A prototype development of visual perception diagnosis games for autism children

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A R T I C L E   I N F O

A B S T R A C T

In order to minimize the negative effects of autism, early identification and diagnosis are the solutions to get students on the right road to dealing with the problems related to autism and overcoming them. The objective of this research is to develop serious games as a tool for special education teachers to diagnose visual perception problems in autistic students. The development of the visual perception diagnosis games is using the Chalfant diagnosis theory. These diagnostic tools show that it assist and help teachers to diagnose their autism students without the teachers needing to have some experience and knowledge of diagnosing visual perception. This prototype will be a high-tech solution to diagnosing visual perception problems designed for autistic children.

1. Introduction

Autism is undetected from birth (Wan and Hisham, 2013) and only when the child is around 18 months of age a brain disorder could be detected (Kanner, 1967). Autism means a condition that causes children to concentrate on their own world. Autism interferes with mental development of children incorporating speech, communication, social interaction, thinking, behavior, emotions, role of play, impairment and also unusual behavior.

Although there are several regular factors shown in most people with autism, Autism Spectrum Disorder (ASD) is a distributive developmental disorder within individuals in numerous degrees of impairment (Sicile, 2004). For example, although these autistic people look well, his gross motor control is lacking, by and large, he loves to interact with technology and video games and become attached to a particular interest like dinosaurs, trains or outer space.

The number of diagnosed autistic children is increasing. With regard to a great progress in early diagnosis, the results for a majority of autistic children are still unsatisfactory where few of them are able to live independently towards adulthood (Billstedt and Gillberg, 2005; Eaves and Ho, 2008; Howlin et al., 2004). In relation to that, ample research on serious game based for children with autism in the field of computing.

Visual perception problem is very common in autistic children. They often have difficulty in recognizing, remembering, organizing and interpreting visual images. As a result, they are easily confused in situations that involve using written or pictorial symbols for learning (Kurtz, 2006).

By and large, the term serious game has been utilised by many researchers. In a book entitled "Serious Games" the first author in his own work in educational-curriculum development, school-system planning, industrial management and technological planning and forecasting is illustrated. In which in order to train managers, students and teachers, he has examined war-games (a mixture of mathematical analysis and the group interaction) and simulations (Clark, 1970). In this paper, the aims are described below:

a) To review current serious games for autism

b) To propose a new development framework
c) To describe the development of prototype

This paper has been divided into four parts. The first section deals with introduction, Section II describes the related works of serious games for autism and Section III presents the proposed development framework model. Finally, Section IV describes the development of prototype and the last section V concludes the paper and suggests future work for research.

2. Related works

Recently, therapy and education which include learning and training are the two main purposes for autism serious games development. 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. Teaching and learning process by using serious games for education will help educators and students.

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 autistic children. Visual perception serious games will be a technological solution to diagnosed autistic children problems. The list of serious games for autism was proposed and adapted by Helmi et al. (2012a, 2012b and 2013), and it is shown in Table 1 and Table 2.

Table 1: Serious games for therapy of autistic children

No.	Purposes/ Objectives	Author
1	E-learning environment	Artoni et al. (2012)
2	Teaching facial expression	Jain et al. (2012)
3	Interaction skills measurement	Bartolome et al. (2013)
4	Learning emotional and social skills	Yan (2011)
5	Increasing intelligibility in speech	Sharmin et al. (2011)
6	Speech delays	Hailpern et al. (2012)
7	Teaching social conversation skills	Zancanaro et al. (2014)
8	Exploring motion-based touchless games	Bartoli et al. (2013)

3. Development framework

The Development Framework was developed as shown in Fig. 1. This model shows the overall development framework model that served as a guide to engage all the referred diagnosis method. This was adapted to the development of the prototype design and research question solutions based on the Vi-Per Games development phase.

Vi-Per Games is a name for Visual Perception Games. In terms of content, the prototype Vi-Per Games was developed based on the ADDIE model. ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation. It is a five-phase systematic model used to guide through the process of creating multimedia products for a variety of settings. Each phase of the ADDIE model is an important element of the design process. In each phase, decisions are made for ensuring the effectiveness of the game experience.

4. Prototype development

4.1. Software

The prototype was implemented on the Multimedia authoring tools which required to design the user interface of visual perception games. In other words, the combination of various tools made the system more powerful. The software involved in this study was (i) Adobe Illustrator CS5 (ii) Adobe Photoshop CS5, and (iii) Adobe Dreamweaver CS5. Adobe illustrator was needed in order to create and edit the needed image in visual perception games. These elements were then imported to flash. Below is a description of the software used in this study.

