comput. Human Behav. 21 (5) (2005) 745–771.
[78] J. Charlton, I. Danforth, Distinguishing addiction and high engagement in the context of online game playing, Comput. Human Behav. 23 (3) (2007) 1531–1548.
[79] G. Matthews, D. Davies, Individual differences in energetic arousal and sustained attention: a dual-task study, Personal. Individ. Differences 31 (4) (2001) 575–589.
[80] T.W. Robbins, Arousal systems and attentional processes, Biol. Psychol. 45 (1–3) (1997) 57–71.
[81] P.S. Raju, Optimum stimulation level: its relationship to personality, demographics, and exploratory behavior, J. Consum. Res. 7 (3) (1980) 272.
[82] E. Brown, P. Cairns, A grounded investigation of game immersion, Extended Abstracts of the 2004 Conference on Human Factors and Computing Systems – CHI '04, New York, New York, USA: ACM Press, 2004 pp. 1297.
[83] S. Pace, A grounded theory of the flow experiences of Web users, Int. J. Hum. Comput. Stud. 60 (3) (2004) 327–363.
[84] P. Léger, H.E.C. Montréal, F.D. Davis, J. Perret, M.M. Dunaway, S.M. Walton PhD, Psychophysiological measures of cognitive absorption psychophysiological measures of cognitive absorption, Proceedings of the Special Interest Group on Human-Computer Interaction (SIGHCI) (2010).
[85] L. Deng, M.S. Poole, Affect in web interfaces: a study of the impacts of web page visual complexity and order, MIS Q. 34 (4) (2010) 711–730.
[86] W.G. Graziano, E.C. Hair, J.F. Finch, Competitiveness mediates the link between personality and group performance, J. Pers. Soc. Psychol. 73 (6) (1997) 1394–1408.
[87] C. Jennett, a Cox, P. Cairns, S. Dhoparee, a Epps, T. Tijs, a. Walton, Measuring and defining the experience of immersion in games, Int. J. Hum. Comput. Stud. 66 (9) (2008) 641–661.
[88] M.W. Eysenck, Arousal, learning, and memory, Psychol. Bull. 83 (3) (1976) 389–404.
[89] W.G. Graziano, A.B. Feldesman, D.F. Rahe, Extraversion, social cognition, and the salience of aversiveness in social encounters, J. Pers. Soc. Psychol. 49 (4) (1985) 971–980.
[90] K. Titz, D. Andrus, J. Miller, others, Hedonistic differences between mechanical game players and table game players: an exploratory investigation on the road to a comprehensive theory for gambling, UNLV Gaming Res. Rev. J. 6 (1) (2001) 23–32.
[91] N. Ravaja, T. Saari, M. Turpeinen, J. Laarni, M. Salminen, M. Kivikangas, Spatial presence and emotions during video game playing: does it matter with whom you play? Presence: Teleoperators Virt. Environ. 15 (4) (2006) 381–392.
[92] P. Vorderer, T. Hartmann, C. Klimmt, Proceedings of the second international conference on Entertainment computing, Proceedings of the Second International Conference on Entertainment Computing (2003) 1–9.
[93] J. Reeve, E.L. Deci, Elements of the competitive situation that affect intrinsic motivation, Pers. Soc. Psychol. Bull. 22 (1) (1996) 24–33.
[94] S. Udvari, B. Schneider, Competition and the adjustment of gifted children: a matter of motivation, Roeper Rev. 22 (4) (2000) 212–216.
[95] P. Vorderer, T. Hartmann, C. Klimmt, Explaining the enjoyment of playing video games: the role of competition, Proceedings of the Second International Conference on Entertainment Computing (2003) 1–9.
[96] D. Cyr, M. Head, A. Ivanov, Perceived interactivity leading to e-loyalty: development of a model for cognitive-affective user responses, Int. J. Hum. Comput. Stud. 67 (10) (2009) 850–869.
[97] K. Hassanein, M. Head, Manipulating perceived social presence through the web interface and its impact on attitude towards online shopping, Int. J. Hum. Comput. Stud. 65 (8) (2007) 689–708.
[98] R.B. Zajonc, Social facilitation, Science 149 (3681) (1965) 269–274.
[99] S.M. Garcia, A. Tor, The N-Effect: more competitiors, less competition, Psychol. Sci. 20 (7) (2009) 871–877.
[100] D.W. Straub, E. Karahanna, Knowledge worker communications and recipient availability: toward a task closure explanation of media choice, Organiz. Sci. 9 (2) (1998) 160–175.
[101] D. Weibel, B. Wissmath, S. Habegger, Y. Steiner, R. Groner, Playing online games against computer- vs. human-controlled opponents: effects on presence, flow, and enjoyment, Comput. Human Behav. 24 (5) (2008) 2274–2291.
[102] H.H. Kelley, A.J. Stahelski, Social interaction basis of cooperators' and competitors' beliefs about others, J. Pers. Soc. Psychol. 16 (1) (1970) 66–91.
[103] K.R. Coventry, R.I. Brown, Sensation seeking, gambling and gambling addictions, Addiction 88 (4) (1993) 541–554.
[104] L. Festinger, A theory of social comparison processes, Hum. Relat. 7 (2) (1954) 117–140.
[105] J.C. Beck, M. Wade, The Kids Are Alright: How the Gamer Generation Is Changing the Workplace, Harvard Business Press, 2006.
