ASSISTIVE TECHNOLOGY FOR STUDENTS WITH DYSLEXIA AT EROS GIRLS SCHOOL

A RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTERS OF SCIENCE IN INFORMATION AND TECHNOLOGY

OF

THE UNIVERSITY OF NAMIBIA

BY

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April 2019

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ABSTRACT

Assistive Technology for Children with Learning Disabilities (ATCLD) was developed in response to the language and arithmetic challenges faced by learners with dyslexia of Eros Girls School (EGS). This development followed from requirement elicitation and is intended for grades 5 - 7. Having discussed the above, Assistive Technology (AT) is any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customised, that is used to increase, maintain, or improve the functional capabilities of children with disabilities ("Assistive Technology Device", 2004). As a counterexample to numerous schools in Namibia, EGS enrols and educates pupils diagnosed with learning difficulties in regular teaching and learning environment. Equally, the Ministry of Education (2009) states that Namibian classes have a wideband mixed ability range of learners, and learners with special educational needs are often included in mainstream school. In response to the dilemma outlined, this study developed ATCLD which is characterised with text to speech features to enable compensatory learning that emphasises repetition. The endeavour of ATCLD pursued the following methods; the Initial and final stage utilised qualitative; case study and quantitative; experimental techniques respectively. Mixed methods state the blend of these approaches. The inferential statistics of the ATCLD, a part of the text – speech assistive technologies of Namibia now, associate younger children with most improved mark. This implies that younger children have the capacity to create new schemas for information. It is reasonable to acquaint them with basic knowledge, since doing this at a later stage may implicate. Furthermore, the widespread input and output text to speech and speech to text assistive technology would expand this research in the future.

Keywords: assistive technology, dyslexia, dyscalculia, text – to speech, english language, mathematics, primary school

LIST OF PUBLICATION(S)/ CONFERENCE(S)/ PROCEEDINGS

1. Veiko, V. (2017). Assistive technology for children with learning disabilities as an artificial intelligence system. *International Journal of Applied Sciences: Basic and Applied Research (IJSBAR)*, 2307-4531.
2. Veiko, V., Sverdlik, W., Hashiyana, V., (2019), Assistive Technology for Students with Dyslexia at Eros Girls School. *University of Namibia, Faculty of Science, School of Computing, the School of Postgraduate Studies: Master's Thesis.*

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LIST OF ABBREVIATIONS AND/OR ACRONYMS

ATCLD	Assistive Technology for Children with Learning Disabilities
EGS	Eros Girls School
AT	Assistive Technology
GG	GraphoGame
PSLC	Parts of Speech Learning Component
PSE	Parts of Speech Exercise
FBOE	Four Basic Operations Exercise
MRW	Math and Real World
UNAM	University of Namibia
WHO	World Health Organisation
VB	Visual Basic

GLOSSARY OF TERMS

Assistive Technology (AT)	Any item, piece of equipment, software program, or product system that is used to increase, maintain or improve the functional capabilities of persons with disabilities
A systematic review	involves two processes, defining review protocol and mapping the field by accessing, retrieving and judging the quality and relevance of studies in your research area. Second, reporting the findings to identify where gaps in the current research exist and so indicate where your research might make a useful contribution
Dyslexia	Comes from Greek DYS-disorder and LEXIA-language
Assistive Technology for Children with Learning Difficulties (ATCLD)	Text to speech-enabled technology implemented in Microsoft's Visual Studio (Visual Basic). It runs English and Mathematics curriculums by allowing text inputs, displaying colourful text and images, and conveying sound to users

DysEggxia	Game used for supporting spelling acquisition in children with dyslexia through the realisation of exercises
Qualitative data analysis (QDA)	Process of turning written data such as interview and field notes into findings
Pre-test	Preliminary test or trial
Post-test	Test given to students after completion of an instructional program or segment and often used in conjunction with a pretest to measure their achievement and the effectiveness of the program
Algorithm	Process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer
Speech Application Programming Interface (SAPI)	Speech Application Programming Interface, an API produced by Microsoft for speech recognition and speech synthesis

Application Programming Interface (API)	Set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or another service
Evolutionary Prototyping	lifecycle model in which the system is developed in increments so that it can readily be modified in response to end-user and customer feedback
Mixed methods research	Methodology for conducting research that involves collecting, analysing and integrating quantitative (e.g., experiments, surveys) and qualitative (e.g., focus groups, interviews) research
Waterfall Model	Software development process in a linear sequential flow; hence it is also referred to as a linear-sequential life cycle model

Assistive Technology Act of 1998 | Section508.gov. *Section508.gov*. Retrieved 2016-04-04; Lindsay S. Uman, PhD; dyslexia-international.org; Dr. Christopher E. Sunday (PhD), Qualitative Data Analysis (QDA); khanacademy.org, Algorithms; echtarget.com/definition/Speech-Application-Program-Interface-SAPI; Construx,

ACKNOWLEDGEMENTS

My indebtedness goes to the following people; Dr. Kauna Mufeti, Prof. William Sverdlik, Prof. Bidwell Nicola, Dr. Valerianus Hashiyana, Prof. Jameson Mbale, Dr. Alex Kanyimba, Prof. Raphael Puente Rodrigues, Prof. Gideon Ferdinand, Dr. Victoria Hasheela Mufeti, Dr. Paulus Sheetekala, Dr. Petrina Kapewangolo, Prof. Isaac Mapaure, Prof. Cristian Cruz, Prof. Manfred Mayer, Mr. Joseph Mutonga, Mr. Immanuel Lundere Mkusa, Mr. James Mutuku, Dr. Nalina Suresh, Ms. Desiree Davies and the University of Namibia's Management including all the people not listed here, but played an important role in contributing towards the attainment of this Master's degree. Most of all I am grateful to the God I serve for keeping me alive and moving me through ups and downs.

DEDICATION

Mrs. Kamwimba Naimi Ngeve

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DECLARATIONS

I, Veiko Veiko, declare hereby that this study is a true reflection of my own research, and that this work or part thereof has not been submitted for a degree in any other institution of higher education.

……. [Signature] Date……..

Veiko Veiko

CHAPTER 1: INTRODUCTION

1.1 The orientation of the study

Dyslexia is a neurologically based condition which is often hereditary (World Health Organization, 2016). Moreover, it is a deficiency associated with the processing of visual inputs (Madeira, De Castro & Delou, 2015). Students affected by this condition have language and arithmetic based problems resulting from the way they organise images, text, and sound ("Bright Solutions for Dyslexia", 2018). The dyslexia-related difficulties amongst others are taken into consideration by the United Nations as the United Nations (UN, 2009) outlined administrative measures for children with learning difficulties and simultaneously defined inclusive education as a process of strengthening the capacity of the education system to reach out to all learners. This is achieved through the inclusivity lens that emphasises the use of Information Communication Technology (ICT) and flexible teaching methods (UN, 2009).

Inclusive Education is defined by the Ministry of Education, Republic of Namibia (2013) as a process of addressing and responding to the diversity of needs of all children, youth, and adults through increasing participation, cultures and communities, and reducing and eliminating the exclusion within and from the education system. This acclaim is strengthened by National Institute for Educational Development's (NIED, 2014) Learning Support Teachers' Manual through the emphasis on offering assistance to learners to reach essential basic competencies in different subjects and skills.

England has administrative organisations for people with disabilities. Centre for Disability Research and the British Dyslexia Association Inc. are, amongst others (Emerson & Hatton, 2008). Besides, Non - Governmental Organisations (NGOs) are active in Bangladesh and many of them are involved in Inclusive Education (IE) related programs. For example, Action in Development, by means of home visits, assess the needs of individual children with disabilities and, if needed, refer them to other organisations which can provide them with proper rehabilitation (Grönlund, Lim & Larsson, 2010).

Similar to Bangladesh, Tanzania has a relatively developed legislation on IE but national level coordination is lacking. Because a smaller number of NGOs are active in the country than in Bangladesh, IE initiatives are limited (Grönlund, Lim & Larsson, 2010). Moreover, countries such as Kenya and Zambia are developing the Grapho Game for learners with needs aligned with reading (Ojanen et al., 2015). Likewise, Namibia has introduced various policies, including the one on inclusivity, this tackles learning challenges through the use of ICT and improved teaching and learning methodologies (Ministry of Education, Republic of Namibia, 2013)

As supported by the Ministry of Education (2009) children at Eros Girl School (EGS) are given instructions applicable to candidates in a mainstream environment. In response to the above, Assistive Technology for Children with Learning Difficulties (ATCLD) was developed for fifth to seventh grades. It runs English and Mathematics curriculums by allowing text inputs, displaying colourful text and images, and conveying sound to users.

