Kasetsart Journal of Social Sciences 39 (2018) 175–182

Contents lists available at ScienceDirect

Kasetsart Journal of Social Sciences

journal homepage: http://www.elsevier.com/locate/kjss

Flow experience in computer game playing among Thai university students

Supat Sanjamsai*, Darunee Phukao

Department of Society and Health, Faculty of Social Sciences and Humanities, Mahidol University, Nakhon Pathom 73170, Thailand

ARTICLE INFO

Article history:
Received 25 August 2016
Received in revised form 2 November 2016
Accepted 8 November 2016
Available online 18 April 2018

Keywords:
computer game,
flow experience,
game addiction

ABSTRACT

This study was based on the flow theory of Mihaly Csikszentmihalyi. A cross sectional study was performed to examine flow experience in computer game playing among university students and to identify behavior that led to positive consequences and addictive behavior. Multi-stage sampling was conducted to select a sample of 478 university students aged 18–24 years who usually played computer games. Data were collected using the assessment instruments of computer game addictive behavior and perception of the consequences from game playing.

Based on exploratory factor analysis, the construct of flow experience could be divided into two dimensions: 1) cognitive flow which was composed of challenge-skill balance, clear goals, and unambiguous feedback, and 2) emotional flow which was composed of action-awareness merging, concentration on the task at hand, sense of control, loss of consciousness, and time transformation. Based on structural equation modeling, cognitive flow was positively correlated to perception of utility from the game ($\beta = .85$) and emotional flow was positively correlated to physical and psychological impacts from the game ($\beta = .52$). Moreover, males were more likely to spend time on computer games than females. This study found that time duration was not a key indicator of game-playing consequences. However, the state of flow in computer game playing was indeed a key factor that could perpetrate positive or negative outcomes.

The findings of this study suggested that flow experience in computer game playing has both benefits and drawbacks. It is recommended that youth-related organizations should promote cognitive flow experiences to develop the self-improvement of computer game players rather than emotional flow experiences.

Introduction

Computer and technology advancements have been influencing everyday lives through communication, education, and recreation. It has been reported by the National Statistical Office that in Thailand, there are 22.2 million computer users with 18.3 million Internet surfers in 2013 (Electronic Transactions Development Agency, 2013). The age groups of users who mostly spend time online using entertainment and games has been analyzed and it is estimated that 2.5 million Thai children had game addiction problems increasing from 13.3 percent in 2002 to 14.4 percent in 2012 (National Health Commission Office of Thailand, 2012). This situation is widespread. It has been demonstrated that American children and adolescents spent 20 h a week on computer games (Anderson et al., 2010). In Australia, 90–94 percent of 6–25 year olds played computer games daily (Brand, 2012). In China, 10.3

* Corresponding author.
E-mail address: suput@g.swu.ac.th (S. Sanjamsai).
Peer review under responsibility of Kasetsart University.

https://doi.org/10.1016/j.kjss.2018.03.003

percent of children and adolescents have become game addicted (Peng & Li, 2009). In South Korea, a death was reportedly caused by acute heart failure due to 80 h of continuous playing online games (Lee, 2004). Some kinds of computer games can lead to aggressive behavior and diminished empathy and altruism (Johnson & Scholes, 2013; Krahe & Moller, 2010). Game addiction is displayed by several types of behavior; obsessing on a game, demanding spending time on games daily, increasing desire, and anger from being obstructed. These behavioral types affect routine life and physical and mental health. Children can use the gaming to escape from unpleasant truths and to compensate for their perceived disabilities and non-acceptance of their real life. The fact is that game addiction is somehow similar to drug addiction even if there is no chemical intake (Hongsangaunsri & Kateman, 2013; Kuss & Griffiths, 2012).

Accordingly, there is huge interest in dealing with game addiction problems. Myriad research studies have endeavored to create alleviation, identify preventative action, and find solutions. In particular, children and adolescents are exposed to online gaming via several gadgets or even through internet cafe access in the community (Usman & Inam, 2013).

