Abstract

Serious games are increasingly being integrated into a diverse set of courses and portrayed as a means of helping train individuals to acquire knowledge and professional skills, thereby improving the learning effectiveness. In order to design an effective serious game, academics and practitioners have studied the characteristics of game design that influence learning performance. One of key characteristics, goal clarity, is believed to be an important element for a successful serious game. Thus, we used the flow theory as a theoretical foundation to propose a conceptual model based on the flow theory proposing that the relationships among goal clarity, concentration, and learning effectiveness are moderated by the type of learning environment. In the future, this study plan to use a mixed methods evaluation methodology that incorporate both qualitative and quantitative methods to evaluate the experiment.

Keywords

Serious game, goal clarity, concentration, learning effectiveness, flow theory.
Introduction

Serious games are facilitated by computer game platforms and are designed for primarily educational purposes (Jarvenpaa et al. 2008; Liu et al. 2013; Zyda 2005). The need for serious games is substantial, with recent estimates from Ambient Insight predicting the revenues will reach approximately US$ 2.3 billion by 2017 with a growth rate of 8.3% annually (Ambient Insight 2013). Serious games are increasingly being integrated into a diverse set of courses and portrayed as a means of helping train individuals to acquire knowledge and professional skills, thereby improving the learning effectiveness (Ebner and Holzinger 2007; Gutierrez and Sastron 2009; Johnson et al. 2013; Keskinocak et al. 2011; Madni 2013; Yang 2012).

In order to design an effective serious game, academics and practitioners have studied the characteristics of game design that influence learning performance. Characteristics such as competition and cooperation between players (Liu et al. 2013; Schafer et al. 2013), playfulness (Kiili 2005; Tao et al. 2009), feedback (Kiili 2005; Sweetser and Wyeth 2005), and clear goals (Kiili 2005) are important to the success of serious games and consequently the performance of students’ learning. Apparently, one of key characteristics, goal clarity, is believed to be an important element for a successful serious game. Goal clarity in games will help the players understand what the task goals are and attract their attentions in the early stage of game (Federoff 2002; Sweetser and Wyeth 2005). For example, a management serious game enables players to gain insights regarding supply chain management by taking on a manufacturer in simulated surroundings. During the game time, players conduct the different levels of supply chain projects along with the goals of developing win-win supply chain relationships, such as assessing various production strategies and customer relationship management policies, and maximizing their own profits (Keskinocak et al. 2011). However, few studies emphasize goal clarity as an important element when designing a serious game (Fu et al. 2009; Kiili 2005; Sweetser and Wyeth 2005), and do not test it empirically. Therefore, in this study, we develop a serious game that emphasizes a set of clear goals, test it in classrooms, conduct experiments, and evaluate whether it influences the players’ behavior and learning effectiveness.

Prior research indicates that serious games in some cases fail to improve players’ concentration since the goals of games were not well described (Ma et al. 2011). This leads to players feeling that games are mundane, and fails to raise their curiosity. Although the effect of concentration has been emphasized in consumer behavior research (Guo and Klein 2009; Jung et al. 2009) and virtual organization research (Rutkowski et al. 2007), it has been generally ignored in serious game research. The key issue in designing serious game is how to sustain players’ concentration during the game. One of the key benefits of using a serious game is to motivate the players to engage in the game tasks intently (Schafer et al. 2013). As the players concentrate by being immersed in a game task, they are aware of only a select range of information (Csikszentmihalyi 1990). Therefore, in this current study, we sought to answer the research question: does goal clarity of game design affect students’ concentration in learning, which in turn, increase their learning effectiveness?

We searched for theories which linked goal clarity to concentration in game-based learning literature and identified cognitive absorption theory (e.g., Magni et al. 2013), intrinsic motivation theory (e.g., Bedek et al. 2012; Erhel and Jamet 2013; Huang et al., 2010; Tao et al., 2009), hedonic-motivation system adoption model (Lowry et al. 2013) and flow theory (e.g., Kiili 2005; Fu et al. 2009). In the information system (IS) field, flow theory has been widely adopted to study individual’s behavior on IT usage (Agarwal and Karahanna 2000). Liu et al. (2013) suggest that flow theory provides an excellent anchor to study game designs and their impacts on players’ managerial and skill development.

