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Self-regulation influence on game play flow state

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ABSTRACT

The authors use the *Music Flow* digital game with 266 Taiwanese junior high school students to investigate the influence of digital game player self-regulation (SR) on game flow state. Game data were used to probe various aspects of Bandura's (1986) SR learning model and related effects on game flow state as described in Csikszentmihalyi's (1990) flow theory to determine if game information can be used to measure SR during different flow states. A tool for recording stage selection, hit rate, and other real time data was created to monitor and measure flow state among players immersed in interactive play. Self-reaction capabilities were measured in terms of skill- and game-level difficulty during different states. Results indicate that SR exerted a significant and positive effect on flow state. Our main conclusions are (a) flow state was continuously influenced by self-reaction over time; (b) hit rate served as an indicator of self-judgment in terms of challenge, skill and flow state; and (c) flow states in players with distinct self-reaction capabilities were influenced by play stage selection. It is our hope that the method used in this study will help researchers in their efforts to measure and/or analyze player sense of fun in game-based learning environments.

1. Introduction

Researchers are increasingly confirming the ways that digital game-based learning (DGBL) environments help learners develop cognitive operations skills (Papastergiou, 2009). Students in DGBL settings have been described as intrinsically motivated to participate in learning activities at high levels of concentration (Chen, Wigand, & Nilan, 1999; Klimmt, Schmid, & Orthmann, 2009; Vorderer & Bryant, 2006). DGBL environments have also been described as supportive of spontaneous learning and explorative skill development (Ke & Grabowski, 2007; Oliver & Herrington, 2001; Raybourn & Bos, 2005). Kiili (2005) and Lancy (1987) are among researchers who believe that games are most successful at attracting learners when they have clear, pre-established rules that encourage gradual advancement to high levels of complexity, and when they provide immediate feedback that supports a sense of player satisfaction and achievement.

Motivation, pleasure, and player subjectivity are three topics of current interest to game researchers (Papastergiou, 2009). In DGBL contexts, players tend to synthesize, analyze and evaluate multiple modes of information to form strategies such as choosing game stages as part of their efforts to achieve high levels of game competency (Chen & Law, 2015). Due to subjective characteristics such as SR, not all players feel pleasure or achieve effective learning when they play the same games, raising questions regarding how they make adjustments in response to limitations and experiences during game play. DGBL environments give players opportunities to continuously adjust playing processes and to apply SR, self-management, and other skills (Chen & Law, 2015). Our belief that active management is a key factor in maintaining a sense of pleasure and fun is our primary motivation for investigating player flow experiences.

Flow experience, during which players are said to feel "carried away," emerges from a mix of pleasure and satisfaction (Csikszentmihalyi, 1975). Players in flow states become more engaged in activities (Starbuck & Webster, 1991). A sense of flow is also believed to exert long-term influences on player judgment—an important point in light of Wu, Wang and Tsai's (2010) observation of player satisfaction as an influential factor in game play. Other influences on flow experience include motivation (Wan & Chiou, 2006), metacognition (Shats & Solomon, 2002), personality (Faiola, Newlon, Pfaff, & Smyslova, 2013) and capability (Hong et al., 2013).

Self-regulation, which Bandura (1986) first suggested as a primary means through which learners comprehend personal

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performance, is an important factor determining improvement in DGBL environments (Erhel & Jamet, 2013). According to Bandura (1986, 2001), SR consists of three stages: *self-observation,* during which learners analyze game environments, set goals, and monitor performance and the effects of specific actions; *self-judgment,* in which learners evaluate their current performance using personal standards or comparisons with others' performance; and *self-reaction*, during which learners assess their satisfaction levels, metacognitively evaluate their errors, and use the information to create new goals and strategies.

Self-regulation is shaped by behavioral and environmental factors (Zimmerman, 2008). Individuals with better SR skills tend to have higher levels of positive flow affect (Barnett, 1991; Csikszentmihalyi, 1990) and more consistent interaction between emotional experience and ability (Zimmerman, 2002). To match expectations, individuals constantly make strategic decisions and search for certain characteristics when choosing and playing games (Costkyan, 2002), and then make ongoing adjustments in response to game difficulty in order to maintain their flow states (Hunicke & Chapman, 2004). When goals cannot be achieved, at some point players are likely to consciously decrease the difficulty level (Bandura, 1991). Whereas good self-regulators tend to expand their knowledge and cognitive competencies, poor self-regulators tend to fall behind (Zimmerman, 1990). Results from a pilot study conducted for this research support the identification of players who are capable of establishing goals and using immediate feedback to achieve short-term flow at different game levels—two factors in game play SR that exert positive effects on game flow. It is our assertion that the higher the level of SR, the greater the potential for player satisfaction.