Previous research mostly aimed at identifying the cause and effect of game addictive behavior. Earlier findings demonstrated mostly negative consequences were associated with negative perspectives of the people toward game playing (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Paul & Willoughby, 2012). It seemed that state organizations emphasized initiating legislation and regulations to handle game addiction problems in children and adolescents. However, these regulations have been called into question, with critics arguing that people should be allowed freedom of choice. Furthermore, the fact that games have been invented to make children happy in the first place is equally important as the fact that playing games at home is safer than committing harmful acts in the broader community (Usman & Inam, 2013). It has also been recognized that some negative consequences of game addiction might be the impacts of predisposed factors, such as social and economic differences, capitalism, poverty, and domestic violence (Johnson & Scholes, 2013; Nielsen & Smith, 2003). On the other hand, playing games can develop intelligence, and help with critical thinking, decision-making, problem-solving, creativity, self-esteem, altruism, and a feeling of liberty (Nielsen & Smith, 2003; Paul & Willoughby, 2012; Przybylski, Ryan, & Rigby, 2009). This has resulted in a myriad of studies focusing on positive consequences (Johnson & Scholes, 2013). Thus, instead of concentrating on the negative side of some computer games, the challenge is to re-design a game to teach and develop positive characteristics; creativity, self-esteem, problem-solving flexibility, problem management, and emotional control in children and adolescents (Adachi & Willoughby, 2012). Associations have been identified between computer game playing and positive variables in previous studies that suggest game playing could lead to several psychological strengths (Johnson & Scholes, 2013; Przybylski et al., 2009; Russoniello, O'Brien, & Parks, 2009). However, it is not always clear at what stage playing games can lead to proper and constructive behavior (Boyle, Connolly, Hainey, & Boyle, 2012). Given that computer games offer fun and enjoyment leading to repetitive behavior and addiction, it is necessary to examine the optimal levels of game playing resulting in good conditions and non addiction (Johnson & Scholes, 2013; Yuksel, 2012).

Flow theory has been considered as a comprehensive theory to explain both sides of the impact from computer game playing because the state of flow refers to what happens when children are playing computer games that involve enjoyment, challenging, reacting, active thinking, feeling, and behaving (Voiskounsky, 2010).

Flow theory was developed by Mihaly Csikszentmahalyi, and describes a state of concentration or complete absorption with the activity at hand and the situation (Csikszentmihalyi, 1997). The flow state is an optimal state of intrinsic motivation, where the person is fully immersed in what he or she is doing. However, too much involvement in flow by being over absorbed and engaged for example, can harm children, since they might obsess with the state of enjoyment but ignore self-care and interpersonal relationships (Chiang, Lin, Cheng, & Liu, 2011). Therefore, flow is considered as the state leading to either positive or negative consequences in computer game playing.

Research Objectives

This research examined the structure of flow experience in the context of computer game playing and explored how the state of computer game playing can cause constructive and addictive behavior through the theory of flow. The components of flow were further examined to determine the impacts (positive or negative behavior) while playing computer games.

Previous Studies and Theory

There has been huge interest in studying this phenomenon regarding its aspects, causes and effects, and other factors that may be positively or negatively related. Earlier research attempted to apply several approaches to explain game addictive behavior. The medical biology concept focused on the cell level, the brain and neurological system, and neurotransmitters, which were associated with addictive behavior (Chou et al., 2013; Hoeft, Watson, Kesler, Bettinger, & Reiss, 2008). Behaviorism, explained that external stimulation or reinforcement could increase computer game playing without the consideration of intrinsic motivation (Beranuy, Carbonell, & Griffiths, 2013; Usman & Inam, 2013). Humanism emphasized individual factors, believing in human potential. Game addictive behavior, consequently, was a freedom of choice fulfilling basic needs, such as physical needs, love and belonging, acceptance, and identity (Hellstrom, 2012; Johnson & Scholes, 2013; Kuss, Louws, & Wiers, 2012). The cognitive concept explored human thought, self-control, and expectation towards computer game playing. However, it was believed that game playing was not because of losing self-control but that an individual might intentionally ignore anything else and feel integrated with the game only

(Przybylski et al., 2009). Trait theory research was examined via a standard personality test and could be referred to a larger population. Nevertheless, trait theory could not clarify the relationship between personality and addictive behavior and provided insufficient explanation of environmental factors and the social context. Social meaning perspective noted that game addictive behavior might be conditioned by social influences, such as role, value, and identity (Lin & Lin, 2011). However, social meaning theory seemed to only describe game playing rather than clarify the causal scheme. Considering the limitations of these approaches, flow theory could explain computer game addiction in terms of causes; personal factors, and external stimulation and also the effects in terms of constructive and destructive consequences. Flow theory can be introduced to investigate game addictive behavior from both its positive and negative impacts.