Table 2: Serious games for education of autistic children

No.	Purpose/ Objective	Author
1	Teaching emotion	Abirached et al. (2012)
2	Social skills	Hourcade et al. (2012)
3	Teaching vocational and daily living skills	Bereznak et al. (2012)
4	Teaching basic skills	Hulusica and Pistoljevic (2012)
5	Learning facial expressions	Hansen et al. (2013)
6	Learning emotion expression	Piana et al. (2013)
7	Natural social engagement	Chukoskie et al. (2013)
8	Developing social skills	Chen (2013)
9	Emotional learning environment	Bertacchini et al. (2013)
10	Facial expression and emotion	Schuller et al. (2014)
11	Learning words	Al-Khafaji et al. (2013)
12	Emotion training in the context of financial decision-making	Jercic et al. (2012)
13	Imaginative play	Bai (2012)
14	Imaginative skills	Porayska et al. (2013)
15	First Aid Learning	De Urturi et al. (2012)

4.1.1. Adobe illustrator CS5

Illustrator is important software or editing tool used in this study. It is a powerful program used in designing interface. It is also used to create layouts for buttons, icons, front pages and others. In addition, it offers a variety of features that make compositing multiple images easier than ever before.

4.1.2. Adobe flash CS5

Vi-Per Games used this software to provide features to support compliance with web accessibility guidelines by allowing for auto-labeling of buttons, tab-order controls and access to assistive technologies such as screen readers. The program's flexibility in learning object design means that the end user has the ability to choose how they want the information to be presented.
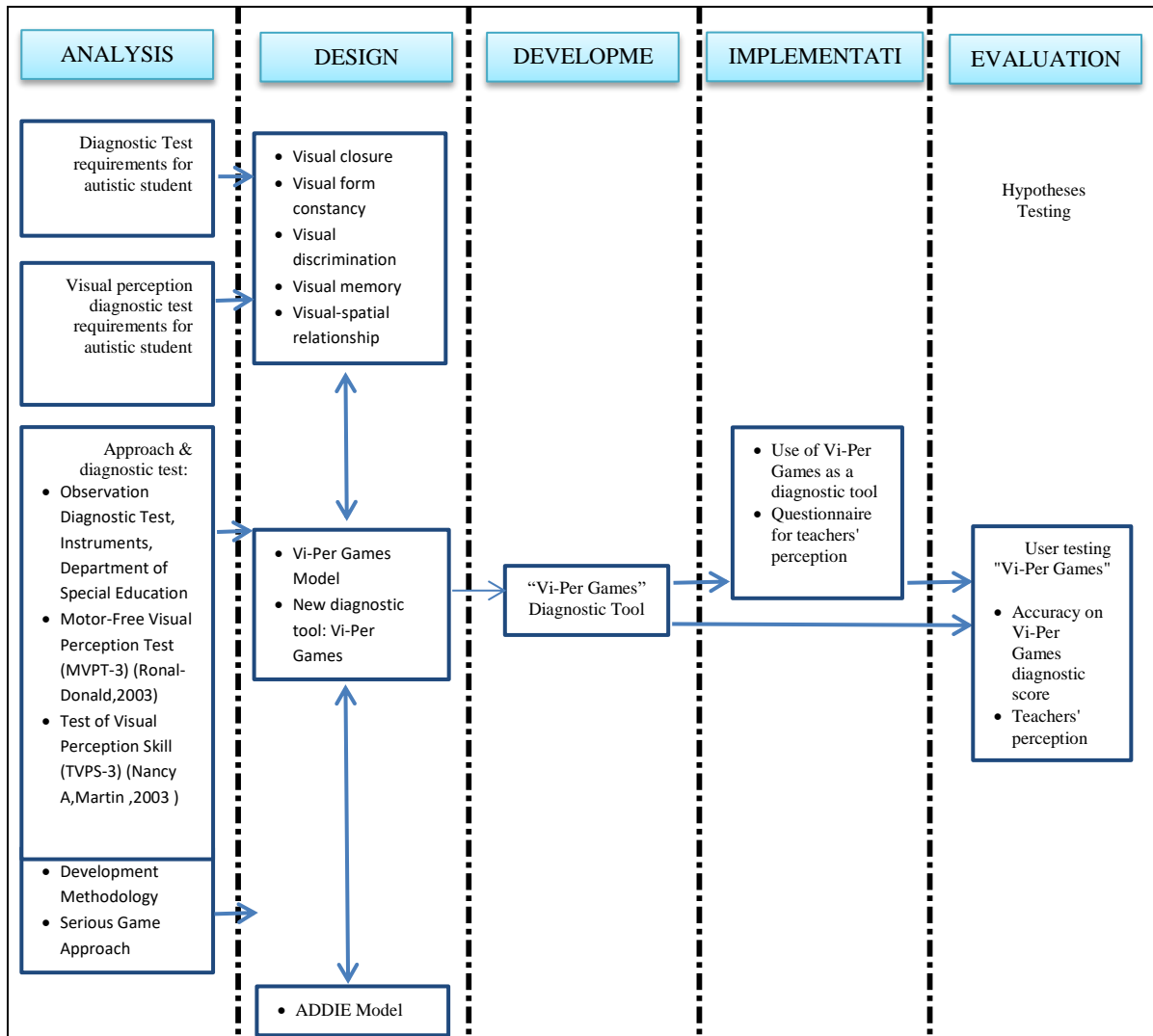
Fig. 1: Development framework