For this study we analyzed the effects of SR on individuals involved in aggressive game activities, using an original microanalytical tool that records game behaviors and flow state self-assessments. Data for investigating player self-judgment and self-reaction include the number of "strings hits" during a music-oriented digital game, plus self-assessments of skills and challenges at different game difficulty levels.

1.1. Self-regulation

Self-regulation is defined as the ability to direct one's own behaviors, as opposed to being passively affected by external influences. According to Bandura's (1986) social cognitive theory, personal cognition factors such as motivation and affect are reciprocally determined by behavioral and environmental factors such as the number of successful hits in a game, scores, and rankings (see also Zimmerman and Schunk (2001)). Three interactive stages are usually involved in the self-regulatory process: self-observation, self-judgment, and self-reaction. Individuals use self-judgment to strengthen positively evaluated behaviors and to weaken/eliminate actions that result in negative feelings. Social cognitive theoretical frameworks generally suggest that SR is context-dependent, therefore one's SR may be high in one situation or domain and low in another (Zimmerman & Schunk, 2001).

Scholars have analyzed different aspects of SR from different perspectives. According to Zimmerman and Schunk (2001), self-regulating learners actively participate in their learning processes metacognitively, motivationally, and behaviorally. Based on their examinations of SR mechanisms in the context of Internet usage, LaRose and Eastin (2004) and LaRose, Lin, and Eastin (2003) established a "deficient Internet SR" construct for studying usage patterns and addiction. Puustinen and Pulkkinen (2001) built on Pintrich and Zimmerman's work to describe the details of SR as a goal-oriented process. An emphasis on SR has also been noted in discussions of self-generation (Zimmerman & Schunk, 1989), self-control (Shonkoff & Phillips, 2000) and self-management (Stright, Neitzel, Sears, & Hoke-Sinex, 2001).

1.2. Self-regulation and flow

The objective of any game is integrated into the game experience and based on player perceptions (Piaget, 1962). In other words, games not only reflect, but also promote additional player cognitive development. When used in learning environments, properly applied digital games can impact learning effectiveness and learner motivation and concentration (Fabricatore, Nussbaum, & Rosas, 2002) while providing entertainment via game rules, scenarios, and goal achievement (Prensky, 2001). However, although games can induce motivation and promote cognitive development, sense of pleasure and internal satisfaction require successful player encounters with game challenges (Järvinen, 2002). It is important to remember that players are likely to have dissimilar goals that can be affected by game design and interactive structure (Costkyan, 2002). Providing choice within a game has the potential to enhance a player's perception of autonomy, which has been shown to increase intrinsic motivation (Ryan, Rigby, & Przybylski, 2006). Players regulate their goals, build a sense of achievement, and motivate themselves in the face of different challenges (Costkyan, 2002). The mix of motivation, cognition, strategy, and behavior produces a range of gaming experiences across different players.

During game play, gaming experiences generate feeling experiences via interaction between intrinsic motivation and SR. Feeling experiences (e.g., playful and exploratory characteristics) are associated with the flow experience identified by Csikszentmihalyi (1975). Individuals who become completely focused on situations and activities frequently fail to perceive their own initiatives while engaged in subjective experiences that fill them with joy and reduce or eliminate anxiety. Such flow experiences increase the potential for future engagement in the same activity (Csikszentmihalyi, 1975, 1990; Webster, Trevino, & Ryan, 1993). Individuals with this intrinsic trait tend to generate pleasure from as well as add pleasure to their activities. An emotional flow state emerges when their skills match the challenges of a situation (Csikszentmihalyi, 1975). To achieve such states, activities must have precise goals and explicit feedback mechanisms. Difficulty levels should be higher than current skill levels so that individuals perceive a challenge but avoid feeling overmatched—a balance that is thought to consistently produce positive feelings.

Other factors identified by Csikszentmihalyi (1990) as producing or resulting from flow states include a sense of easy control, a merging of action and awareness, concentration on the task at hand, a loss of self-consciousness, a transformation in time perception, and autotelic experiences. Chen et al. (1999) have established three categories of flow state characteristics: an *antecedents stage* involving clear goals, unambiguous feedback, and a balance between activity challenge and skill; an *experience stage*, during which action and awareness merge, distractions are removed from consciousness, and worry of failure is eliminated; and a *behavioral stage* in which progress reflects internal and optimal experience such as the loss of self-consciousness, a distorted sense of time, and a sense of reward from the activity itself (Table 1).

Since they are based on personal perceptions of skills and challenges, flow experiences are considered subjective, with determinations varying from person to person. Such subjective feelings can produce perceptions of optimal experiences or of anxiety and/or boredom. Individuals must therefore clearly understand their goals and maintain awareness of their progress so as to make immediate adjustments when necessary (Csikszentmihalyi, 1975). When self-perceived challenge and skill level achieves an equilibrium, the potential for entering a flow state increases, thus