The word, 'flow' was coined by Csikszentmihalyi (1975) who put much effort into studying and investigating several groups of people (athletes, artists, and musicians) regarding their personality and other related factors which motivated continuing participation. This theory is based on the concept of how people can balance their abilities and the challenges of specific tasks (Csikszentmihalyi & Csikszentmihalyi, 1988). People felt fully involved while doing things, so things around them seemed less attractive. Afterward, they became self-satisfied and internally rewarded resulting in repetitive behavior due to intrinsic motivation rather than outer force. According to Csikszentmihalyi (1990, 1996), flow referred to an optimal psychological state when a person engaged in an activity with challenge-skill balance, often resulting in immersion and a concentrated focus on a task. This could result in deep learning and a high level of personal and work satisfaction. Flow was a sense of adequate skill to cope with the challenges at hand in a goal-directed, rule-bound action system providing clear clues. Concentration was intensely high and there was no residual attention to think about anything irrelevant or to worry about problems. Consciousness disappeared and the sense of time became distorted. An activity that produces such experiences was so gratifying that people were willing to do it for its own sake, with little concern for what they would get in return, no matter whether it was difficult or dangerous. The state of flow considers the positive experience when a person shows his or her potential. Conforming to the study of Eisenberger and colleagues, flow is a good predictor of one's performance (Eisenberger, Jones, Stinglhamber, Shanock, & Randall, 2005). In addition, flow experience is associated with positive emotion and creativity in work or sport (Csikszentmihalyi & LeFevre, 1989). Moreover, the structure of flow components is not limited to enjoyment but also covered self-efficacy, goal-directedness, integration, and creativity. Flow is a state beyond enjoyment or passion but it covers cognitive ability, self-efficacy, emotion, and positive consequences (Engeser, 2012; Obada, 2013).

Nevertheless, flow can display its drawbacks in time distortion, fatigue, low self-awareness, unconsciousness, and limited attention, all of which, can be harmful to life (Engeser, 2012; Partington, Partington, & Olivier, 2009). Flow seems to lead people to where they want happiness, pride, and skill, but it somehow can bring about difficulties including chaos, being upset, depression, and addictive behavior (stronger desire and craving) (Partington et al., 2009; Wanner, Ladouceur, Auclair, & Vitaro, 2006). This means that flow could be seen as a two-edged sword due to its impacts on consciousness (Partington et al., 2009). To illustrate this, the computer game has created competitive and challenging conditions (challenge-skill balance), so that game playing can bring positive consequences as a reward resulting in repetitive behavior (Seifert & Heddersen, 2010). On one side, repetitive action becomes skillful, on the other, doing something over and over again can be called obsession causing multiple dangers such as poor health and poor interpersonal relationships. A player might lose self-control and strive for achievement without recognizing time transformation (Thatcher, Wretschko, & Fridjhon, 2008). According to the theory of flow, some elements could influence computer game playing developing to game addiction (Boyle et al., 2012). Conforming to the study of Voiskounsky, Mitina, and Avetisova (2004), it has been found that the more flow appeared, the more attractive a computer game became. In other words, intense flow experience could lead to game addiction. Previous studies regarding flow experience and game addiction reported that the main components of flow were concentration, time distortion, involvement, enjoyment, and telepresence (Keller & Bless, 2008; Liu & Chang, 2012; Teng, 2012). The elements of flow, 'self-relatedness' and 'time distortion' are literally associated with the diagnostic criteria of game addiction. People with game addiction tended to obsess on playing the game and could not quit it even when it was starting to affect daily living; schooling, health, and relationships. They were more likely to omit their favorite activity so they could play the game instead—anything else seems unimportant (Partington et al., 2009; Weinstein, 2010; Wood, 2008; Wu, Scott, & Yang, 2013). According to the statement of the problem and the literature review, a research hypothesis was developed: the structure of flow experience in the context of computer-game-playing behavior is different from the original theory's structure and different flow structures have a different influence on computer-game-playing behavior.

Methods

The research questions were the structure of flow experience in the context of computer game playing and which states of game playing behavior would result in beneficial behavior and which states would cause game preoccupation or addiction. The research examined structural equation models between flow experience while playing a game that caused several consequences from computer game playing and empirical evidence. Multistage sampling was conducted to select samples from university students aged 18–24 years who exhibited computer-game-playing behavior and were currently studying in the second semester of the 2015 academic year at Srinakharinwirot University. Their daily computer-game-playing behavior consisted of either online or offline modes on any device such as a smartphone, personal computer, laptop computer, or tablet. The sample size was calculated by formula and the criteria for research that used the structural equation model technique to analyze the statistical data. As a result, the proper sample size was 400–500 people. Although data were collected from 500 people, 478 students completed the questionnaire satisfactorily, which was equal to a 95.6 percent response rate.

Research Tools

The study on flow experience in computer game playing among Thai university students was a quantitative study using a cross sectional design. All the tools in this research were developed based on theory, relevant studies, and a conceptual framework. The instruments used in this research were: 1) personal information: gender, age, average number of hours playing games per week, and types or characteristics of games; 2) assessment of computer-game-playing behavior based on 45 items in 9 domains, with 5 items each. The domains were challenge-skill balance, action-awareness merging, clear goal, unambiguous feedback, concentration on the task at hand, sense of control, loss of consciousness, time transformation, and autotelic experience. A 5-rating scale was used from strongly agree (5) to strongly disagree (1). The overall reliability was .882 (The reliability of each aspect was between .311 and .829); and 3) assessment of the perception of the consequences from game playing based on evaluating a player's cognition, emotion, and perception of the computer-game-playing behavior's outcome in terms of both advantageous outcomes and outcomes that affected emotions and behavior. There were 22 items, with 12 being about awareness of the beneficial outcome while 10 items were about awareness of the consequence that influenced emotions and behavior. The overall reliability was .919. The reliability of the first part was .923 and the latter part was .896.