4.1.3. Adobe dreamweaver CS5

Adobe Dreamweaver CS5 was used in Vi-Per Games to design the web based environment. It delivers powerful new tools that support Hypertext Preprocessor (PHP) based content management system. The PHP is free software released under the PHP License and can be set up on most web servers. It is also a standalone shell on almost every operating system and platform for free.

4.2. Game interface

As the saying goes, a picture is worth a thousand words. Thus, it is essential to incorporate graphics in order to increase users' understanding. In this project, two types of graphics were incorporated, vector and bitmap. Vector graphics or vector images define the curves and shapes in a picture and they are stored as algorithms or a set of mathematics equations. Each game will start with the introduction montage (Fig. 2). Then, autism student can start with drag and drop playing games (Fig. 3). After finish the games, ending montage will play (Fig. 4).

5. Conclusion and future work

Serious game is relevant to help several problems such as autism. In this paper, a related work of current serious games for autism; a

development framework model to diagnose visual perception problem for autism children and the development of prototype were discussed.
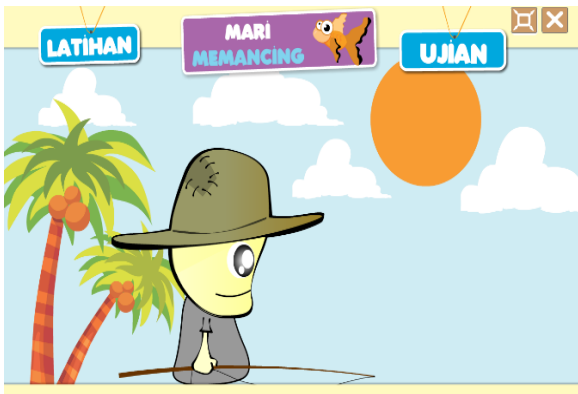

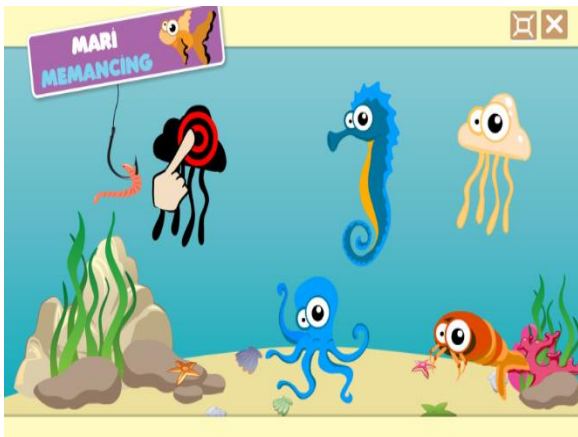**Fig. 2:** Introduction to let's go fishing game 1 interface

Fig. 3: Let's go fishing game 1 exercise interface

Fig. 4: Ending montage of let's go fishing game 1 interface

Serious games are a fresh alternative compared to this flat, rigid type of assessment. Insomuch that digital games can be assessed regularly by integrating other forms of conventional assessment with modern procedures. Additionally, this situation offers the opportunities to create assessment that is more intricate and complete. Future work should concentrate on the analyze result of visual perception diagnosis assessment by using serious game to identify visual perception problems among autism children.

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