EGS is a girl's school that prepares pupils with special needs for the industrial endeavour as it offers grades 5 -10 including vocational levels organised into hairdressing, secretariat and Edu - Care. ATCLD was made for novice grades as this would equip learners at this level.

A qualitative approach; a case study of learners with dyslexia of EGS, was employed during the initial stage of the research followed by the quantitative approach; an experiment was exercised as ATCLD was tested. A combination of these techniques relates to mixed methods. Waterfall model guided the study's system development as requirement gathering was the preliminary stage. The research revolves on the improvement of Math and English because people challenged by dyslexia encounter problems on the iteration of the comprehension of language and arithmetic. A pilot study concerning the adoption and use of iPads for active reading showed improvement in academic performance (Culèn & Gasparani, 2011). The work of this study relates to the above technologies, therefore ATCLD is on the basis of improving academic performance as the above technologies.

1.2 Context and Background

During the time of research, the number of learners was rounding to three hundred, whilst that of teachers was around thirty according to the numbers provided by EGS at that time. Teaching strategies employed at the time included remedial classes which made use of traditional counting, reading and writing. Moreover, extra classes were an alternative for accommodating slow learners. Learners diagnosed with dyslexia would have lower marks compare to the groups not diagnosed with such. This study merely focuses on the teaching of Mathematics and English as subjects

since people with dyslexia have issues related to reading and writing of language and dyscalculia. Junior grades are focused since they are foundations of education.

1.3 Statement of the problem

The use of mainstream instructions in Namibian schools as emphasised by Ministry of Education (2009) is the predicament faced by the EGS and this raises the need for Assistive Technologies (AT) since ATs have worked in numerous countries (European Parliamentary Research Service, 2018). This study has developed ATCLD in order to meander around this problem. Moreover, currently, there is no assistive technology being used at EGS. According to a study by Rello et al. (2014), approximately 15-20% of the world population have a language-based learning disability and likely 70-80% of them have dyslexia. EGS is not an exception in this occurrence. Furthermore, dyslexia is not a mental deficiency as people diagnosed with it have the normal intellect except the obstruction of processing of information from the inefficient posterior reading system (Shaywitz, E., n.d; Shaywitz, A., nd). Hence, special accommodations are called for. World Health Organization (2016) states dyslexia as a neurologically based condition which is often hereditary. Furthermore, the exclusivity of the development of a graphically interfaced compensatory assistive technology that provides access to sight, and text to speech features for EGS ensured feasibility in relation to time and resources.

1.4 Objectives of the study

The main objective of this study was to develop an assistive technology namely ATCLD for the enhanced understanding of Mathematics and English concepts for learners with dyslexia at EGS.

The main objective of this study was achieved by realizing the following sub-objectives:

- ☑ Identify the system requirements of the assistive technology-ATCLD
- ☑ Develop and deploy the assistive technology-ATCLD
- ☑ Assess the effectiveness of the assistive technology-ATCLD in enhancing the understanding of Mathematics and English concepts

1.5 Significance of the study

There have not been assistive technologies in the country specialising on the resolve of curriculum subjects specifically Mathematics and English as a subject. The compensatory text to speech ATCLD has been build to accommodate Namibia's primary education curriculum for English and Mathematics. Compensatory technologies improve capabilities with repetition to help develop learners' specific skills (Osewalt, 2016).

1.6 Limitation of the study

Since dyslexia type varies depending on the genetic setup of the host (Palchik & Gaab, 2016), both the dyslexia type and school's calendar posed limit to generalisation of results and reach to participants, furthermore, Assistive Technology for Children with Learning Difficulties was developed for EGS since it is the only girl school in the vicinity of Windhoek. There is nothing beyond the academic performance that EGS was nominated to be part of this study. Moreover, a study that would have taken a sample from Pionier Boys' School and EGS would conflict, because there are various variables pertaining to this combination; the gender and the age, to be precise.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

The review discusses the following variables sequentially in the context of Africa, World, and Namibia. This includes the role of assistive technologies in enhancing the understanding of Mathematics and English for dyslexic students, identifying the system requirements to develop assistive technologies, developing and deploying the assistive technologies and assessing the effectiveness of assistive technologies.

The criterion for accessing literature

This study utilises a systematic review of the literature that involves two processes, defining review protocol and mapping the field by accessing, retrieving and judging the quality and relevance of studies in your research area. Second, reporting the findings to identify where gaps in the current research exist and so indicate where your research might make a useful contribution ("Doing a literature review", 2018)

This paper focuses on publications and tools which are:

- ☑ Educational Assistive Technologies
- ☑ Language learning systems
- ☑ Mathematical systems
- ☑ Text to Speech Systems

Dyslexia and Dyscalculia

Dyslexia is a neurologically based condition which is often hereditary; it results in problems with reading, writing, and spelling (World Health Organization, 2016). ATCLD is implemented for children defied by the above issues, further; the etymology of the word dyslexia comes from Greek DYS-disorder and LEXIA-language. Diagnosis of dyslexia does not imply intellectually impaired, individuals with dyslexia are completely capable of being productive, but this can only be improved with proper identification and appropriate training (International Dyslexia Association, 2017). Instead, dyscalculia is a specific learning disability in math it may cause difficulties in understanding number-related concepts or using symbols or functions needed for success in mathematics ("Understanding dyscalculia", 2018).

2.2 Role of assistive technologies in enhancing the understanding of Mathematics and English for dyslexic students:

Assistive Technology tools reviewed by Stanberry (2015), (World perspective)

The subsequent are tools reviewed by Stanberry (2015) for learners with special needs. Though these are stand-alone devices, it is from which ATCLD has resembled reckonable GUI and text to speech features. Underneath is a condensed list;

- ☑ Abbreviation expanders
- ☑ Alternative keyboards
- ☑ Audiobooks and publications
- ☑ Electronic math worksheets

ATCLD opposes the use of standalone devices since it may lure users to acquire multiple. ATCLD is not necessarily holistic, though it is developed to attain the countable needs of users.

2.3 Identifying the system requirements to develop assistive technologies

Conceptual framework

A conceptual framework is a researcher's understanding of how particular variables in a study connect with each other. Thus, it identifies the variables required in the research investigation. It is the researcher's "map" in pursuing the investigation (Patrick, 2015). Patrick (2015) further outlines a sequence for coming up with the conceptual framework:

- ☑ choose your topic
- ☑ do a literature review and isolating important variables

As for Graham & Richardson (2012), the author of this thesis stretches variables pertaining to achieving objectives of the study such as AT functionality and needs of learners with dyslexia at EGS. Requirements elicitation as one of the objectives of this study gave the researcher a chance to evaluate dependencies between variables in question; AT and users with dyslexia.

Levelling the Playing Field: Assistive Technology, Special Education, and Canadian Perspective (World perspective)

Fundamental lack of understanding by educators directly relates to the profound learning difference and identified learning disability (Graham & Richardson, 2012). In most cases there is no link between researcher's understanding of what a piece of AT actually does

in terms of assisting students and what that particular student's needs are, and as principals, it is important to have courageous conversations around whether there is an understanding of how each child learns best and what the best match for AT is (Graham & Richardson, 2012). This study has taken a top-down approach by understanding user needs prior to the development of ATCLD.

Facilitating Student Achievement with Assistive Technology (World perspective)

Compensatory nature of AT creates a floor of opportunity for students with disabilities (Parette & Karlan, 2007), congruently Currie and Drewry (2011) added that assistive technologies are often promoted to schools, parents and educators as tools to assist students with special needs by providing a compensatory value, to remediate learning problems and to promote personal independence. The use of assistive technology may provide a compensatory alternative, and when embedded within quality writing instruction, improved achievement may ensue like MacArthur (as cited in Young, 2013). ATCD is a compensatory AT, therefore, may yield these parameters.

In the evolution of the field of special education, it was once typical that AT was viewed as devices provided to persons having physical, sensory (hearing and vision), and communication disabilities (Parette & Karlan, 2007). Typically, the responses from education professionals were to provide AT to enable physical access to educational and community programs and services. The prominent role of AT in facilitating access to educational experiences is a means to achieve important curricular outcomes (Parette & Karlan, 2007). Figure 1 beneath indicates the performance gap AT fills.