Data Collection and Analysis

After obtaining permission from the Research Ethics Committee of Mahidol University, the researcher explained the objectives and processes of the study, and elucidated the rights in answering a questionnaire to samples. Samples received an explanation of the study and were informed that completion of the questionnaire took approximately 25–30 min. Completed questionnaires were checked and then basic data were recorded and analyzed using fundamental statistical formulas in the SPSS software for Windows Version 22. In addition, confirmatory factor analysis was exploited to examine the structural validity of an assessment of the components of flow experience, positive computer-game-playing behavior, and computer game addition, and structural equation model analysis was undertaken using the AMOS program.

Results

This study intended to examine flow components in a computer-game-playing context and to study which states of game playing influenced beneficial behavior and which states led to a mental and physical impact or game addiction. The research also examined structural models of flow experience in the context of studying computer-game-playing behavior. The respondents from the study were fairly equally split by gender with males making up 50.2 percent and females 49.8 percent. The average time spent on gaming was 14.2 h/week. Online games were the most popular (60.2%) followed by simulation and puzzle games (56.2%).

The structure of flow experience in the context of computer-game-playing behavior was different from the original theory's structure. To examine the structural equation model of the flow experience components and the structural validity of the flow experience components, the researcher used exploratory factor analysis (EFA) because, all nine elements were not congruent with empirical evidence reflecting that it was not significantly applicable (Figure 1).

EFA was used to examine the relationship among observable variables and revealed that two elements displayed good Eigen values (Component 1 = 3.927, Component 2 = 1.307). According to the Varimax method, flow experience could be divided into two domains. The first one was composed of challenge-skill balance, clear goals, and unambiguous feedback while the second one was composed of action-awareness merging, concentration, sense of control, loss of self-consciousness, and time transformation (Figure 2).

After adjusting the model, the structural validity examination of the 2 first-order factor (correlated) measurement model of flow experience had values of chi-squared = 39.283, df = 18, CMIN/df = 2.182, GFI = .980, AGFI = .960, CFI = .987, NFI = .976, and RMSEA = .050. These results suggested that the constructed model of the hypothesis was congruent with the empircal evidence. The structure of flow experience could be divided into two flows: cognitive flow and emotional flow. The cognitive

