THE APPLICATION OF DIGITAL CONSOLE GAME FOR THE TREATMENT OF CHILDREN WITH SENSORY INTEGRATION DYSFUNCTION: PARENTAL PERSPECTIVE

Objective: The present study aims to investigate the effect of applying digital console game to the treatment of children with sensory integration dysfunction and to explore the experience and feedback from parents' perspective. Method: 4 school-aged children with sensory integration dysfunction (SID) and their parents participated the present study. Participants received 12-week training programs which consists of their regular therapeutic treatment once a week and additional training activities (i.e., designed Digital Console Game activities) once a week. Observations and interviews were conducted. Results: Results derived from the direct observations of children's behaviors and the parents' feedback confirmed that the characteristics of the digital console games may positively reinforce the inner drive of children with SID and further elicit their motivation on treatment participation and engagement. Conclusion: Parents of children with SID support the positive effects of applying digital console games into the regular therapeutic treatment of their children had received. The child's playful experience may increase their motivation to engage in the therapeutic process and distract their focus away from the unpleasant feeling of treatment, and then further encourage their continuation of chronic treatment regimes. It is hoped to provide an innovative approach to SID therapy.

Keywords: Digital Console Game, children, sensory integration dysfunction, Parental Perspective, play theory

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Introduction

Recently, the prevalence of children with sensory integrative dysfunction (SID) is increasing (Ahn et al., 2004; Ren et al., 1995; Shi, 2006; Yeh-Chang, 2004). This population may demonstrate difficulty in sensory processing that cause emotional problems and learning disabilities and further caught the attention of the medical professionals, parents, and teachers. Sensory integration dysfunction (SID) is a complex and multifaceted problem. SID is a neurological disorder in which the brain is unable to accurately process certain information received through the senses so that people with SID may have behavioral disorders; however, it is not a disease that leads to the loss of brain function. Neurological specialists are good at searching for brain damage and brain deterioration but unable to effectively identify children with disorders (Ayres, 2005; Ayres and Robbins, 1979). The current clinical identification of SID can be categorized into four patterns, “Disorders Involving the Vestibular System”, “Developmental Dyspraxia”, “Visual Perception and Auditory-Language Disorders”, and “Tactile Defensiveness”. However, children with SID may not have all symptoms of a certain dysfunction among the previous mentioned four patterns of dysfunctions. Mostly, they have more or less symptoms of the four dysfunctions (Ayres, 2005; Ayres and Robbins, 1979; Kranowitz, 1993, 2006; Miller and Fuller, 2006).
The current modified SID therapies

The current approaches for treating SID are based on the intervention principles of Ayres Sensory Integration and sometimes combined with other therapies. Sensory integration therapy (SIT) is a game-based approach to improve symptoms of children with SID to form adaptive responses during the game playing (Ayres and Robbins, 1979; Chen, 2003; Wu, 2001). Therefore, SIT is adaptive to meet different needs of children with SID.

Wu (2001) proposed game principles of designing activities as follows: (1). Activities need to be interesting and amusing to raise motivation; (2). Activities promote a large amount of vestibular stimulation (e.g., let children fall prostrate on a sliding board to produce the sense of gravity); (3). Activities correct abnormal postures, such as excessive flexion, retraction, and rotation, are necessary (e.g., raising and laying down arms); (4). Activities allow muscle to resist the bilateral tension (e.g., digging sand and playing drums); (5). Activities provide proprioceptive feedback (e.g., clapping hands and jumping rope); (6). Activities attract eye tracking (e.g., throwing a ball and asking the children to bring it back); (7). Activities provide the deep pressure input (e.g., hair brushing activity or putting weighted blanks around children’s shoulders or whole body can provide a calming effect).

The previous principles of design activities indicate that interests, encouragement, rewards, and self-challenges are central elements of SIT which allow children with SID to produce inner drive and build confidence, and they are the strengths of digital games which provide a solid foundation of the study.

Types of digital game platforms and their applications

This study adopted “digital games” as a tool for the reason that the similarity of digital games and SIT is game-based. Digital games provide outcomes, feedback, and eye tracking activities to stimulate children’s vestibular, proprioceptive, and sensory perceptions so that the brain can integrate information received from the sensory systems. In addition, digital games can complement characteristics that traditional games don’t have, such as sound and visual effects (Chen, 2001), to raise children’s inner drive and strengthen their visual and auditory stimulation. Mostly, children receive SIT in a therapy room that has limited space for activities; however, digital games provide more sensory stimulation and virtual scenarios for children to interact which the design of SIT activities cannot provide. It is anticipated that digital game treatment can raise children’s inner drive and increase the possibility of having spontaneous intensive training (i.e., parents and teachers’ participation to promote the density and intensity of the training) for SID children to improve the outcomes of sensory integration therapy.