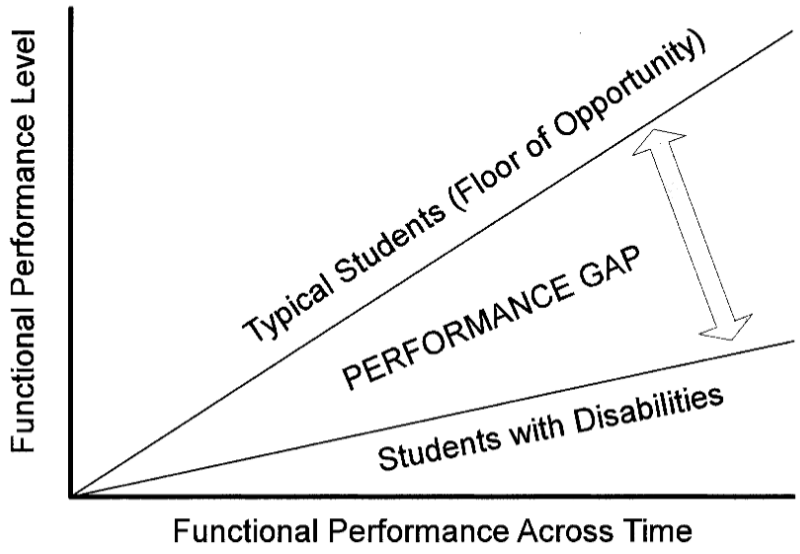


Figure 2.1: AT compensates for functional performance gaps and creates a 'floor of opportunity' for participation (Parette & Karlan, 2007).

2.4 Developing and deploying the assistive technologies:

Identifying and Teaching Children and Young People with Dyslexia and Literacy Difficulties (World perspective)

Rose (2009) conferred teacher training measures for handling children with dyslexia as the illustration beneath shows what a teacher training program could look like. This is composed of three layers, specialist skills, advanced skill, and core skills. In general, teachers require in-service and professional training during the course of their carrier. Similarly, training has been recommended for teachers of EGS on functionalities of ATCLD.

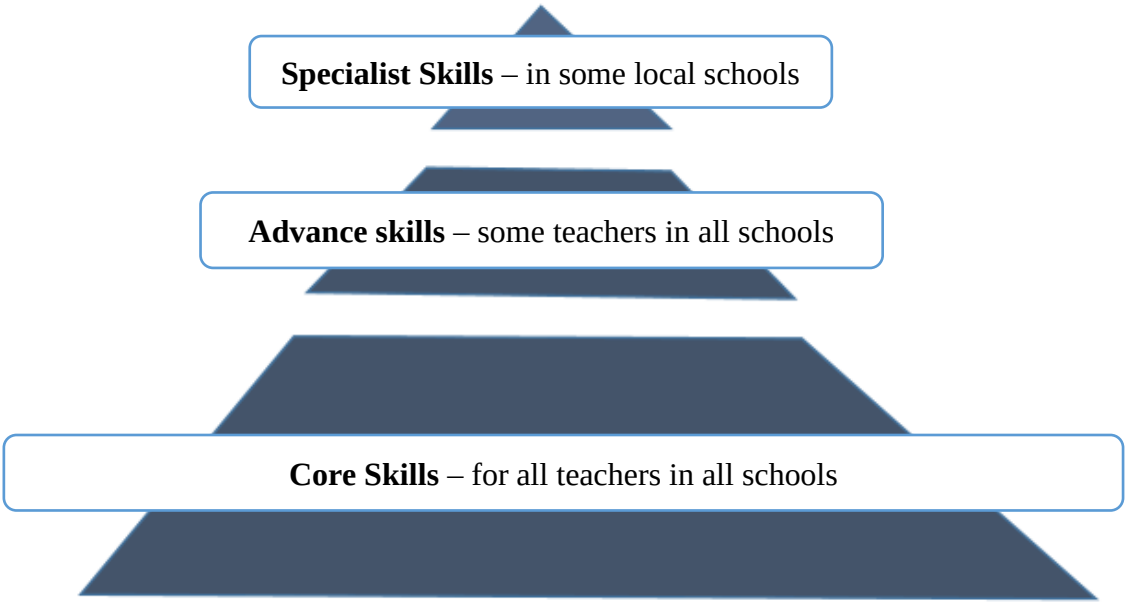


Figure 2.2: Rose's (2009) model which portrays what teacher training program could look like.

Teachers' Knowledge and Use of Assistive Technology for Students with Special Educational Needs (World perspective)

Relating to Graham and Richardson (2012), Keetam and Alkahtani (2013) found that teachers do not have an adequate level of knowledge and skills of using assistive technology. Keetam and Alkahtani (2013) further suggest teachers should have pre-service and in-service training to increase their overall knowledge of implementing assistive technology and using universal design for learning for students with disabilities.

Tablet PCs – an Assistive Technology for Students with Reading Difficulties (World perspective)

While Stanberry (2015) outlined a range of assistive technologies, two pilot studies conducted between September 2010 and January 2011 focused on the adoption of iPads in teaching and learning. These studies contrasted and compared two student groups: one deemed learning disabled, as determined by Culèn and Gasparani (2011) and a control group of a non – special needs students. The evaluation was based on memory and comprehension as participants used iPad and Paper during the course of the study.

Table 2.1: Children with no reading difficulties (Culèn and Gasparani, 2011)

Understanding	Child 1	Child 2	Child 3
iPad	4 memory 4 comprehension	4 memory 2 comprehension	4 memory 3 comprehension
Paper	Reading time 1:54 3 memory 4 comprehension	Reading time 2:27 3 memory 2 comprehension	No Reading time 4 Memory 3 comprehension

Table 2.2: Children with reading difficulties (Culèn and Gasparani, 2011)

Understanding	Child 1	Child 2
iPad	4 memory 2 comprehension	4 memory 5 comprehension
paper	Reading time15:29 2 memory 0 comprehension	Reading time 76:27 1 memory 0 comprehension

The use of iPad provided notable outcomes as compared to Paper and this extended to improving the results of children considered not having reading difficulties. The children remarked on preference for zooming on text, in response Culèn and Gasparani (2011) indicated that it would have been interesting to repeat the experiment with both readings from the iPad, one of them with the possibility of enlarging the text and one with Speak Text App. User needs which rose during the study of Culèn and Gasparani (2011) were taken into consideration as ATCLD was implemented.

A Method to Improve the Spelling of Children with Dyslexia (DysEggxia), (World perspective)

DysEggxia supports spelling acquisition through the realisation of exercises, Rello et al. (2014) have since developed this game to remedy children with dyslexia since high rates of academic failure are associated with dyslexia when it is not diagnosed and treated correctly. Furthermore, DysEggxia has five difficulty levels: Initial, Easy, Medium, Hard, and Expert designed by considering the difficulties of people with dyslexia, these levels

have been considered for ATCLD. Regarding testing, post and pre-test were considered in both of these studies.

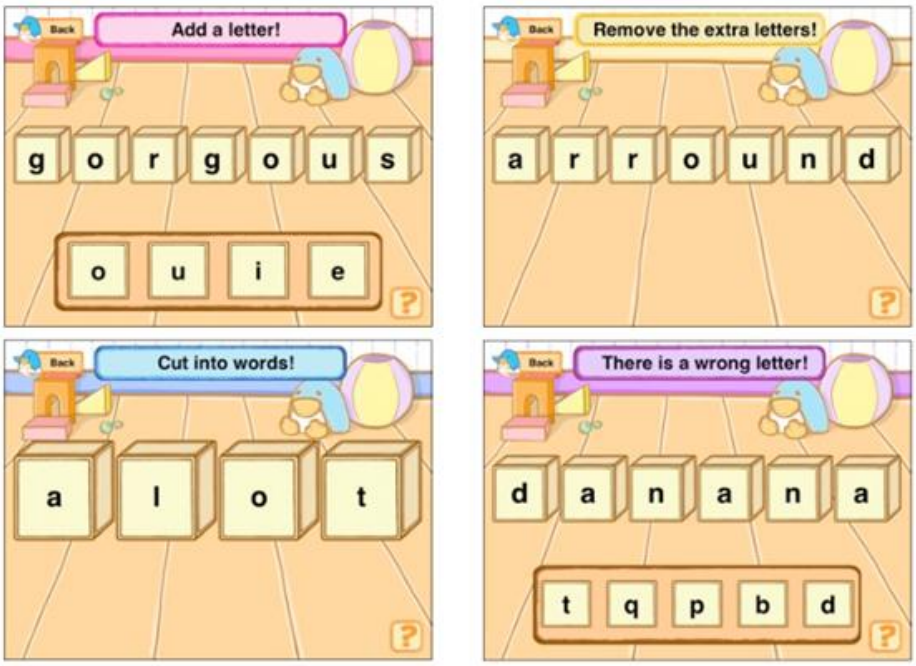


Figure 2.3: DysEggxia exercises (Rello et al., 2014)

ATCLD and DysEggxia coincide on a reach for finding a solution for children with dyslexia, however, the absence of text to speech and arithmetic features are significant in DysEggxia, and this is what ATCLD has built upon.