To answer the research question, we used the flow theory as a theoretical foundation to propose the relationships among goal clarity, concentration, and learning effectiveness and identified the moderating role of learning environments (serious game learning; SGL versus no serious game learning; NSGL). The next section reviews the literature and develops the hypotheses for this research. This is followed by presenting our suggestions for future direction.
Research model and hypotheses development

Overview

We use flow theory to anchor this research (Csikszentmihalyi 1990). The flow theory was initiated in the field of psychology, explaining a person’s subjective state of flow experience in a variety of task contexts (Csikszentmihalyi 1988; 1990). The flow experience is defined as an experiential or psychological state that occurs when individuals engage in skill-related activities (Csikszentmihalyi, 1990; Nakamura and Csikszentmihalyi, 2002; Keller and Blomann, 2008). The original flow framework only mentions the flow experiences that include the ability to concentrate on the task, immediate feedback, a sense of control over actions, deep but effortless involvement, loss of concern for self, clear task goals, an altered sense of time, and a task to accomplish (Csikszentmihalyi 1988). However, in order to explain how the flow experiences occur in a task and what the consequences for flow are, Guo and Klein (2009) suggest that the antecedents and outcomes of flow should be studied. Thus, the revised flow framework proposed by Finneran and Zhang (2003; 2005) and Guo and Klein (2009) has added two majority constructs: flow antecedent and flow outcome. In this study, we use the revised flow framework, and choose goal clarity as a flow antecedent, concentration as a flow experience, and learning effectiveness as a flow outcome.

In addition, we not only focus on the three elements of the flow framework, but also add the type of learning environment as a moderating role to flow framework. There is a need for elaborating on these moderating factors that might impact the successful application of the models of learning (Leidner and Jarvenpaa 1995). Our notion of learning environment moderating the effects of flow perspective is based on the suggestions of Leidner and Jarvenpaa (1995). They suggest that the ideal way to understand whether IT serves as a role for the effective use of non-traditional learning is to compare the effectiveness of IT incorporated into the learning model versus the model without technology (Leidner and Jarvenpaa 1995, pp. 286). It is proposed that a learning environment acts as a moderating variable in the relationship among flow antecedent, flow experience, and flow outcome. Therefore, the type of learning environment as a moderator in flow framework was constrained to instructional methodologies. Students who used the serious game were considered the experimental group and the students who do not use the serious game as the control group (see Figure 1). In the next section, we describe each flow construct.

Figure 1. Research Model

Goal Clarity

Goal clarity defines that the primary and intermediate objectives are presented and defined in a context (Csikszentmihalyi 1993; Sweetser and Wyeth 2005). Researchers have noted that goal clarity acting as an antecedent significantly impacts human behaviors in a variety of contexts. For example, in the context of online shopping, when the customers browse a shopping website with clear objectives, they clearly know what they want to buy. Positive moods and complete immersion are found to keep them engaged in a web
world (Guo and Klein 2009). The dominant literature on entertainment game focuses on the impacts of goal clarity (Hsu and Lu 2004; Keller and Blomann 2008; Sweetser and Wyeth 2005). Goal clarity is the essence of digital game design (kii 2005). This is because that the goal in a game is the primary reason to keep the players in performing the tasks (Johnson and Wiles 2003). In other words, goal clarity is the key element for a game to intrinsically motivate players to engage in a game setting and to retain them in the game experiences. Therefore, we treat goal clarity as a key antecedent for this research and evaluate its impact on serious game.