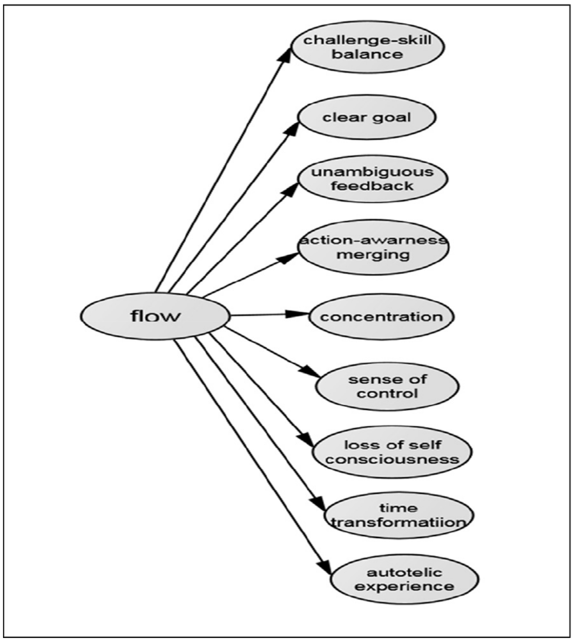

Figure 1 Mihaly Csikszentmihalyi's first-order model

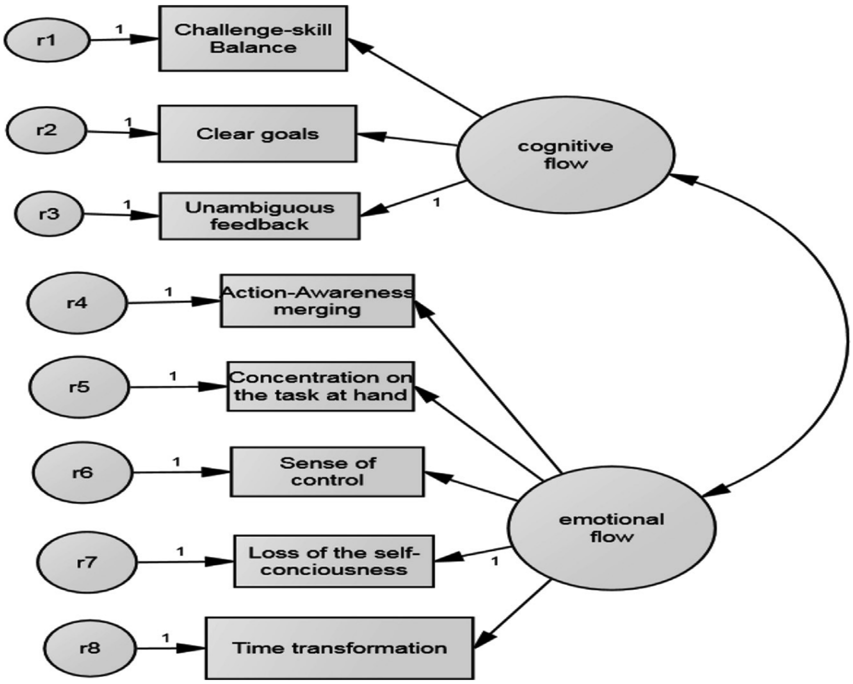

Figure 2 The 2 first-order factor (correlated) measurement model of flow experience

flow consisted of: 1) challenge-skill balance, 2) clear goal, and 3) unambiguous feedback. The emotional flow consisted of: 1) action-awareness merging, 2) concentration on the task at hand, 3) sense of control, 4) loss of consciousness, and 5) time transformation. Both flows had a positive relationship as the 2 first-order factors were correlated with the measurement model of flow experience (Figure 3).

The modified structural equation of flow experience that affected computer-game-playing behavior was correlated with empirical evidence (chi-squared = 176.122, df = 53, p = .00, CMIN/DF = 3.32, GFI = .948, AGFI = .911, RMSEA = .070). This implied that flow experience during game playing influenced computer-game-playing behavior. In particular, cognitive flow had a direct effect on the recognition of advantages of game playing (β = .85). On the other hand, emotional flow indirectly affected the recognition of mental and physical consequences induced by game playing (β = .52). Time spent on computer game directly influenced the perception of negative consequences of game playing both mentally and physically (β = .22) as well as directly influencing perception of game utility (β = .13). Gender was a factor associated with the time spent gaming, with males spending more time than females. People were more likely to spend more time playing online games rather than offline games. Essentially, cognitive flow and time spent on the game together explained 81 percent of the positive consequences from

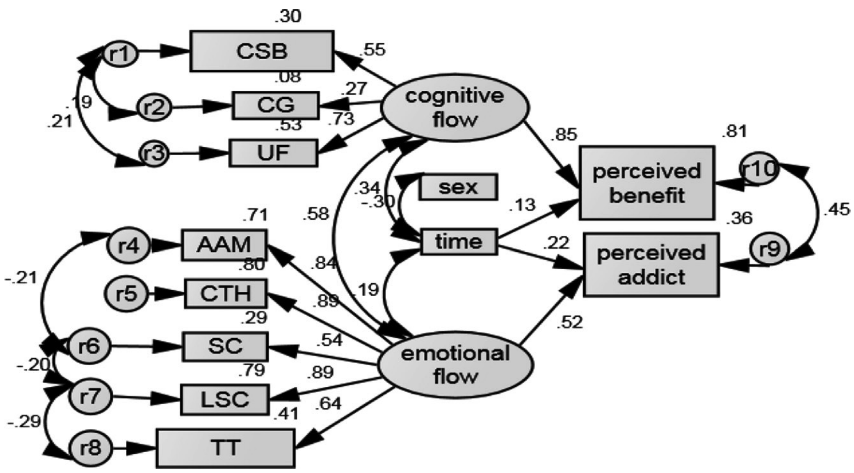

Figure 3 Structural relationship between flow experience and computer game playing

computer game playing, while emotional flow together with time spent on the game were able to explain 36 percent of the negative consequences from game playing. The factor of time spent on the game was associated with both cognitive flow and emotional flow.