2.5 Assessing the effectiveness of assistive technologies

Using Assistive Technology in Teaching Children with Learning Disabilities in the 21st Century (Nigeria), (Africa context)

Adebisi, Liman, and Longpoe (2015) explored the meaning, benefits, and answer why the use of assistive technology for children with learning disabilities may close the achievement gap. The paper discussed the various types of assistive technology devices that were designed and used to solve written language, reading, listening, and math problems of children with learning disabilities such as spellcheckers, proofreading, speech Synthesisers, Microsoft Word, Tape Recorder, and Talking Calculator etc. It pointed out the need for selecting the right technology tools for the children with learning disabilities, and highlighted instructional guides for the classroom teachers, that would make children with learning disabilities benefit maximally from the use of assistive technology tools, whether in the classroom or at home, in order that the technology would make the teaching-learning process enjoyable and productive. Research parameter of Adebisi, Liman, and Longpoe (2015) agrees with what ATCLD has incorporated in terms of resolving issues related to reading, writing, and arithmetic.

Field Testing GraphoGame in Zambia, (Africa context)

A literacy game developed by Finish experts, GraphoGame (GG) is an intervention method for supporting children with reading difficulties (Ojenen et al., 2015). Intervention results indeed showed increased performance in literacy tasks (Ojanen et al., 2015). Surprisingly, however, the study also revealed that children encountered extensive difficulties with vowels /a/, /e/, and /i/ the phonemes whose English letter names include

vowel sounds that do not correspond with the vowel sounds of these letters in the local Bantu languages. GG is equally an AT as ATCLD; however, it lacks text input features and functions for responding to math queries.

Kenya and Tanzania, (Africa context)

Encouraged by the success of the Zambian GG team the same approach was introduced in Kenya and Tanzania. The first step of the GG adaptation process is the analysis of the existing language environment and the current curriculum for literacy instruction (Ojanen et al., 2015). Similarly, elicitation of requirements for ATCLD was done. Moreover, results of Kenyan GG trials showed that the children who received the intervention of at least 4 h training time improved in their orthographic awareness in Kikuyu and Kiswahili thus Users of ATCLD from EGS would need extra time on exercise when using the AT in order to improve. Tanzanian Kiswahili players correspondingly enhanced letter-sound knowledge as their Kenyan counterparts. This literally supports the fact that assistive technologies can improve academic performance.

Personal communication with February Pamela (University of Namibia), (Namibia perspective)

P. February, Personal communication, September 9, 2016, recommended chronological presentation of the content of ATCLD, moreover, the Afrikaans GraphoGame (GG) implemented by a Finland organisation rose during this dialogue. This communication was a recommendation by the postgraduate committee of the University of Namibia which ensured that the researcher supposed to have the insight of what local experts had

ongoing about inclusive and special education, this communication would simultaneously provide the researcher with professional advice.

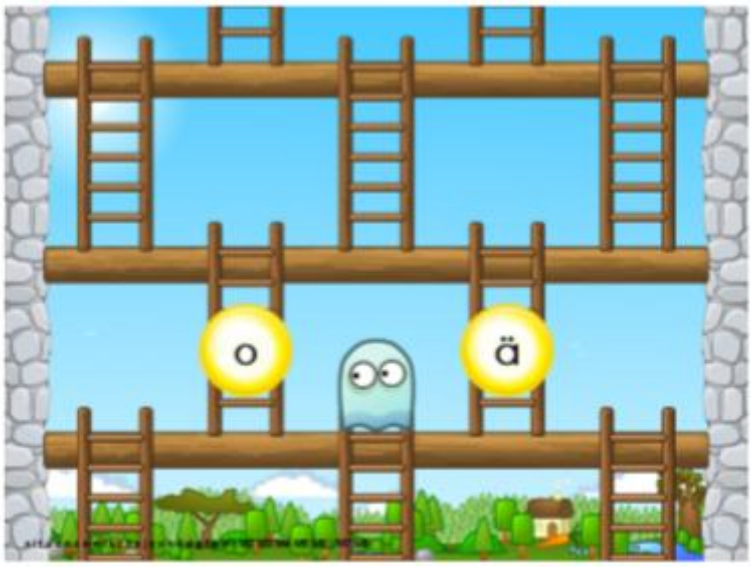


Figure 2.4: A screenshot of GraphoGame (GG)

The child is expected to choose the letter matching the letter sound. In case of a correct response, the game character climbs the ladder and falls down the ladder when the response is incorrect (Ojanen et al., 2015).

Learning Support Teachers' Manual, (Namibia perspective)

Learning Support is a way of uplifting acquisition of knowledge in the mainstream class (National Institute for Educational Development (NIED, 2014)) it involves teaching methods and materials that enable learners with learning difficulties and other disadvantaged learners to reach essential basic competencies in different subjects and skills. This discussion demonstrates the current movement in Namibia in relation to ways

of assisting candidates challenged by learning difficulties. Despite this plan, manual teaching and learning are ongoing in the country and assistive technology may be a strange term to the Namibian community.

The Republic of Namibia, Ministry of Education Sector Policy on Inclusive Education, (Namibia perspective)

Ministry of Education (ME, 2013) puts forth strategies for achieving Inclusive Education. The following are strategies relevant to this study;

- ☑ Support institutional development by developing human and instructional resources.
- ☑ Review the National Curriculum for Basic Education to reflect the diversity of learning needs of all learners
- ☑ Develop a mechanism for monitoring and evaluating the implementation of the Sector Policy on Inclusive Education.

Policies are plans in Namibia to get activities operational; they guide procurement costs as well as the implementation of programs. In this case, ATCLD would be implemented nationally if it agrees with national policies.

2.6 Literature summary

Little research on the framework of dyslexia, AT and learning difficulties ongoing in Namibia and Africa at large as opposed to the world. This will become a need for Namibia in to achieve the desired economic growth. Most western researches on this subject are in the dimension of resolving the link between AT and needs of people with

difficulties, the likelihood of Graham and Richardson (2012), this would construct tangible constructs.

2.7 Features on which the study built upon

ATCLD has built upon DysEggxia and Grapho game by adding the following;

- ☑ text to speech,
- ☑ text input functions,
- ☑ magnified text,
- ☑ colourful text
- ☑ and Image → Text→ Speech

English as a second language's software functionalities are based on:

- ☑ Language usage, structure, vocabulary, and grammar.

In the framework of Mathematics, the software runs and responds to the following:

- ☑ Arithmetic concepts and user requests based on Namibia's primary education syllabus by the National Institute for Educational Development (NIED, 2009).

CHAPTER 3: METHODOLOGY AND METHODS

3.1 Introduction

Research approaches undertaken by this study are discussed in this section; this includes the clarification of population and sample of the study.

3.2 Research Design

Waterfall model guided the study's system development. This model illustrates the software development process in a linear sequential flow (Tutorialspoint, 2018).

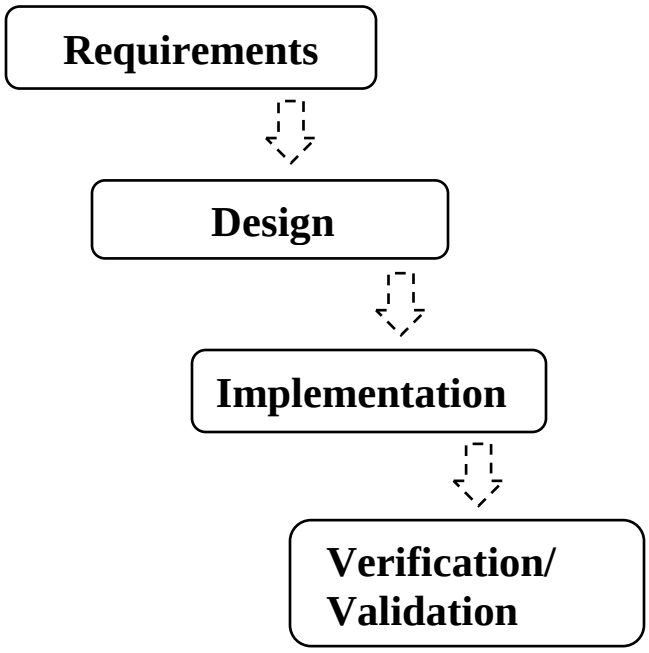


Figure 3.1: Waterfall Model (Tutorialspoint, 2018)

The following are reasons why a waterfall model was favourable for the development of ATCLD;

- ☑ simple and easy to understand and use

- ☑ it is easy to manage due to its rigidity
- ☑ each phase has specific deliverables and a review process
- ☑ phases are processed and completed one at a time

V-shaped Model, Spiral Method (SDM), Iterative and Incremental Method and Agile development may be complex and costly ("Waterfall model- advantages", 2018).