Concentration

Concentration refers to a centering of attention on a limited stimulus field (Csikszentmihalyi 1975, pp. 40). The most significant requirement for instructors and curriculum designers is to gain the learners’ focused attention on learning materials (Gagne et al. 1988). In general, serious games are capable of providing interesting stimuli based on simulating different levels of real-world tasks. This includes the gaming mechanisms of success and failure situations, time limited mechanisms, scoring and reaching different levels in a highly dynamic virtual universe and an incentive system (Squire and Jenkins 2003). These features of the game are most likely to raise the players’ curiosity, to arouse their enthusiasm, and to promote prolonged and advanced use.

Yet not all researchers are convinced of the utility of serious game in a learning environment if the players lack concentration on the game. For example, serious games may result in students’ failure to concentrate on the game situation (Ma et al. 2011). Ma and her colleagues further explain that the players in a serious game may not have the same motivation, involvement, and concentration as they are in the entertainment game (Ma et al. 2011). This is because the primary purpose of serious games is to educate and train, not be played just for fun (Prensky 2007). The players may encounter a heavy cognitive load and fell boredom and anxiety when playing a serious game (Liu et al. 2011). Although goal clarity and concentration are important in design of games, their impacts on learning effectiveness have yet to be examined in these studies.

Concentration has been identified to positively impact the overall experience of the users working in a virtual environment (Koufaris 2002; Rutkowski et al. 2007; Guo and Klein 2009). Although researchers have frequently advocated the importance of concentration for learning-related research, it is not always treated as a key construct and its impact has not been examined in past research (Hsu and Lu 2004; Lambert et al. 2013; Liao 2006; Moon and Kim 2001). For instance, Hsu and Lu (2004) investigate the effect of playfulness experience, including the dimensions of concentration, curiosity, and enjoyment in a world-wide-web context. Hsu and Lu’s work did not evaluate the effect of concentration individually on the users’ attitude and behavioral intention. In this study, however, we view concentration as a key flow construct and evaluate its impact on learning effectiveness in the context of SGL.

Learning Effectiveness

This study utilizes three measures for learning effectiveness: perceived usefulness, perceived ease of use, and the development of higher-order cognitive skills (HOCS). Both perceived usefulness and perceived ease of use are frequently used to measure students’ behaviors in the use of new technology related to technology-mediated learning in many information technology studies (e.g., Agarwal and Karahanna 2000; Saade and Bahli 2005; Tao et al. 2009). Perceived usefulness and perceived ease of use stem from the concept of technology acceptance model (TAM) and are used to predict the intention to use a particular technology. Davis et al. (1989) defined perceived usefulness as the degree to which a person believes that using a particular system would enhance the job performance. Perceived ease of use can be described as the degree to which a person is able to interact with a particular software artifact (Agarwal and Karahanna 2000; Davis et al. 1989). Previous research holds that perceived usefulness and perceived ease of use for an information technology have a positive effect on behavioral intention to use the information technology (Agarwal and Karahanna 2000; Venkatesh and Morris 2000). Therefore, in this study, both perceived usefulness and ease of use were used to evaluate the degree to which students’ believe that using the serious games would strengthen their learning performance.
HOCS was originally derived from a hierarchy of cognitive levels (Zoller 1993). Cognitive skills are divided into two categories: lower-order cognitive skills (LOCS) and HOCS. HOCS refer to a portfolio of skills developed by the individuals within a specified period of time. It implies an improved ability to identify, integrate, evaluate, and interrelate concepts, and thus make the appropriate decision in a given problem-solving situation (Hingorani et al. 1998; Mbarika et al. 2003). In the context of technology-mediated learning, HOCS represent an engaging process that requires the learners to derive abstract concepts and new knowledge from real-world situations and to learn how to solve problems by identifying, integrating, analyzing and evaluating the information that is provided from IT-mediated instruction (Alavi 1994; Alavi et al. 1995). HOCS can be viewed as an outcome of perceived learning, which is to change the learners’ perceptions of skill and knowledge levels during their learning experience (Alavi et al. 2002; Bond et al. 2014). Therefore, in this study, HOCS was chosen to evaluate the degree to which students’ perceive that using the serious games would improve their critical thinking, problem-solving, and decision-making skills.

