Design considerations of an original serious game for training working memory in Down syndrome individuals

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1 Introduction

It is a fact that people with Down syndrome (e.g. DS) have deficits related to verbal working memory [1]. Previous research proves that working can be improved through rehearsal training using computerized environments [2]. However, technology enhanced interventions on people with DS have not focused to verbal work memory alone. Studies have either combined evaluation with other cognitive functions or not at all [3, 4]. In this paper we describe a technology tool designed for specific verbal memory training of people with DS, called "Memorize- Image it!" and its design aspects as they have been evaluated by DS intervention facilitators.

2 Materials and methods

The "Memorize-Imagine it!" application is a simple memory game adapted for the needs of children with DS. The game was created following some simple design guidelines in order for it to be both educationally appropriate and technically simple. It consists of several levels on which the user hears and reads a series of words and then has to choose in the correct order the objects that are described with these words. The game starts from two words and has an upper limit of 7 words.

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3 Results.

The "Memorize- Image it!" application was put for testing in front of 6 facilitators who have worked in DS technology-based interventions of more than 100 DS users. They were asked to evaluate the application by a qualitative 4-item questionnaire, structured as a 5-point Likert scale (e.g. 1= strongly agree) focusing on the characteristics of the application as well as its potential for transfer to VR. The results of these quantitative questions are presented in **Figs. 1&2**
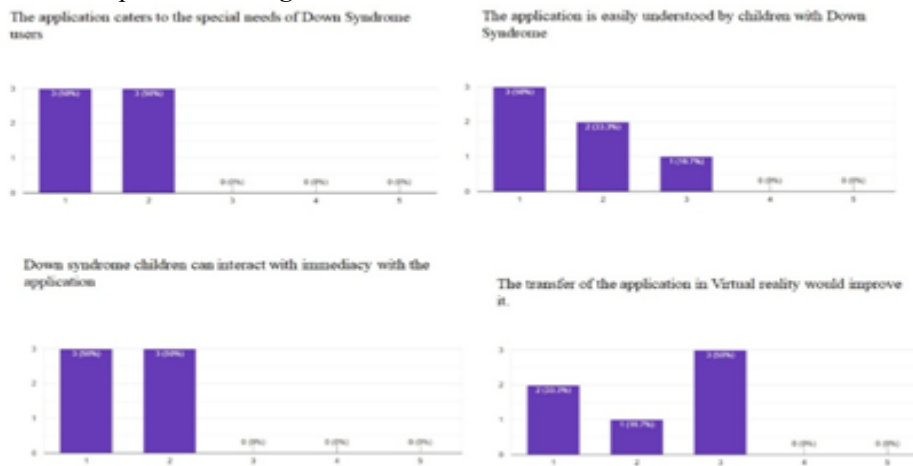

Fig. 1. Results of evaluators' perceptions about the usefulness of the application regarding users with DS.
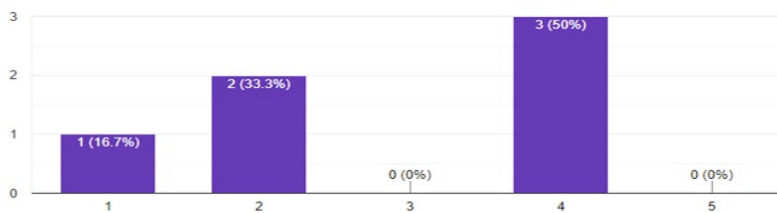

Fig. 2. Facilitator perceptions for acceptance of MR equipment for use with children with Down Syndrome.

4   Discussion

The results of the facilitator's evaluation revealed some interesting insights. The first of these was that the facilitators did not perceive the application to have been designed with enough focus for DS users, since the user experience was not deemed transparent enough. Additionally, the qualitative responses revealed interesting design insights. The strongest point in the design was the simple but audio-visually rich design. The use of simple but impressionable color schemes and the use of audio cues for the word lists were considered significant advantages. On the other hand, the difficulty of the game, the fact that its word lists reached the 7 objects was deemed an unnecessary difficulty. Furthermore, the initial choice of having a definitive lose state and not just revert to lower difficulty at different times has been identified as key weaknesses. A common theme for improving educational efficacy was exactly this addition as well as adding the capability of repeating the audio descriptions of the word lists. Regarding the transfer to VR the most noteworthy result is that it isn't recommended by the facilitators.

5   References.

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