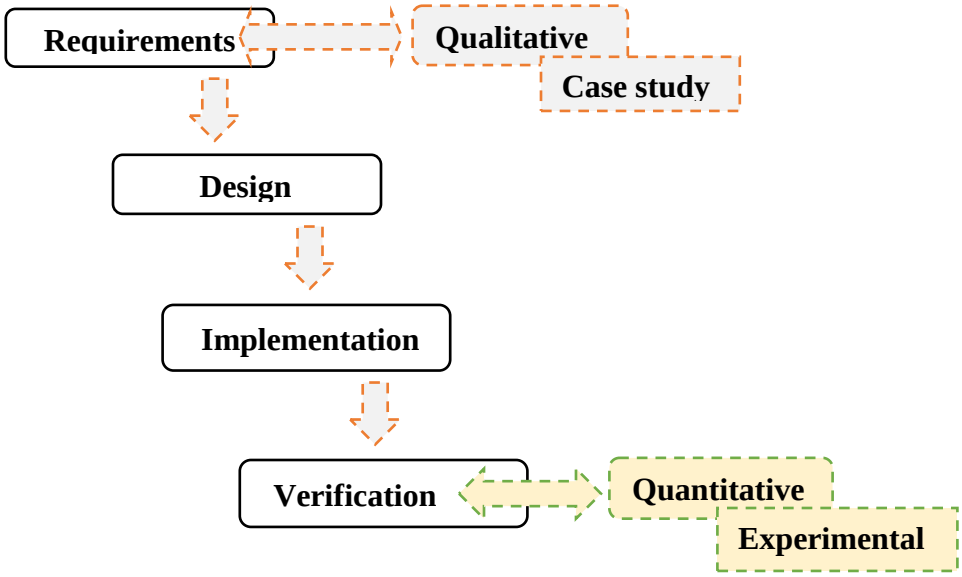


Figure 3.2: The Waterfall and Research design ((CIRT), 2012; Tutorialspoint, 2018)

3.3 Alteration of field data to use of ATCLD

Questionnaires and interviews unfolded resources, teaching and learning methods employed at EGS. These research tools sequentially drew data concerning suggestions, strengths, and weaknesses, and held a platform for the development of ATCLD. Henceforth Appendix E and F entail teacher and learner participants' questionnaires. Further into the study; qualitative data produced user stories and system requirements.

3.4 Evolutionary Prototyping

Evolutionary Prototyping a secondary design to Waterfall model during the development of ATCLD is illustrated beneath. It begins with the building of the prototype → then user tests the prototype → user provides feedback → developer refines prototype → final product is formed.

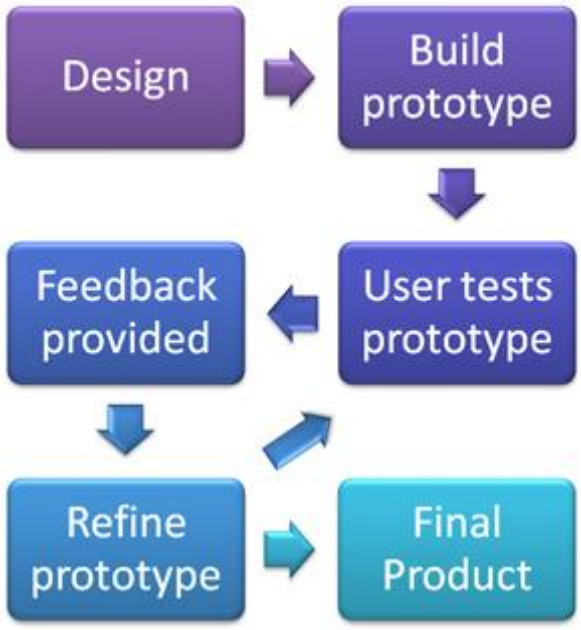


Figure 3.3: The Evolutionary Prototype (Construx software, 2002)

3.5 Evaluation, testing, and assessment

Concurrently, evaluation, testing, and assessment took place during the final stage of the study, which involved a statistical appraisal of data. This stage has found formulas for data manipulation, e.g. percentage increase, and decrease determined by ((b-a) / a) * 100). Hence, assessment took place on two occasions, had scores for the occasion one

been greater than or equal to (S1 ≥ S1) scores for occasion two, the application could be considered a failure.

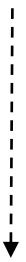
3.6 Population

Twenty teachers, and one hundred learners of fifth to seventh grade drawn from thirty-one teachers, and three hundred and twelve learners of EGS formed the population of the study.

3.7 Sample

Five and ten, teachers and learners drawn by purposeful sampling from population ensured cost-effectiveness and feasibility of the study as for the illustration below purposefully Martha and Seibes situated on even numbers were selected, this was done until the desired sample size.

1. Tosca Lukas
2. Martha Ikorwa
3. Shoongo Rauha
4. Seibes Ingini



3.8 Research Instruments

Reliability of questionnaires used during the study was achieved by scrutiny by supervisors of the researcher of the study, further, a sample was given to teacher participants.

3.9 Procedure

In a course of two weeks, questionnaires were returned from teacher participants, conversely, interviews applied to learners due to their incompetence in reading and language comprehension. Interview questions were sourced from learner questionnaire.

3.10 Data analysis

Content analysis involving classification, summary-making, and tabulation of verbal and behavioural data is the qualitative data analysis used in this study. Quantitative data was appraised statistically with Microsoft excel in which numerical data was represented graphically.

3.11 Accessibility

Visual impairment, neurological disorder, and physical disability are some barriers to effective computer use (John, 2013). For this study, a special needs assessment was requested for participants and it was carried out by a psychologist assigned to EGS. Results from the tests recommended the need for assistive technology for the students with dyslexia at EGS for example when students had visual or hearing problems etc and these recommendations became parts of system requirements.

3.12 Research Ethics

The intention for research was communicated to participants in writing, and this is demonstrated in the following postscripts;

- ☑ the letter to the principal of Eros Girls School, Appendix A

- ☑ appendix B - a supporting letter from the department of computer science
- ☑ appendix C - a letter from the researcher to Khomas education's Directorate
- ☑ response from Khomas' directorate, Appendix D
- ☑ and appendix G, consent form

CHAPTER 4

RESULTS

4.1 Introduction

User requirements, implementation of ATCLD, and results of the experiment are discussed subsequently.

4.2 User requirements

User stories pertaining to learner participants

These are the information learner users provided during interviews and questionnaire narrating their concerns and preference.

(a) Current study mode

- ☑ Reading from exercise and textbooks
- ☑ Written notes from chalkboard etc.

(b) Inabilities

- ☑ Cannot read properly
- ☑ Cannot write properly
- ☑ Inability to perform in Math class
- ☑ Cannot speak English fluently

(c) Methods for improving reading, writing, and mathematics

- ☑ Reading during reading period and at home
- ☑ Spelling words (spoken and written)

- ☑ Studying the multiplication table

(d) How learners need to be assisted by teachers to improve their reading, writing and mathematics proficiency

- ☑ Teacher/s should read for the learner/s different words
- ☑ Do spelling with the learner
- ☑ Explain different math formulas to learners
  - Learners classify teacher/s teaching speed as FAST
  - Learners prefer teacher/s to be REPEATING content in class
  - Learners prefer the size of letters and numbers to be BIG or
  - COLOURFUL

(e) Learners' academic problems are listed to be

- ☑ Difficulties with reading and writing
- ☑ Reduced mathematics proficiency

User stories pertaining to teacher participants

These are the information teacher users provided during interviews and questionnaire narrating their concerns and preference.

(a) Software currently used for teaching and learning

- ☑ Microsoft Word
- ☑ Publisher
- ☑ Excel

(b) Eros Girls School does not currently use any specific technology for learners with special needs they rely on the traditional method of teaching and learning

(c) The current traditional way of teaching and learning supports inclusive education by

- ☑ adjusting teaching strategies
- ☑ adjusting sitting arrangements, etc.

(d) Learner-centred Education

- ☑ teaching strategies, group work, etc.