The Type of Learning Environment

NSGL was considered in this study since the type of learning environment was chosen as moderating effect. No serious learning method only involves classroom-based lectures setup in which the instructor leads the class using materials, such as textbooks, class slides, and overhead projector during class time (Piccoli et al., 2001). Students in the NSGL environment are able to interact face-to-face with the instructor and ask for repetition of concept if allowed by instructor, which is more communication and immediate responses than other learning environment (Nemanich et al., 2009). However, they cannot control the order and skip over topic in which the material is presented (Piccoli et al., 2001). Although the use of NSGL methods has been used in educational institutions or companies for a long time, this method is no longer the only avenue to success for gaining grounding knowledge concurrent with specific skills training (Piccoli et al., 2001). For example, Hernandez and Rangel (2010) suggest that some complicated knowledge or skills, such as product design skill cannot be taught sufficiently in lectures alone, they need to be a more active learning experience. Based on these considerations, we chose the NSGL as a control instructional method that compared with SGL in this study under the moderating factor.

Serious games, on the other hand, take advantage of the visual effects with a high degree of interactivity, advanced graphics, and gameplay sounds (Prensky 2007). Serious games are particular techniques or attributes of games that can help learners understand complex material faster and better. SGL can be viewed as a virtual world where the learners play simulated events using characters that interact with them, and, in turn, make them learn a concept more thoroughly than what is possible in a classroom setting. Empirical and anecdotal evidences indicate that serious games have benefits on learning effectiveness (e.g., Ebner and Holzinger 2007; Gutierrez and Sastron 2009; Yang 2012). The appropriate use of serious game in a learning environment may increase the level of engagement of the trainees so that they want to play the game and they want to learn how to successfully complete the game (Prensky 2007).

Hypotheses development

We developed a set of moderating effect hypotheses based on flow theory and used two types of learning environments as the moderating factor. These hypotheses are described below.

The Impact of Learning Environment on Goal Clarity and Concentration

Serious games enable players to identify the goals of the task using digital storytelling, different levels of goals in task bars, and mission statements. In doing so, the players increase awareness of goals, thereby increasing their attention toward learning (Li et al. 2013). Serious games with clear goals allow players to simulate real-world dilemmas (Squire and Jenkins, 2003) and experience the consequences when they make certain decisions (Wasko et al. 2011). This may improve students’ motivations and passions to learn, and maintain their concentration on the simulated situation (Huang et al. 2010; Liu et al. 2013). In other words, well-designed serious games apply the real-world cases as the goal-focused activities to provide a
strong context and clear goal structures, helping the students become involved attentively to solve the real-world problems in the game circumstances (Kii 2005). In addition, learning in a serious game enables the development of critical thinking when users receive information about how they are progressing toward goals (Wasko et al. 2011).

In contrast to the SGL, NSGL environment generally provides the instructional goals through class lectures, or using textbooks or lecture notes. In some cases of traditional learning, when a set of learning goals for a given course and task are explained clearly, the students will be able to immerse themselves in learning during the classes and task activities (Beenen and Mrousseau 2010). Yet, if the instructors set the goals of covering the maximum amount of materials in the time allotted, the goals that students aim to accomplish will remain vague (McKeachie 2002). Under these circumstances, the students may experience mental dazzle, or being distracted by irrelevant information and getting frustrated by misunderstanding the contents, resulting in an impairment of their concentration and learning (McKeachie 2002). Thus, we attempt to understand whether goal clarity acts as a better enabler of learners’ concentration in the serious games-based learning than in the NSGL classroom. This leads to the following hypothesis.

**Hypothesis 1**: The relationship between goal clarity and concentration will be stronger in a SGL environment than in a no serious game environment.

