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Involving teachers, parents and rehabilitation instructors in visual training for visually impaired children: A web-based approach

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ABSTRACT

A significant number of children have difficulties either receiving or processing visual stimuli from their environment. To an extent, visual perceptive development can be improved by visual stimulation programs. These programs are usually guided by specialists in low vision that make use of different tools to help stimulation of the child. In addition, to make visual training more successful, the specialist in low vision needs to collaborate closely with parents and teachers taking into account the preferences and characteristics of each child. Traditional materials used in visual training are physical worksheets with special exercises and different colors and forms. Although these traditional worksheets have been recreated in computer programs, they currently have some limitations: (1) require that the specialist works with the child at the same place; (2) have a lack of assessment, monitoring and feedback mechanisms. To overcome these limitations, we have implemented EVIN, a web-based platform that provides games for visual training (among other things). In addition to the specialist, EVIN may and must be used by teachers at school and by parents at home. EVIN has monitoring capabilities and provides reports about children's performance. In fact, reports of EVIN are to be assessed by the specialist in low vision. EVIN promotes a better integration of visually impaired children in schools and improves the children's interaction with visual stimulation programs. In this paper, we present the main characteristics of EVIN and we focus on the Explorations game, the most popular game in EVIN.

1. Introduction

Seeing is an art that can be learned and the quality of the result can be improved with training. Visual stimulation aims to develop sight to its maximum potential. That encourages children to take an interest in and explore their surroundings, using their vision as a vehicle for accessing information.

On the grounds of evidence that increasing visual experience enhances neuronal growth in the visual cortex [1], the most effective course of action is to provide opportunities for visual development wherever possible. That should be done with exercises in order to acquire gradually more complex visual behavior [2].

Visual stimulation programs should be undertaken at the earliest possible age. They must afford the largest possible number of visual experiences and they must be adapted to the child's stage of development (thus, thoroughly individualized). Therefore, Visual stimulation/training should always be implemented after a meticulous assessment. This assessment must show that the child's visual development lags behind his age and cognitive level. Although visual training is particularly advisable during the sensitive period of visual development, intervention may be initiated at any age [3]. In addition, it is important to highlight that visual training may also be useful for children without any kind of visual disability: for instance, as an activity to improve the attention at school [4].

After the initial assessment of the child's visual function, the specialist must design the visual training plan: i.e. deciding which materials to use in each session. These materials are mainly physical worksheets and/or activities with a computer program. The lightbox [5] (see Fig. 1) or EFIVIS[1] are examples of materials traditionally used in visual training. Specialists in low vision also create their own materials using popular software tools such as text processors o presentation authoring tools. Even though these resources are extremely useful for visual training, they have as main requirement that the specialist must work with the child

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[1] http://www.portaltica.net/recursos/257/efivis.

Fig. 1. Materials for activities with light box.

together at the same place. This prevents the participation of the rest of the agents (apart from the specialist) involved in the visual training: the parents and the teachers. In fact, in a visual stimulation program for low vision, the specialist may collaborate with parents and teachers all together in order to enrich the work with the child. Thus, visual training should be supported by teachers at school and by parents at home as well as the specialist (wherever) [6]. In addition, another notable limitation of traditional materials is the total or partial absence of feedback mechanisms. These mechanisms should facilitate the assessment and monitorization of students and should allow to adapt to different types of and degrees of visual impairment. Also, it is really convenient to have the possibility of collaboration between teachers, parents and specialists in low vision during visual training. For instance, the monitoring mechanisms would allow the specialist to evaluate the visual training performed by their parents or teachers.

The rise of technology in education has led to the development of initiatives for software that improves interaction techniques for children with difficulties related to vision [7–10]. However, to date only a few specific software programs have been used for visual training of children with low vision. First programs, Lilli & Gogo [11] and a set of games developed in the Resource Tomteboda Centre of Sweden: *The truck, Worm max, Look Here* [12] covered some basic visual functions (fixing, tracking, monitoring, mapping and exploration, etc.) with just a few exercises. However, many of these exercises neither allowed to adjust the stimular features for each child (size, color, contrast, etc.) nor catered to the needs of all types of visual impairment (as it varies significantly depending on different degrees of the remaining vision).