Table 4.1: Summary of user stories, corresponding technologies, and recommendations in relation to the implementation of the assistive technology

User stories	**Corresponding technology**	**To be implemented on user application as:**
(a) Current study mode ☑ Reading from exercise and textbooks ☑ Written notes from chalkboard etc.	Talking dictionaries, Audiobooks, Content management software	Talking dictionary, Alphabets which are speech-enabled/ Text input for text to speech Database based text/content
(b) Inabilities ☑ Cannot read		

properly ☑ Cannot write properly ☑ Inability to perform in Math class ☑ Cannot speak English fluently	Fundamental phonics and alphabets Talking calculator, basic formulas according to NIED specifications	Speech enable phonics and alphabets Talking calculator, speech-enabled Math operations. Speech-enabled multiplication table and fractions etc.
(c) Methods for improving reading, writing, and mathematics ☑ Reading during reading period and at home ☑ Spelling words (spoken and written) ☑ Studying the multiplication	Text to speech technologies For language and mathematics Text to speech/speech to text	Speech-enabled textboxes, buttons, images, formulas etc.

table		
(d) How learners need to be assisted by teachers to improve reading, writing, and mathematics		Speech enable text
☑ Teacher/s should read for the learner/s different words ☑ Do spelling with the learner ☑ Explain different formulas to learner/s in mathematics	Recommended user interface	Speech enable text
○ Learners classify teacher/s teaching speed as FAST		

○ Learners prefer teacher/s to be REPEATING content in class ○ Learners prefer the size of letters and numbers to be BIG ○ Learners prefer COLOURFUL information		Application content designed with different colours/but not too much-varying colours
(e) Learners' academic problems are listed to be ☑ Difficulties with reading and writing ☑ Reduced mathematics proficiency		

(f) Software currently used for teaching and learning ☑ Microsoft Word ☑ Publisher ☑ Excel	Content management application	Text by Microsoft Visual Studio
(g) Eros Girls currently uses traditional methods for teaching and learning	Text to speech assistive technology	
(h) The current technology supports inclusive education ☑ By adjusting teaching strategies ☑ Adjusting sitting arrangements etc.		

(i) Learner-centred Education ☑ Teaching strategies ☑ Group work etc.		The assistive technology will act as a study buddy and or teacher to the learner/s

4.3 Features and Activities of ATCLD

Text to speech object

The assertion of Sapi for text to speech in Visual Basic (VB) is demonstrated beneath. This makes it possible for text to speech features to be called and used by methods and functions within the application.

```
Dim Speech
            Speech = CreateObject ("Sapi.spvoice")
```

Figure 4.1: Sapi's text to speech object

The login page is the frontier door to ATCLD composed of a speech-enabled teacher and learner login.

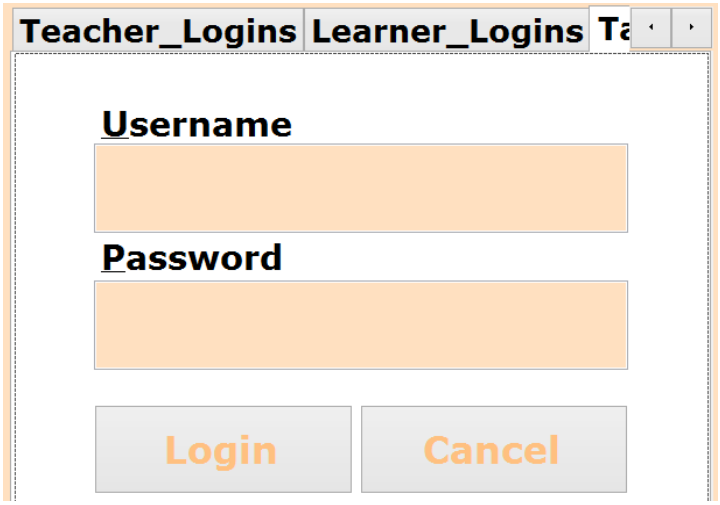


Figure 4.2: Login page for teacher and learner user

Learner form

A learner is directed to the following interface once authenticated.

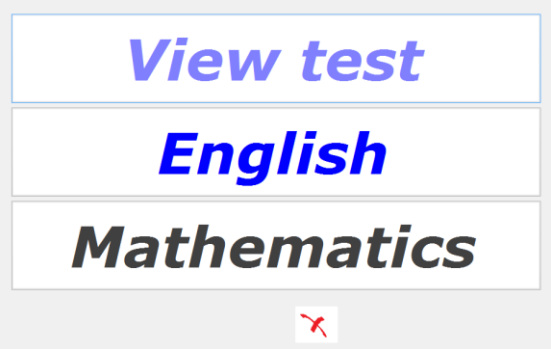


Figure 4.3: Learner form

The three language test trials took by learners

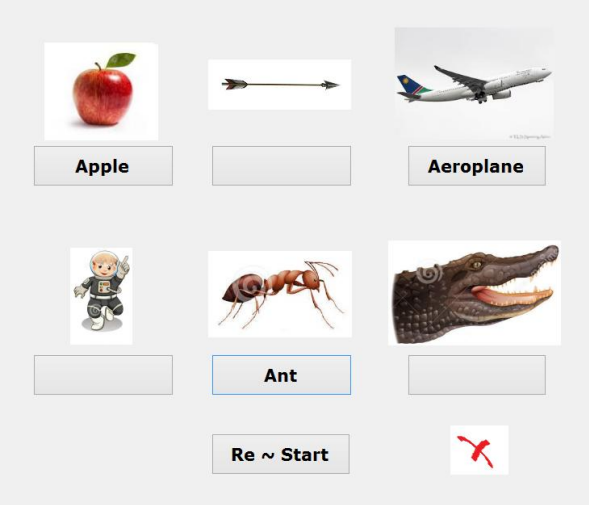


Figure 4.4: Matching Image with Text

Object-oriented learning is practicable in this exercise as images are linked to spelling, e.g. apple image in relation to /ap(ə)l/.

Matching Image with Text exercise was based on the following algorithm (Example):

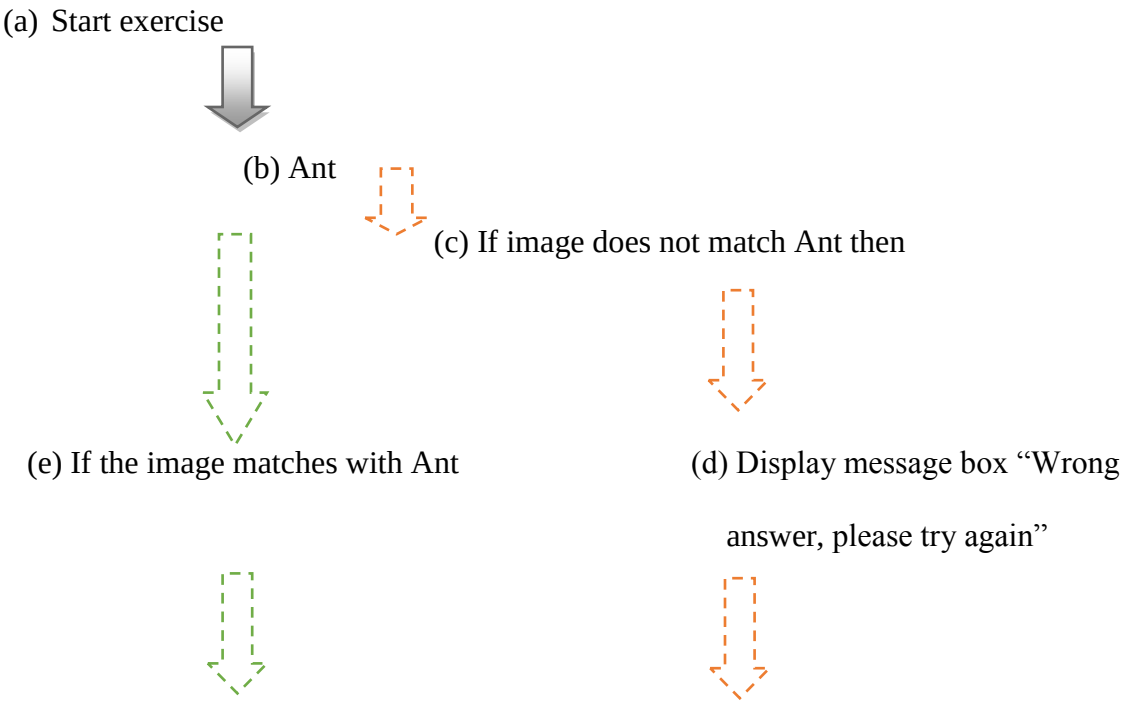


Figure 4.5: Matching Image with text algorithm

Source code for object Ant

Beneath is the source code for Matching Image with text exercise.

```
If Label1.Text () = "Ant" Then
Dim Speech
Speech = CreateObject ("Sapi.spvoice")

Speech.speak ("Ant")
Speech.speak ("Correct")

MessageBox.Show ("Correct")

Else
Dim Speech
Speech = CreateObject ("Sapi.spvoice")
Speech.speak ("Wrong Match, please try again")
MessageBox.Show ("Wrong Match, please try again")

End If

If MessageBox.Show ("Click for next question") Then

Label1.Text () = ("Alligator")
```

