

Enhancing Learning for Visually Impaired with Technology: MATHVIS

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Abstract— Mathematics for Visually Impaired Students (MATHVIS) is a researched and developed software application that is capable of uplifting the educational background of visually impaired students. This research focuses on providing access to education for all, including the visually impaired, using MATHVIS, which embraces game based learning methodology. The critical factor in the project is the use of sound to communicate with the visually impaired students. All voice instructions were provided along with soundtracks and a menu to enable selecting local languages such as Sinhala and English. The main emphasis of this paper is to discuss the current generation of MATHVIS, which has been extended in several ways, through intensive evaluation and testing.

The evaluators selected from categories such as technical personnel, instructors and visually impaired students carried out in depth reviews of the application. This paper discusses the features of the application, evaluation carried out, the technology and learning pedagogy used to develop the application for visually impaired students. The paper also highlights how MATHVIS can be used to provide education for all, including the visually impaired.

Keywords—game based learning, visually impaired students.

I. INTRODUCTION

The entertainment industry that attracts many youngsters has been recognized by educators as a means of encouraging learning in an interesting and interactive manner. With the massive technological revolution in the entertainment industry, it is evident that use of these gaming concepts could assist learners [1]. Abner and Lahm [3] and French [2] state that visually impaired students have fewer opportunities to play computer games due to their physical disability. The software application MATHVIS is a researched and developed application that enables visually impaired students to learn mathematics, using game based learning methods.

One of the main objectives of this research was to bring forth, with the use of technology, a learning environment that is new and exciting, to visually impaired students. Taking the opportunity, the team carried out research to identify the needs of visually impaired students. The literature revealed information about available software

tools and resources such as JAWS, TextAloud, MAGIC, and Zoom text for the visually impaired.

Bishop [4] stresses on the importance of education for visually impaired children. It is important to encourage learning for visually impaired students as much as for other students. However, visually impaired students are at a disadvantage as resources that they could use are limited. In order to provide equal opportunities for visually impaired students, the research focused on providing education for all, embracing game based learning with technology for teaching mathematics to visually impaired students.

II. BACKGROUND AND MOTIVATION

MATHVIS, a researched and developed application, was further enhanced to increase its usability. While the initial requirement of the project was to facilitate an interactive mathematics learning tool for visually impaired students, further suggestions such as usability, flexibility and accuracy were taken into account in this phase of development. Taking Bishop's [4] argument further, the project attempted to provide education for visually impaired as well, in an entertaining environment. Therefore, the team was motivated to enhance the application and evaluate it further through different types of users, enabling additional development through a spiral model development strategy. The application was further fine tuned by incorporating the above mentioned quality factors.

III. METHODOLOGY

MATHVIS was developed using the qualitative research methods. The enhancements of MATHVIS were carried out considering factors such as findings through real world settings [5]. Initial requirements were gathered through interviews with visually impaired students and their instructors, while observations were carried out at Jinasena research laboratory to learn visually impaired students' learning methods. Sampling techniques such as snowball were used to gather requirements.

The gathered requirements were analyzed and a set of project requirements were developed while clarifications were carried out through member checking [6]. Several instructors, visually impaired students and educators were consulted and made participants of the project. These qualitative research methods allowed the researchers to gather first hand information that was needed to enhance the application by incorporating additional quality factors.