Developing a Hybrid Visual Perception Game using the ADDIE Approach for Autism

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Abstract: Vision problems are frequently associated with autism. Currently, a systematic manual diagnosed has been developed to assess autism children. However, the method for diagnosed visual perception problem is still using manual and hands on technique. In this paper, a systematic research framework using analyze, design, develop, implement and evaluate (ADDIE) approach is proposed for a hybrid visual perception game to diagnose autism children. Thus, a technological solution to address visual perception problems among autism children can be done. It will benefit from intervention to improve perceptual skills among autism children. This serves as a guide and reference to build a prototype for further research. The outcome from this research and invention can be used for educational area and medical field.

Key words: Hybrid, autism, serious game, visual perception.

INTRODUCTION

Autism is a condition that resulting from a brain disorder that takes place during the first two and a half years of childhood (Kanner, L., 1943). Autism Spectrum Disorder (ASD) is a pervasive developmental disorder which affects individuals with varying degrees of impairment (Belanich, J., *et al.*, 2004), even though there are numerous consistent factors present in all or most autistic people. The presence of three aspects of impairment is namely social cognition, communication, and imagination. These three impairments are categorized as the most familiar of the serious developmental disabilities (Keen, D.V., *et al.*, 2010). This neurodevelopment condition has a frequency of one in 625 children in Malaysia (Dolah, J., *et al.*, 2011). These autistic children are known to be diverse in group and the manner of how the autism manifests in each child is different as well (Seigel, B., 2003). For example, it is common that these individuals lack fine or gross motor control, enjoy interacting with technology and video games (Dayan, E., 2006), and become fixated with a particular subject area referred to as a special interest, such as dinosaurs, trains, or outer space.

Children with autism have a high incidence of visual perception problems. They often have difficulty in recognizing, remembering, organizing and interpreting visual images. As a result, they are easily confused in situations that involve written or pictorial symbols for learning. The relationship of visual perception problems to reading disorders is well understood, but children with these problems also have difficulty with other symbolic learning such as using graphs, charts, tables, measurements, etc.

They may also have a poor sense of direction and get lost easily or have difficulty coordinating body movements in time and space, resulting in clumsiness. They may have difficulty in recognizing non-verbal aspects of social interaction and as a result, may have difficulty in negotiating friendships and communication with others (Lisa, A.K., 2006). Pertinent to that, research on serious game based for autistic children is done by many researchers in the computing field. The term serious game has commonly been used by many researchers. A book entitled "Serious Games" illustrates author own work in educational-curriculum development, school-system planning, industrial management and technological planning and forecasting where he examined war-games (a mixture of mathematical analysis and the group interaction) and simulations to coach managers, students and teachers. His definition of such game is that: "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" (Abt, C., 1970). This does not mean that serious game is not, or should not be entertaining (Prensky, M., 2000). Therefore, the objectives of this paper are to review the current serious game for autism and to propose a new development framework model for hybrid visual perception games by using ADDIE approach.

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Current Serious Games:

Currently, serious games for autism developed for two purposes: first is for therapy and secondly for education (include learning and training) (Helmi Adly, M.N., *et al*., 2012). The autism serious game is proposed and is shown in Table 1:

Table 1: Autism Serious Games

Author	Year	Type	Purpose
Mohammed E. Hoque *et al*.	2009	Therapy	Communication Skill
Md. Mustafizur Rahman *et al*.	2010	Therapy	Communication Skill
Md. Mustafizur Rahman *et al*.	2011	Therapy	Communication Skill
Min Young Choi *et al*.	2010	Therapy	Visual motor Coordination, Social Skills, Sensory Integration
Qiang Wang *et al*.	2010	Therapy	Concentration
Alberto Battocchi *et al*.	2009	Therapy	Social Behaviors
Arshia *et al*.	2011	Education	Social Skill
Emilia Barakova *et al*.	2007	Education	Social Skill
Samantha *et al*.	2009	Education	Social Skill
Anika Anwar *et al*.	2011	Education	Communication Skill
Maite Frutos *et al*.	2011	Education	Communication Skill
Zelai *et al*.	2011	Education	First Aid Learning
Megan Davis *et. al*.	2007	Education	Narrative

Autism serious games for therapy have been done with the main purpose therapy for communication skill, visual motor coordination, social skill, sensory integration, concentration and social behaviours. Serious games for education are designed to help educator or student during the teaching and/or learning process. The purpose is to learn the concept of money, social skill, communication skill, first aid learning and narrative learning. Currently, there is no other serious game used as a tool to diagnose and assess visual perception problem for autism children. Hybrid visual perception game for autism will be a technological solution to address autism problems.