Discussion

The flow experience structure in the context of computer-game-playing behavior was different from the original theory's structure. The structure of flow experience could be divided into two flows, being cognitive flow and emotional flow. The cognitive flow reflected cognitive qualities such as evaluation, expectation, control, and decision-making and consisted of: 1) challenge-skill balance, 2) clear goals, and 3) unambiguous feedback. The emotional flow comprised: 1) action-awareness merging, 2) concentration on the task at hand, 3) sense of control, 4) loss of consciousness, and 5) time transformation. This dimension indicated an expression of emotional experience responding to an external stimulus after a person perceived it. The cognitive flow and emotional flow were correlated. When playing a game with positive emotional experience, a person would recognize and remember it. In addition, the positive emotional experience could enhance cognitive abilities such as problem-solving skills, recollection, analysis, and creativity. On the contrary, playing a game with negative feelings like frustration or anger could interrupt cognitive functions like decision-making, evaluation, and memory process (Hunt & Ellis, 2004). However, emotional experience could not occur without cognition. When something happened, a person would use his/her cognition to evaluate and interpret it. The person would decide how to appropriately respond to a given situation. For example, when encountering a mission or an obstacle in a game, a player would use cognitive ability to analyze and evaluate it. If he/she interpreted or considered it as a challenge, the emotional experience would be positive. However, if a player saw it as a difficulty, he/she would feel anxious or stressed out. Therefore, this indicated that although the cognitive process and emotional process came from different dimensions, they were correlated and influenced each other (Fulcher, 2003; Schulkin, 1993).

Flow experience while playing a game could yield both positive and negative consequences. On the bright side, it enhanced a player's cognitive skills, learning ability, visual-motor coordination, and self-efficacy, as well as positive emotions such as enjoyment, contentment, relaxation, and a sense of social belonging. In addition, it could improve a player's English, cognitive skills, planning, and working with hands. On the negative side, it caused adverse effects to a player and surrounding people. It also had a direct effect on the recognition of the mental and physical impact from game playing or game addition behavior, if a player had flow experience involving an emotional experience, involvement, a decrease of self-consciousness, and incorrect sense of time. The drawbacks of game playing resulted from a lack of emotional control. In particular, when a player was deeply immersed in a game, it could lead to a loss of consciousness and low attention to surroundings and responsibilities. Thus, game playing in adolescents could have both benefits and drawbacks.

If a player experienced cognitive flow while playing a game such as evaluating, analyzing, planning, making a decision, setting a goal, or becoming aware of a positive change or improvement in skills, it was more likely to create positive game playing behavior or a realization of the game's benefits. A player could control his/her behavior in a proper way by the function of cognitive process. It was created by an opportunity to use cognitive abilities such as analysis, planning, and goal setting while a game player could recognize the game's advantages as well as evaluate his/her potential to deal with the game's difficulty. In terms of emotional flow, if a player had flow experience involving a positive emotional experience, involvement, a decrease of self-consciousness, and an incorrect sense of time, it would be more likely to have the perception of mental and physical impact. In particular, when a player was deeply immersed in a game, it could lead to loss of consciousness and low attention to the surroundings and responsibilities. Similarly, Sublette and Mullan (2012) found that negative consequences from playing an online game happened when a player used the game to escape from reality and excessively soaked himself/herself in the game's world. Nonetheless, this research found that flow experience in the cognitive aspect could directly cause recognition of game playing benefit. If a player were having a cognitive experience while playing a game such as assessing, decision-making, analyzing, planning and goal-setting, it would lead to positive outcomes or the perception of game-playing advantages. Choi and Kim (2004) also reported similar findings, indicating that flow experience from playing a game and the positive consequences resulted from positive feedback from the game and appropriate goal-setting in the game. However, flow experience from the emotional aspect would directly cause mental and physical effects. If a player experienced an emotional flow like a positive emotional experience, intense concentration, and lack of concerns, it would lead to drawbacks from playing the game or recognition of emotional and physical effects. Game addictive behavior criteria include intention, loss of consciousness and surroundings, positive or oneness feelings, and a perceived distortion of time. The components of the criteria reflect that when a person spent most of the time with a game, the person might forget or ignore responsibilities leading to disturbance of activities that a player should do and avoidance of reality's hardships. These characteristics were relevant to studies in game addiction noting that a key indicator of game additive behavior was the lack of attention or interest in surroundings (Weinstein, 2010; Wu et al., 2013).

The current findings indicated that the length of time spent on a game directly affected computer-game-playing behavior, both positively and negatively. Males were more likely to spend more time on a game than females because they probably played the game in order to fulfill their social yearning and to gain acceptance and success, while females did not use game for these purposes. In addition, males often played online games that required a great amount of time to finish the missions or pass the stages. Therefore, they were more likely to spend more time playing the game. Yet this study found that duration was not a key indicator of game playing consequences. The state of flow in computer game playing was indeed a key factor that could penetrate its positive or negative outcomes.

Conclusion and Recommendation

The flow experience structure in the context of computer-game-playing behavior was different from the original theory's structure and could be divided into cognitive flow and emotional flow. In particular, if a player had a cognitive flow experience to evaluate, analyze, plan, set a goal, and become aware of self-improvement, he/she would be more likely to have a positive outcome. On the contrary, if a player had emotional flow experience causing contentment, intense concentration, and low consciousness, it could cause psychological and physical impacts. Gender and the type of game were relevant to the duration. Males and online games tended to consume more time. The duration of game playing could affect the recognition of mental and physical consequences. Nonetheless, the key factor of positive and negative behavioral outcomes was identified using the flow experience of a game player.