Noun Exercise

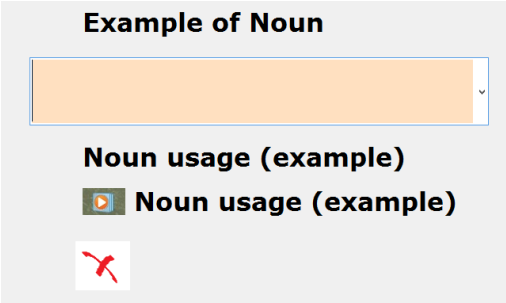


Figure 4.6: Nouns

A sentence demonstrates how a noun is used once selected from a drop-down menu. This is shown in figure 14 for the term ‘Africa’.

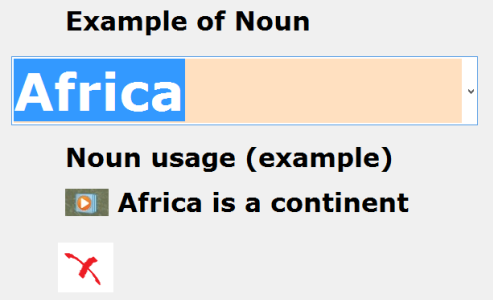


Figure 4.7: Nouns (example)

Figure 4.8: Dropdown Menu (Nouns)

Parts of speech exercise

Parts of speech implement is a combination of Noun, Pronoun, Verb and the Adjective exercise.

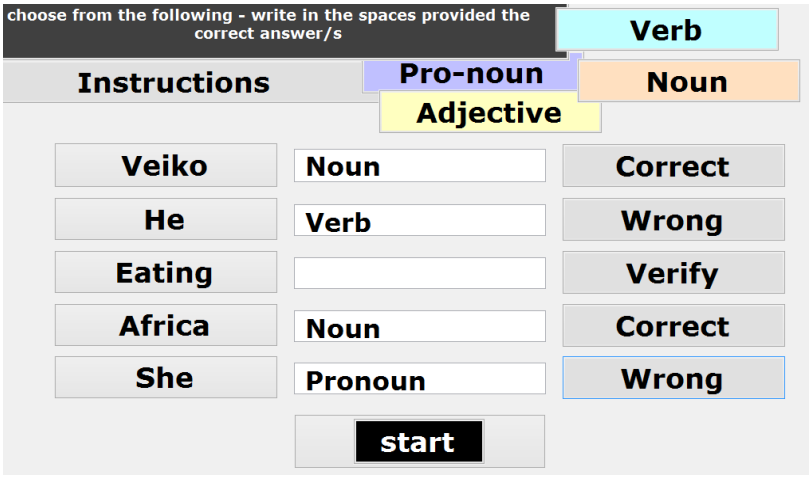


Figure 4.9: Parts of Speech Exercise (PSE) with entries

Mathematics Proficiency Section

Numbers, The four basic operations, and Math - real world is part of this fragment.

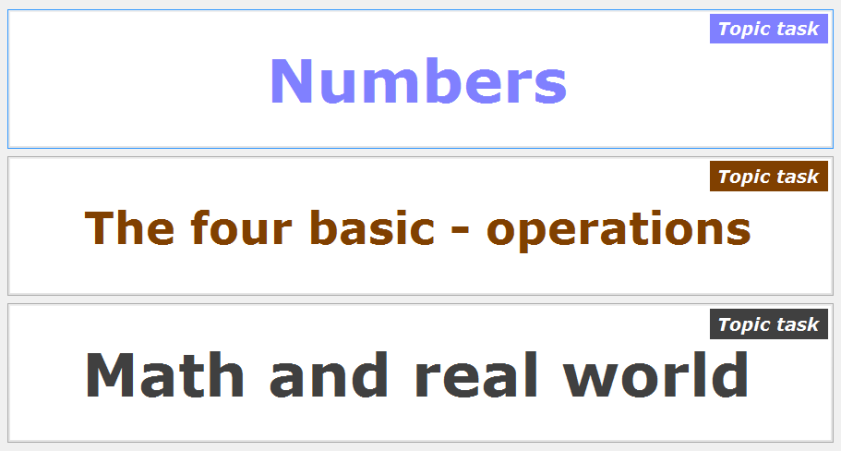


Figure 4.10: Mathematics proficiency

The Four Basic Operations Exercise

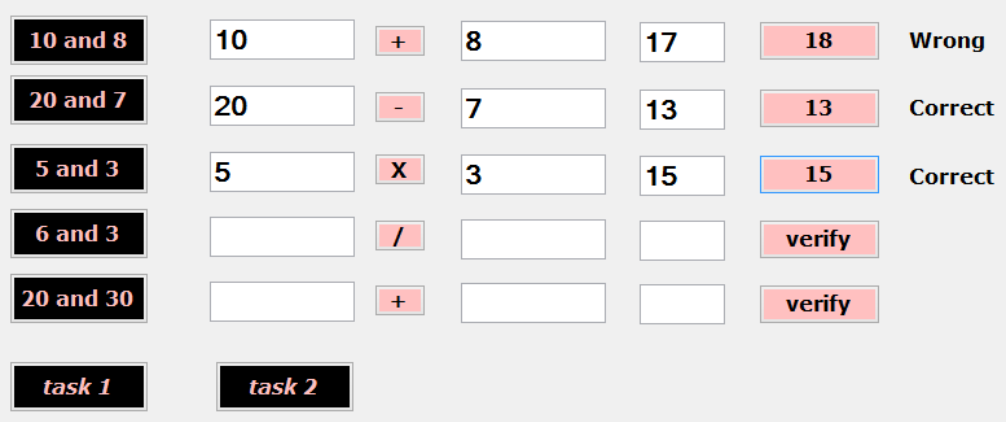


Figure 4.11: The Four Basic Operations Exercise (FBOE)

FBOE is composed of features of a talking four basic operations calculator

Math and Real World

This exercise relates to counting real-world objects.

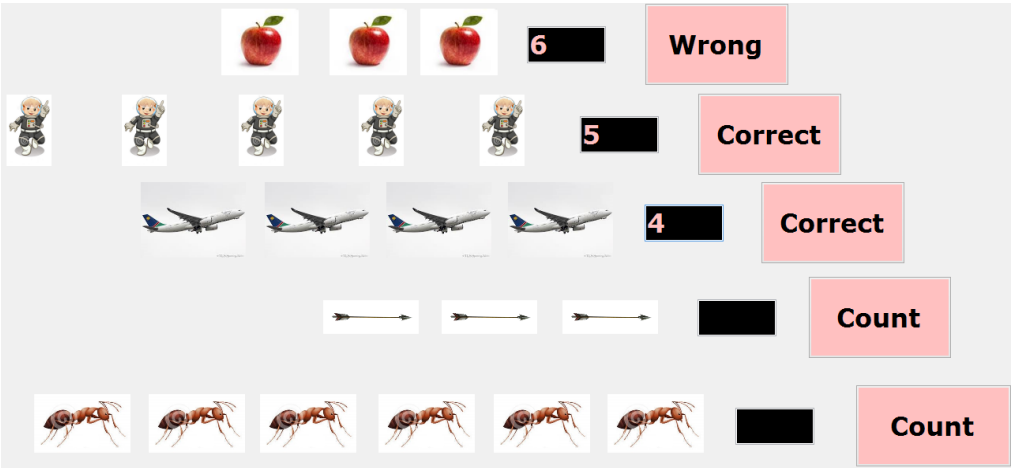


Figure 4.12: Math and Real World (MRW) exercise

Implementation of ATCLD and Results

Each learner took four tests, namely; the language proficiency pre-test (a), post-test (b), mathematics proficiency pre-test (c), post-test (d) denoted by (a), (b), (c) and (d) respectively. Besides, difference in post and pre-test/s are symbolised by (b) Sub (a) and (d) Sub (c) whilst percentage (%) increase or decrease is expressed by ((b-a) / a) * 100). Additionally, letters E, F, G, and H represent the test taker. The following is an example of data manipulation for learner G. Ten students took part in the interview; however, the testing was scaled down to six candidates as it can be deduced from the analysis.