At the turn of the century, two interesting applications were released: EVO[2] (Computer-assisted visual training) and SENSwitcher.[3] On the first hand, EVO [13] is the result of a research program funded by ONCE (Spanish National Organization of the Blind). Currently, EVO is one of the most comprehensive applications: it contains 24 exercises that cover a wide variety of visual tasks, allowing the variation of stimular settings and suitable for different child characteristics: age, type of visual impairment, cognitive ability, etc. It is also the first in providing feedback about the degree of success or failure of children in performing a given task. However, this feedback is not available in real time and it is just stored locally in the computer where the visual training is carried out. On the second hand, SENSwitcher is a tool for basic visual training. It contains a large number of exercises in which the child performs tracking of stimuli, obtains simple cause and effect responses, observes different shapes and forms, etc. The main drawback of SENSwitcher is that it is not designed specifically for children with visual impairment. Thus it can be used only for basic visual training. None of these applications allow the collaboration between parents, teachers and specialist.

Visual training should be supported by an application with tracking capabilities that could be used remotely by children at home and at school. To this end, we have designed and implemented EVIN[4] (*Visual Stimulation on the Internet*), a web-based platform for visual training. EVIN is composed of several games that can be configured by the specialist taking into account the special needs of each child. When children use EVIN, their interactions and their performance metrics are stored in a database. Later, all that information can be analyzed by the specialist. As a web-based platform, EVIN is usually utilized ubiquitously, which allows parents and teachers to collaborate with the specialist by supervising the children while using EVIN.

The rest of the paper is organized as follows. Section 2 overviews EVIN and its main characteristics. In Section 3 we describe the Explorations game, its objectives and how to configure it. Next, in Section 4 we describe the evaluation we have carried out up to the moment and the results obtained. To conclude, in Section 5 we present the conclusions obtained from the research and some future lines of work.

2. General description of EVIN

The main objective of the EVIN approach is to provide a tool for visual training intended for children with low vision. Nowadays, there exist commercial computer games or online playgrounds that are also intended for visual training. Nevertheless, they do not have the required characteristics to be used by children with low vision (i.e. adaptable attributes such us: size, contrast, presentation speed, etc.).

Visual stimulation in EVIN is performed through *games* that train the children in different visual tasks. Each game must be adapted to the different child's characteristics by setting up the game's parameters. These parameters allow for different levels of difficulty in each visual task. Some examples of such parameters are: size of stimuli, allow rotation, presentation speed, etc. These options, allow the provision of adapted games and tasks for each child. This fact greatly motivates children since they are provided with tasks that can achieved. Normally these children are usually frustrated when they cannot use programs or games that other children with the same age use.

The five games currently offered in EVIN are: Exploration, Facial expression, Spatial perception, Puzzles and Prominent features. EVIN is being developed as a dynamic tool that allows instructors (specialists, parents and/or teachers) to guide the children while they perform tasks essential to their visual development. A few recommendations for achieving this aim are listed below.

- As much time as necessary should be devoted to "winning the children over to intervention". Motivation is imperative to the process.
- Information must be conveyed in a way that children understand the task they are supposed to perform.
- Instructors must be able to understand children's messages. They must recognize what is meant by a significant response, which may vary from child to child.
- The computer score constitutes only a tiny part of the information that can be gleaned from children–application interactions. While training, observation is essential; factors to bear in mind include: children's attention level, eye movements, head movements if any and the regularity of cursor movements, among others.

[2] http://educacion.once.es/appdocumentos/educa/comun/programaestimulacionvisual(evo).zip.

[3] http://www.northerngrid.org/content/senswitcher/index.htm.

[4] http://evint.org/.