From this study, organizations related to children and adolescents' affairs, science and technology, software industry promotion, education, and public health should encourage children to play a game in a positive way. Moreover, there should be support to develop games that can yield advantages to computer game playing and to organizing a competition in a game that was beneficial or in game-development competitions. Future research could consider a comparison between samples who were diagnostically addicted to games and game players who played on a daily basis regarding how similar or different their antecedents of flow experiences were. This study could be applied in other contexts for social benefit, such as flow experience in work, flow experience in playing sport, or flow experience in playing music.

Conflict of Interest

There is no conflict of interest.

References

Adachi, P. C., & Willoughby, T. (2012). Do video games promote positive youth development? *Journal of Adolescent Research, 28*(2), 155–165.

Anderson, C. A., Shibuya, A., Ihori, I., Swing, E. L., Bushman, B. J., Sakamoto, A., et al. (2010). Violent video game effects on aggression, empathy, and pro- social behavior in Eastern and Western countries. *Psychological Bulletin, 136*(2), 151–173.

Beranuy, M., Carbonell, X., & Griffiths, M. D. (2013). A qualitative analysis of online gaming addicts in treatment. *International Journal of Mental Health and Addiction, 11*(2), 149–161.

Boyle, E. A., Connolly, T. M., Hainey, T., & Boyle, J. M. (2012). Engagement in digital entertainment games: A systematic review. *Computers in Human Behavior, 28*(3), 771–780.

Brand, J. (2012). *Digital Australia 2012: National research prepared by Bond University for the interactive games & entertainment association*. Robina, QLD, Australia: School of Communication and Media, Faculty of Humanities and Social Sciences, Bond University.

Chiang, Y. T., Lin, S. J., Cheng, C. Y., & Liu, E. Z. (2011). Exploring online game players' flow experience and positive affect. *The Turkish Online Journal of Educational Technology, 10*(1), 106–114.

Choi, D., & Kim, J. (2004). Why people continue to play online games: In search of critical design factors to increase customer loyalty to online contents. *Cyberpsychology and Behavior, 7*(1), 11–24.

Chou, Y. H., Yang, B. H., Hsu, J. W., Wang, S. J., Lin, C. L., Huang, K. L., et al. (2013). Effects of video game playing on cerebral blood flow in young adults: A SPECT study. *Psychiatry Research, 212*(1), 65–72.

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education, 59*(2), 661–686.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety: Experiencing flow in work and play*. San Francisco, CA: Jossey-Bass.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row.

Csikszentmihalyi, M. (1996). *Creativity, flow and the psychology of discovery and invention*. New York, NY: Harper Perennial.

Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York, NY: Basic Books.

Csikszentmihalyi, M., & Csikszentmihalyi, I. (1988). *Optimal experience: Psychological studies of flow in consciousness*. Cambridge, UK: Cambridge University Press.

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology, 56*(5), 815–822.

Eisenberger, R., Jones, J. R., Stinglhamber, F., Shanock, L., & Randall, A. T. (2005). Flow experiences at work: For high need achievers alone? *Journal of Organizational Behavior, 26*(7), 755–775.

Electronics Transaction Development Agency. (2013). *Survey report of internet user's behavior in Thailand 2013*. Bangkok, Thailand: Author.

Engeser, S. (2012). *Advances in flow research*. New York, NY: Springer Science+Business Media.

Fulcher, E. (2003). *Cognitive psychology*. Exeter, UK: Crucial, a division of learning Matters Ltd.

Hellstrom, C. (2012). Influences of motives to play and time spent gaming on the negative consequences of adolescent online computer gaming. *Computers in Human Behavior, 28*, 1379–1387.

Hoeft, F., Watson, C. L., Kesler, S. R., Bettinger, K. E., & Reiss, A. L. (2008). Gender differences in the mesocorticolimbic system during computer game-play. *Journal of Psychiatric Research, 42*, 253–258.

Hongsangaunsri, S., & Kateman, P. (2013). *Game addiction: The crisis and solution*. Bangkok, Thailand: Faculty of Medicine, Ramathibodi Hospital and Siriraj Hospital, Mahidol University.

Hunt, R. R., & Ellis, H. C. (2004). *Fundamentals of cognitive psychology* (7th ed.). New York, NY: McGraw-Hill.

Johnson, D., & Scholes, L. (2013). *Videogames and wellbeing: A comprehensive review*. Melbourne, VIC, Australia: Young and Well CRC.

Keller, J., & Bless, H. (2008). Flow and regulatory compatibility: An experimental approach to the flow model of intrinsic motivation. *Personality and Social Psychology Bulletin, 34*, 196–209.