The Impact of Learning Environment between Concentration and Learning Effectiveness

Serious games can closely approximate actual working environments with real-life facts or objects that are presented in a virtual environment, which allows the players to communicate using virtual roles, safely take risks, navigate game situations, thereby ensuring them iteratively engage in the learning experience (Kelly 2013). The players in games have the greatest potential for sustaining concentration, resulting in digesting knowledge or concepts efficiently and having a positive perception of a game’s value (Csikszentmihalyi 1990; Sanchez et al. 2011). To maximize the players’ concentration through animation and immersive features of game has tremendous potential to increase students’ learning effectiveness (Squire and Jenkins 2003). Particularly, keeping the students engaged in solving more complex learning tasks that include the different levels of challenges is the way to facilitate the growth regarding students’ HOCS acquisition.

One of the dimensions of cognitive absorption theory, focused immersion, which has the similar notion with the flow state, has a significant influence on users’ perceived usefulness and perceived ease of use (Agarwal and Karahanna 2000; Saade and Bahli 2005). Agarwal and Karahanna’s work contends that game-based training environments are more attractive and enjoyable for players and the players are willing to pay attention on the game, which results in cognitive absorption and amplifies the users’ beliefs about the impacts of game training and its ease of use. In addition, serious games can help students develop their higher-order cognitive skills (Ebner and Holzinger 2007; Gutierrez and Sastron 2009; Kelly 2013; Madni 2013; Yang 2012) since these games have the potential to amplify the learners’ affective, behavioral, and cognitive processes (Garris et al., 2002; Malone 1981). With a game task that produces challenges, dilemmas, or problem solving instantiation, the players may maintain unbroken concentration and enjoyable, thereby developing their critical thinking and creative problem solving skills as they accomplish and learn from the game tasks (Eow and Baki 2009; Kelly 2013).

In contrast, NSGL may not be an effective approach to attract learners’ affective and cognitive processes simultaneously (Sitzmann 2011). Generally, no serious game lacks the instruction embedded in fantasy contents, interesting storytelling, and problem-solving situation to reinforce students’ interest (Cordova and Lepper 1996). Therefore, it is most likely that the students may not concentrate on the course materials and pay attention to the learning issues. Empirical evidences also suggest that gaining the cognitive skills regarding post-training efficacy and higher declarative knowledge were greater for learners taught with serious games (Garris et al. 2002; Vogel et al. 2006). To address this issue, this study examines the moderating effect of learning environments on the relationship between concentration and learning effectiveness using two methods: SGL and NSGL. Thus, this leads to the following hypothesis.
**Hypothesis 2:** The relationship between concentration and learning effectiveness will be stronger in a SGL environment than in a NSGL environment.

The following specific sub-hypotheses were further developed in this study.

**Hypothesis 2a:** The relationship between concentration and perceived usefulness will be stronger in a SGL environment than in a NSGL environment.

**Hypothesis 2b:** The relationship between concentration and perceived ease of use will be stronger in a SGL environment than in a NSGL environment.

**Hypothesis 2c:** The relationship between concentration and improvements in higher-order cognitive skills will be stronger in a SGL environment than in a NSGL environment.

**Future directions and conclusion**

We developed a conceptual model based on the flow theory proposing that the relationships among goal clarity, concentration, and learning effectiveness are moderated by the type of learning environment. The contribution of this study is to extend flow theory to a new context. This theoretical extension not only encourages educators to integrate serious games into courses but also allows practitioners to rethink the characteristics of game design when they design serious games. We propose to use mixed methods evaluation methodology that incorporate both qualitative and quantitative methods to evaluate the experiment. The quantitative and qualitative studies allow us to examine the robustness and generalizability of our hypothesized model. We plan to conduct a longitudinal field experiment adopting a two group measure design (control and experiment groups) and examine two groups that play a serious game and no serious game for two semesters at a southeastern U.S. university. We plan to report the results of the research in the future.

**Reference**


Serious Games: Goal Clarity, Concentration and Learning Effectiveness


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