[106] W.W. Chin, The partial least squares approach to structural equation modeling, Modern Methods for Business Research 295 Lawrence Erlbaum Associates, Mahwah: NJ, 1998, pp. 295–336 2.
[107] D. Gefen, D.W. Straub, M.C. Boudreau, Structural equation modeling and regression: guidelines for research practice, Commun. Assoc. Inf. Syst. 4 (7) (2000) 2–77.
[108] J.L. Roldán, M.J. Sánchez-Franco, Variance-based structural equation modeling: guidelines for using partial least squares, Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems, (2012), pp. 193–221.
[109] H. Teo, L. Oh, C. Liu, K. Wei, An empirical study of the effects of interactivity on web user attitude, Int. J. Hum.-Comput. Stud. 58 (3) (2003) 281–305.
[110] J.K. Burgoon, J.A. Bonito, B. Bengtsson, C. Cederberg, M. Lundeberg, L. Allspach, Interactivity in human–computer interaction: a study of credibility, understanding, and influence, Comput. Human Behav. 16 (6) (2000) 553–574.
[111] J.C. Nunnally, I.H. Bernstein, Psychological Theory, McGraw-Hill, New York, 1994.
[112] C. Fornell, D.F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, J. Mark. Res. XVIII (1981) 39–50.
[113] S.B. MacKenzie, P.M. Podsakoff, N.P. Podsakoff, Construct measurement and validation procedures in MIS and behavioral research: integrating new and existing techniques, MIS Q. 35 (2) (2011) 293–334.
[114] D. Gefen, D. Straub, A practical guide to factorial validity using PLS-Graph: tutorial and annotated example, Commun. Assoc. Inf. Syst. 16 (1) (2005) 5.
[115] R.F. Falk, N.B. Miller, A Primer for Soft Modeling, University of Akron Press, 1992.
[116] M. Wetzels, G. Odekerken-Schroder, C. Van Oppen, Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration, Manage. Inf. Syst. Q. 33 (1) (2009) 11.
[117] J. Cohen, Statistical Power Analysis for the Behavioral Sciences, Lawrence Erlbaum, 1988.
[118] P.M. Podsakoff, S.B. MacKenzie, J.Y. Lee, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, J. Appl. Psychol. 88 (5) (2003) 879–903.
[119] R.L. Wakefield, D. Whitten, Mobile computing: a user study on hedonic/utilitarian mobile device usage, Eur. J. Inf. Syst. 15 (3) (2006) 292–300.
[120] E.L. Deci, R.M. Ryan, The general causality orientations scale: self-determination in personality, J. Res. Personal. 19 (2) (1985) 109–134.
[121] D.-M. Koo, J.-H. Lee, Inter-relationships among dominance, energetic and tense arousal, and pleasure, and differences in their impacts under online vs. offline environment, Comput. Human Behav. 27 (5) (2011) 1740–1750.
[122] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, Multivariate Data Analysis, Prentice Hall, Englewood Cliffs, NJ, 2009.
[123] S. Sepehr, M. Head, A Meta-Analysis of The Effect of Flow on Attitude and Intention to Use of IT Systems, Administrative Sciences Association of Canada (ASAC), Halifax, Canada, 2012.
[124] S. Abuhamdeh, M. Csikszentmihalyi, The importance of challenge for the enjoyment of intrinsically motivated, goal-directed activities, Personal. Soc. Psychol. Bull. 38 (3) (2012) 317–330.
[125] S. Seok, B. DaCosta, Distinguishing addiction from high engagement: an investigation into the social lives of adolescent and young adult massively multiplayer online game players, Games Cult. 9 (4) (2014) 227–254.
[126] S. Sepehr, M. Head, Dualistic model of passionate video gameplay: addiction or flow? The 11th Pre-ICIS Annual Workshop on HCI Research in MIS, Orlando, USA, 2012.
[127] J. Spence, R. Helmreich, Achievement-Related Motives and Behaviors, Achievement and Achievement Motives: Psychological and Sociological Approaches, WH Freeman, 1983.
[128] D. Gefen, D.W. Straub, Managing user trust in B2C e-Services, e-Serv. J. 2 (2) (2003) 7–24.
[129] C.a. Anderson, N.L. Carnagey, Causal effects of violent sports video games on aggression: is it competitiveness or violent content? J. Exp. Soc. Psychol. 45 (4) (2009) 731–739.
[130] B.H. Wixom, P.A. Todd, A theoretical integration of user satisfaction and technology acceptance, Inf. Syst. Res. 16 (1) (2005) 85–102.

Dr. Sepandar Sepehr is a recent PhD graduate from the DeGroote School of Business at the McMaster University. He also holds an MS in Computer Science from the McMaster University and BS in Computer Software Engineering from the University of Tehran, Iran. His main research area falls under the discipline of human-computer interaction. His research interests include adoption of, continuing use of, engagement in, and addiction to information systems, in particular video games used for improving learning and working experience and producing positive health outcomes.

Dr. Milena Head is a Professor of Information Systems and the Wayne C. Fox Chair in Business Innovation at the DeGroote School of Business, McMaster University. Her research interests relate to human-computer interaction, technology adoption, and interface design with focus on age, gender, and culture. She has published over 100 papers in academic journals, books, and conferences including MIS Quarterly, Information Systems Research, Information & Management, International Journal of Human-Computer Studies, Interacting with Computers, International Journal of Electronic Commerce, among others. Dr. Head has been the recipient of several research and teaching awards and serves on numerous journal editorial boards.