It is hoped that the recent transformation of digital games could offer diverse methods to improve symptoms of children with SID and provide them a wide range of training opportunities. Therefore, the study proposed to apply digital games to improve SID children’s symptoms and expect that the activity design of the study can complement traditional sensory integrative training therapy. In addition, parents’ attitude toward the impact of digital games is another difficult issue often related to parental teaching that parents have to face in a new generation. This study aims to investigate the effect of applying digital console game to the treatment of children with sensory integration dysfunction and to explore the experience and feedback from parents' perspective.

Method

Participants

The research participants consisted of 4 students, including two boys and two girls. Participants were 1st and 2nd graders with vestibular, proprioceptive, and sensory
dysfunctions evaluated by licensed occupational therapists. The children with serious tactile defensiveness were excluded. The participants’ informed consents were obtained.

**Procedures**

Participants received 12-week training programs which consists of their regular therapeutic treatment once a week and additional training activities (i.e., designed Digital Console Game activities) once a week. Observations and interviews were conducted to collect data during the training. The study protocol was approved by the Institutional Review Board of Ethical Committee for Human Research.

**Instruments**

This study adopted Wii Fit Traditional Chinese version which consists of yoga poses, strength training, aerobics, and balance games as a training tool. Wii Fit can provide adaptive training, enhance reaction and cognitive ability, elicit gross motor actions and feedback, offer opportunities for competitions and challenges, and present balance tests with safety features. All the training activities were proper modified and analyzed by professional occupational therapists.

**Results**

**Parents’ perspective on the designed activity**

Some parents always stayed behind the experimental site and watched participants playing Wii during the experiment. The researchers found that parents who watched the participants playing Wii indicated that the participants improved their body postures a lot and understood how to use their body movements to complete the activities. Sometimes parents noticed that the participants showed body movements that had never demonstrated. Participants learned how to coordinate their bodies and integrate sensory from the game playing; they demonstrated what they had learned in daily life. Participants’ parents expressed in the interview that participants had better eye-hand coordination ability to manipulate subjects in daily life and better balance while walking. In addition, it was found that most SID children cannot tolerate frustration and terminate therapies. However, Wii can provide a lot of fun. Even thought participants may encounter frustration, they can keep playing Wii because of having fun and raise their inner drive. The results from the interviews showed that participants’ parents had a positive attitude toward the overall activity design. There were a variety of the Nintendo Wii training games that affected parents to have positive feedback toward the activity design; Parents agreed that diversified games made participants to use different body movements to complete the goals of the games; moreover, the content of the experimental design didn’t limit participants to play a certain game.

Since parents held a positive view of the Nintendo Wii games, they suggested that it had better to increase the length of the experiment time and frequencies of playing the Wii games per week to have an intensive training and significant results of the experiment. In addition, participants’ parents and therapists verified that participants improved a lot on compliance with the rule, gregarious performance, frustration tolerance, emotional control, confidence and the performance of adaptive behavior.

The games adopted in the study provided multisensory input and stimulation together, and participants can learn awareness of multiple stimuli and registration. Digital games offered more visual images, clues, and excitement to stimulate participants to react. Therefore, participants made progress on improving their sensory integration expected after receiving the training. They also made progress on processing their oral sensation which needed a further detailed investigation. The results of parents’ discussions revealed that participants were more willing to try new objects in daily life after receiving the
training, and their responses to intolerable things were improved. For example, one
parents expressed that her kid was more cooperative and had better appetite. She actively
asked for meals and was willing to try food with certain textures, smells, and flavors that
she refused to taste. Another parent indicated that her kid increased food intake and
didn’t insist on having food which had a certain specific flavor or from a specific store
and was willing to try food that he hated under the conditions. Those changes were for
the reason that participants’ confidence, frustration tolerance, and self-challenging attitude
were positively improved; therefore, they were willing to adjust and try to have different
eating habits and changes in daily routine of life.

Discussion and implication

Those participants still received professional sensory integration therapy from
occupational therapists. The study is a preliminary research; the clinical studies that
adopting a digital game as a tool for training people with sensory integration dysfunction
is very rare. The study analyzed and investigated the characteristics of digital games; it is
expected that the view of adopting digital games for training people with SID and the
results of the preliminary research could be used for reference and provide an alternative
clinical treatment or a home training mode.

Recognition of parents

According to literature review and preliminary analyses, the possibility of adopting
interactive 3D digital games to improve children with sensory integration dysfunctions or
other relevant disorders provides therapists an alternative choice. Moreover, it could
improve people who have recurrent falls, a fear of heights, and other conditions so that
the study proposed an experiment to apply Wii Fit games to train children with SID and
improve their symptoms. Motion sensing games changed the traditional way of playing
digital game. The results of the study showed that the change made 4 participants’ parents
have a positive attitude toward digital games; some parents suggested to expand the time
ranges and increase the frequencies of the training.

The study combined principles of the SIT game design with game theories to help
children with SID. The results showed that using the Nintendo Wii as an intervention in
the training is a positive help for children with SID so that they may also play the Wii
games at home based on therapists’ recommendations and learn from the game playing.
Therefore, parents agreed that the Nintendo Wii games are an important supplementary
aid.