Proposed Research Framework:

The construction of the framework derives from every single component. It is done by mapping all components into a framework as illustrated in Figure 1.
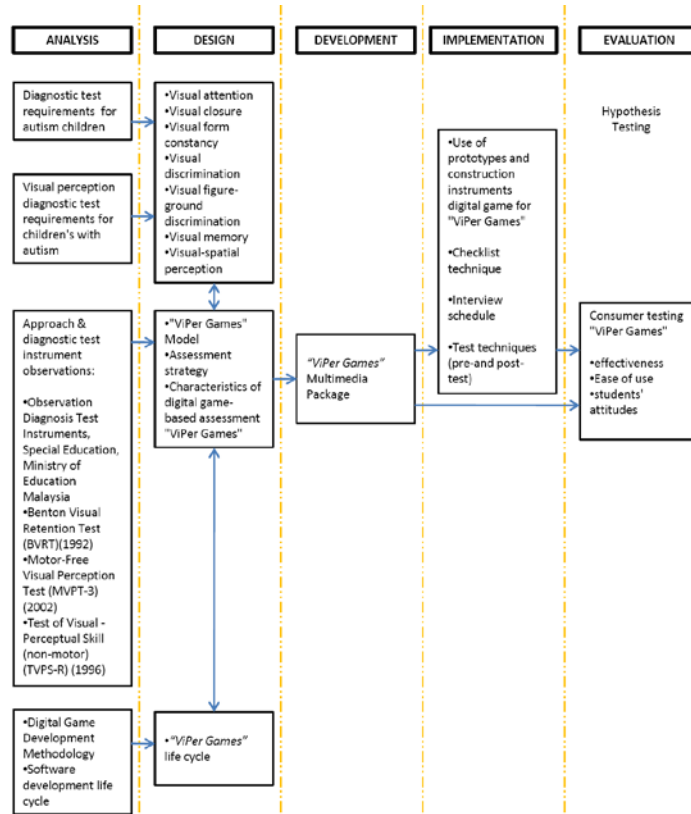

Fig. 1: Development Framework Model: Visual Perception Games for Autism Children.

The methodology used to develop a courseware is ADDIE model. ADDIE is five-phase systematic model used to create sound instructional products for a variety setting. Each phase represents a series of tasks that help to ensure development efforts stay on tract, time, and target. Completing each phase satisfactorily increases the chance for the information to be presented timely which remains relevant to the needs of the audience. Each phase of the model has an important element of constructing the instructional design process. In each phase, the instructional designer makes the decisions that are critical for ensuring the effectiveness of the instructional experience.

A. Analysis phase: In the analysis phase, the visual perception diagnostic test requirements for children's with autism are made. Besides, the problems that directly influence the motives of the research must be identified. Then, goals and objectives are established and the game environment and game methodology were identified so that autism children requirements for diagnosis and assessment will be achieved through this game model. By closely analyzing and understanding the target audience, scope (specific platform and specific functional), the significance of developing this model and the expected output can bring clearer view of developing this research that help in the next phase. All important relationship needs to be developed with the target audience, fulfil their needs, and develop a development strategy and timeline. The application should be determined too on what the whole picture will look like: content, performance, and intended audience. Approach & diagnostic test instrument observations include the Observation Diagnosis Test Instruments, Special Education, Ministry of Education Malaysia, Benton Visual Retention Test (BVRT), Motor-Free Visual Perception Test (MVPT-3) and Test of Visual-Perceptual Skill (non-motor) (TVPS-R).

B. Design phase: Designing a game based on the model proposed and concerned with the assessment approach. From the game outcomes, the results obtained from the above analysis showed that the interactive game can be designed by selecting content, media and type of interactivity that best underpins these game objectives. The user-centred design is used to construct game design. It includes layout and design, colour scheme, navigation, graphics and the concept of the game. The steps used for designing phase to: create storyboards, design the user interface and user experience, navigation design, game method design and lastly prototype creation (input and output design).

C. Development phase: The develop stage integrates artwork and game design. At this point, developing process initiates based on the storyboard created and concluded in an Alpha version of the product. The development of this application is carried out in this phase. By using the storyboard as a guide, the development will start with interface development followed by the content. Each module will be built, and each button and function need to be function properly.

D. Implementation phase: This phase is to make sure that the game application is functional. All the modules and elements will be integrated to produce a final product that is ready to use. Prior to full-scale implementation, it is usually helpful to demo the application with a small group so that their feedback can be used to revise and improve the software such as the interface, game methodology and content.

E. Evaluation phase: Evaluation process is collecting feedbacks from end users. Any dissatisfaction from end users should be taken into action before finalizing the product. The questionnaire from the testers will be used for collecting feedback from the users of the software regarding the effectiveness, ease of use and students attitudes of using the game.

Conclusion:

Serious games are relevant to address some human's problems such as autism. In this paper, a review of current serious games for autism and a systematic development framework model to diagnose visual perception problem for autism proposed is discussed. Serious games provide a leeway to move past this one-dimensional, narrowly fixed type of assessment. As a matter of fact, by combining other forms of conventional assessment with modern methods, games can be assessed on a regular basis. In addition, this situation provides the possibilities to create assessment that is more complex and complete. For now, there are no similar serious games that focus on visual perception diagnosis. Future work is to develop visual perception diagnosis by using serious game to identify visual perception problems among autism children.

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