Krahe, B., & Moller, I. (2010). Longitudinal effects of media violence on aggression and empathy among German adolescents. *Journal of Applied Developmental Psychology, 31*, 401–409.

Kuss, D. J., & Griffiths, M. D. (2012). Internet and gaming addiction: A systematic literature review of neuroimaging studies. *Brain Sciences, 2*, 347–374.

Kuss, D. J., Louws, J., & Wiers, R. W. (2012). Online gaming addiction? motives predict addictive play behavior in massively multiplayer online role-playing games. *Cyberpsychology, Behavior, and Social Networking, 15*(9), 480–485.

Lee, H. (2004). A new case of fatal pulmonary thromboembolism associated with prolonged sitting at computer in Korea. *Yonsei Medical Journal, 45*(2), 349–351.

Lin, W. L., & Lin, H. W. (2011). A study on the goal value for massively multiplayer online role-playing games players. *Computers in Human Behavior, 27*, 2153–2160.

Liu, C. C., & Chang, I. C. Measuring the flow experience of players playing online games. *PACIS 2012 Proceedings*. Paper 104.

National Health Commission Office of Thailand. (2012). *24 hours environment management for Thai children*. Nonthaburi, Thailand: Author.

Nielsen, S. G., & Smith, J. H. (2003). *Playing with fire: How do computer games affect the player?* Copenhagen, Denmark: The Media Council for Children and Young People.

Obada, D. R. (2013). Flow theory and online marketing outcomes: A critical literature review. *Procedia Economics and Finance, 6*, 550–561.

Paul, J. C., & Willoughby, T. (2012). Do video games promote positive youth development? *Journal of Adolescent Research, 28*(2), 155–165.

Partington, S., Partington, E., & Olivier, S. (2009). The dark side of flow: A qualitative study of dependence in big wave surfing. *The Sport Psychologist, 23*, 170–185.

Peng, L. H., & Li, X. (2009). A survey of Chinese college students addicted to video games. *China Education Innovation Herald, 28*, 111–112.

Przybylski, A. K., Ryan, R. M., & Rigby, C. S. (2009). The motivating role of violence in video games. *Personality and Social Psychology Bulletin, 35*, 243–259.

Russoniello, C. V., O'Brien, K., & Parks, J. M. (2009). The effectiveness of casual videogames in improving mood and decreasing stress. *Journal of Cyber Therapy and Rehabilitation, 2*(1), 53–66.

Schulkin, J. (1993). Neuropsychology and the cognitive nature of the emotions. *Cognition and Emotion, 7*, 43–59.

Seifert, T., & Heddersen, C. (2010). Intrinsic motivation and flow in skateboarding: An ethnographic study. *Journal of Happiness Studies, 11*, 277–292.

Sublette, V. A., & Mullan, B. (2012). Consequences of play: A systematic review of the effects of online gaming. *International Journal of Mental Health and Addiction, 10*(1), 3–23.

Teng, C. I. (2012). How do challenges increase customer loyalty to online games? *Cyberpsychology, Behavior, and Social Networking, 16*, 884–891.

Thatcher, A., Wretschko, G., & Fridjhon, P. (2008). Online flow experiences, problematic internet use and internet procrastination. *Computers in Human Behavior, 24*, 2236–2254.

Usman, A., & Inam, U. (2013). *Video games addiction: Positive and negative effect of playing video game on youth and children* (Research Report). Boras, Sweden: School of Business and IT, University of Boras.

Voiskounsky, A. E. (2010). Internet addiction in the context of positive psychology. *Psychology in Russia State of Art, 3*, 541–549.

Voiskounsky, A. E., Mitina, O. V., & Avetisova, A. A. (2004). Playing online games: Flow experience. *Psychnology Journal, 2*(3), 259–281.

Wanner, B., Ladouceur, R., Auclair, A. V., & Vitaro, F. (2006). Flow and dissociation: Examination of mean levels, cross-links, and links to emotional well-being across sports and recreational and pathological gambling. *Journal of Gambling Studies, 22*(3), 289–304.

Weinstein, A. M. (2010). Computer and video game addiction-a comparison between game users and non-game users. *The American Journal of Drug and Alcohol Abuse, 36*(5), 268–276.

Wood, V. A. (2008). Problems with the concept of video game “addiction”: Some case study examples. *International Journal of Mental Health and Addiction, 6*(2), 169–178.

Wu, T. C., Scott, D., & Yang, C. C. (2013). Advanced or addicted? Exploring the relationship of recreation specialization to flow experiences and online game addiction. *Leisure Sciences: An Interdisciplinary Journal, 35*(3), 203–217.

Yuksel, M. (2012). The positive psychology of gaming: Immersion through flow in simulations. *Journal of Internet and e-Business Studies, 2012*, 1–10.