In addition, the activity design of sensory integration therapy makes most people think
that parents are able to conduct therapies for their children with SID. However, therapists
must evaluate children’s abilities, recommend and provide therapy, and help them
participate as fully as possible in activities. Repetitive instructions and practices can
improve children sensory integration, motor function, and other abilities. The therapy
usually lasts for an hour; when the therapy is finished, there is no one to facilitate children.
If parents can adopt an adaptive digital gaming platform and game software to raise
children’s inner drive, children with SID can independently learn how to integrate their
sensations through the digital game playing, trigger some abilities that seldom use, and
increase opportunities of integrating sensations and coordinating behaviors besides regular
therapies. Moreover, it may improve children’s cognitive ability, increase interactions with
their parents and among peers, and enhance relations with their families.

Expected environment

The study showed that families may affect their children with SID to select games or
activities. It is expected that family relationships can make children with SID to play some
games or activities that they don’t like before, change the attitude toward the game
playing, and increase opportunities of integration sensations through playing the Wii games. Besides, parents and therapists are needed to facilitate, encourage, and interact with children with SID to accomplish goals of the Wii games.

Therapists expressed that they assign training assignment or activities to children with SID after finishing a therapy or having temporarily stop of the SIT for some reasons; children can practice the training activities by themselves at home, and their parents monitor their children to complete the assignment. Similarly, the Wii games are expected to be part of the assignment because some parents have the Wiis, and some parents buy it after the study which means the Wii is an affordable tool to facilitate children with SID. If therapist have a better understanding of features and instructions of the Wii games, they can design appropriate instructions as assignment for children that have the Wiis at home. The Wii training games are amusing, and children with SID are more willing to complete their assignment.

Recommendation

Appropriate game levels

The current digital games for Wii Fit are not many for children with SID; the content of Wii Fit Chinese Version games may not be appropriate for those children so that the difficulties of the game levels need to have minor adjustments. The results of the study showed that children with SID are easier to get frustrated because of failures; therefore, it had better have many mini tasks in the beginning level. Once children can complete all the tasks in the beginning level, they can play the advanced levels which can encourage children and eliminate frustration from the game playing. In addition, Nintendo keeps releasing new Wii Fit games that allows parents and therapists to have more choices to select appropriate games based on their features and genres for applications.

Lessons for parents

Parents’ every movement in the process of playing the Wii games affect the children’s attitude toward the games playing. Therefore, further researches should inform parents to notice their attitudes and postures while playing the Wii games. Occupational therapists need parents’ assistance to guide children with SID to complete effective trainings and activities with an appropriate attitude toward the game playing. Lessons for parents include: (1) When playing the game, parents use the Wii Remote to mimic each games’ respective method of play, such as swing the Wii Remote at an appropriate timing. However, children with SID may not be able to move their body adequately so that the results of using the Wii to train their sensory integration may not be as expected. For example, the tennis of the Wii Sports requires players to move the remote in a similar manner to how the separate games are played in real life. (2) Don’t restart the games or give up during the game playing. Children with SID get frustrated easily and hardly tolerate frustration. Parents must demonstrate their abilities through sports experiences and show the true spirit of sports; they need to facilitate their children with SID with techniques to have successful experiences, the feelings of victory, and the senses of accomplishment, the important indicators of the training.

Appropriate Nintendo Wii Games for different needs

Nintendo Wii games have different features and genres; therefore, selecting appropriate Wii games to train children with SID is necessary. Training activities need to be adapted to meet different needs of Children with SID, so do the selection of the Wii games. The Wii is on the market since 2006, Nintendo keeps releasing new Wii games which means children with SID have more choices to carefully select appropriate games based on the features and genres to meet the needs of training their sensory integration. Additionally,
parents and therapist are needed to stand aside and guide children with SID to play the Nintendo Wii games with correct body movement and attitude to produce positive outcomes, not allowing children to play along. The further researches should focus on what types of the Wii games are appropriate for children with different sensory integration dysfunctions as references for parents and therapists.

Applications of new motion sensing devices and games

Microsoft launched a brand new motion sensing input device, Kinect, in November, 2010. Kinect for Xbox 360 has more delicate visual and auditory effects and doesn’t require players to use additional devices which may distract players’ attention in comparison with the Nintendo Wii. However, the content analysis of the qualitative research that investigated the current Kinect games based on the sensory integration therapy (Chuang et al., 2012) showed that the Kinect cannot fully interpret and sense body gestures and requires players to wait for confirming or loading a game. Not all the Kinect games are appropriate to provide training sessions for children with SID; the difficulties and genres of the games may also affect the effectiveness of the therapy. Therefore, if the system can adapt to meet different persons’ needs and situations and design multiple functions and interest games, Kinect could have the potential to be a useful tool after adjusting the difficulties, training modes, the time sessions of the games for patients with SID to receive therapies besides hospitals and rehabilitation centers which have better recovery efficiency.

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