- ☑ (b) Sub (a) = 11 – 9 ~ 2 and
- ☑ (d) Sub (c) = 12 – 10 ~ 2
- ☑ ((b-a) / a) * 100)

  = (2 / 9) * 100)

  = 22.222 ~ 22
- ☑ ((b-a) / a) * 100).

  = (2 / 10) * 100)

  = 20

Table 4.2: Test trials for grade 5 learners

Learner Name	Language Proficiency Pre – test (a) **16 Marks**	Language Proficiency Post – test (b) **16 Marks**	Mathematics Proficiency Pre –test (c) **16 Marks**	Mathematics Proficiency Post –test (d) **16 Marks**	(b) Sub (a)	(d) Sub (c)	%(language) increase/ decrease	% (math) increase/ decrease
E	5	8	6	9	3	3	60	50
F	3	5	4	7	2	3	67	75

Table 4.3: Test trials for grade 6 learners

Learner Name	Language Proficiency Pre-test (a) **16 Marks**	Language Proficiency Post-test (b) **16 Marks**	Mathematics Proficiency Pre-test (c)**16 Marks**	Mathematics Proficiency Post-test (d) **16 Marks**	(b) Sub (a)	(d) Sub (c)	%(language) increase/ Decrease	%(math) Increase/ decrease
G	9	11	10	12	2	2	22	20
H	8	10	10	13	2	3	25	30

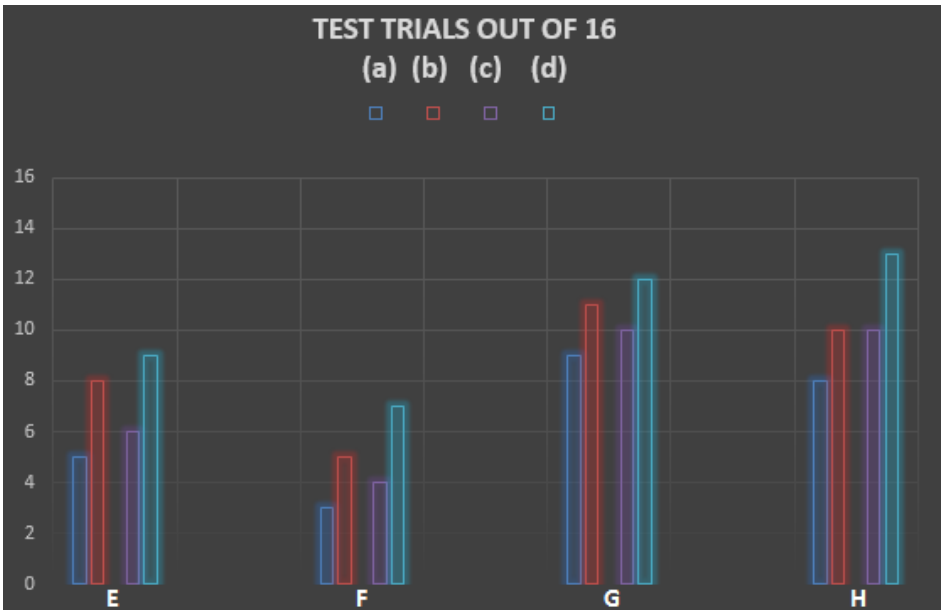


Figure 4.13: Test trial out of 16 Marks for learner E, F, G and H

Grade 5 learners brought to book low marks in comparison to their grade 6 counterparts. This is evidential as illustrated on the above figure 4.13

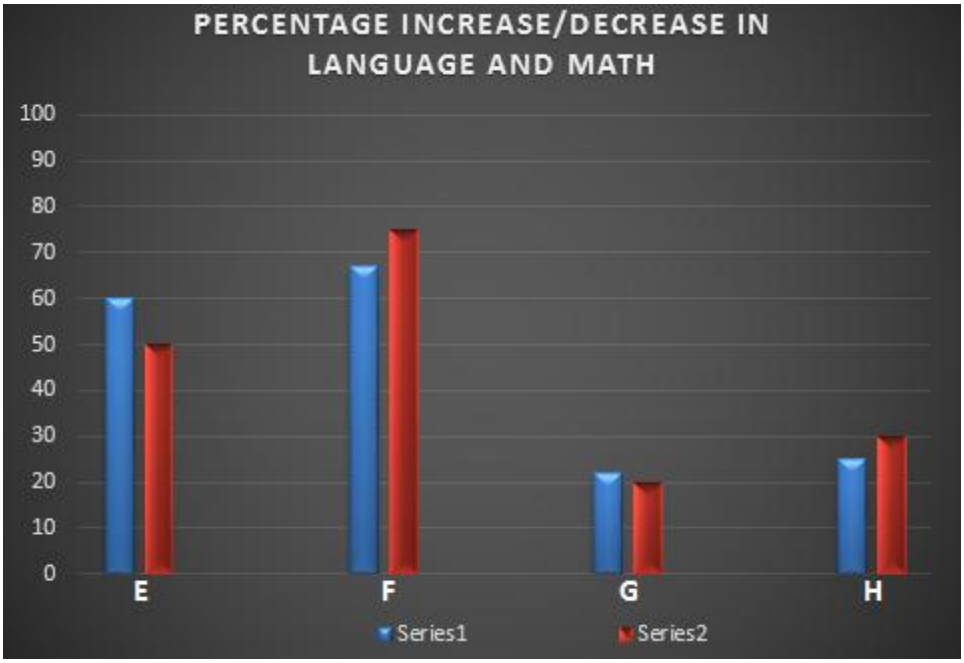


Figure 4.14: Percentage increase/decrease in language and mathematics

(Series1/Series2)]

Series 1 and 2 represent language and mathematics correspondingly. Though grade 5 learners demonstrate a lower performance in figure 4.13, they hold a record of most improved marks in figure 4.14.

CHAPTER 5: DISCUSSIONS

5.1 Introduction

This section focuses on the explanation of results, references to previous research, deduction and hypothesis.

5.2 Explanation of results

Most improved marks associated with pupils of fifth grade signify the concept of younger children being better learners. This means the teaching of basics should not be done at any later stage to avoid complications as older children may be prepared for other activities in life.

5.3 How results relate to the schema theory

Rumelhart (as cited in Shuying, 2013) Schema theory is an explanation of how readers use prior knowledge to comprehend and learn from text. The improved performance of pupils of fifth grade means; younger children have the capacity to develop new schemas which nutshell sets of information.

5.4 References to previous research

This study emulated and adopted Graham and Richardson's (2012) concept of understanding the relationship between the role of AT and needs of users. Hence during the development of ATCLD requirement elicitation took place. Conversely, Culèn and Gasparini (2011) carried out a case study which is the approach similar to the one employed by this study. Coincidently both of these studies have shown

improvement. The objective; improving the reading and writing for children with learning disabilities were in the endeavour of Culèn and Gasparini (2011), moreover, the experimental approach by Rello et al. (2014) involving the use of post and pre-tests was followed by this study.

5.5 Deduction

The author of this document would not recommend the measure of leaning on forecasts, because the dimensions of the results are influenced by uncontrolled variables. Also, the following objectives have been achieved;

- ☑ Elicitation of user requirements
- ☑ Development of ATCLD

Due to small sample size, further research is recommended in order to enhance the features and functionalities of the ATCLD.

5.6 Hypothesis

Younger children are fast learners due to the capacity in their brains to gain new information.

Resultant questions are as follows;

- ☑ How can an assistive technology be structured to cater for a range of age groups?
- ☑ Which are the needs of different age groups in relation to assistive technologies?

CHAPTER 6

RECOMMENDATIONS

6.1 Introduction

Recommendations, suggestions for further research and the conclusion have been discussed subsequently.

6.2 Recommendations

The outcomes of this study indicate the need for enhancing ATCLD or a relative application, therefore EGS and other schools in Namibia should respond to this call by availing human and capital resources in order to amend user requirements and source of data for populating the assistive technology. The implementation of ATCLD should extend to teacher and learner training that will ensure efficient use of the AT. Moreover, the Ministry of Education and National Institute for Educational Development should ensure the enforcement of ICT since this is in accord to the Inclusive Education policy.

6.3 Suggestions for further research

Researchers in Namibia should dwell on developing tangible artefacts, especially in the area of teaching and learning. Inclusive education-related policies have been introduced; the issue here is the conversion of policies into desired forms. In addition to the implementation of policies, existing applications should be developed further, for example, the addition of speech to text feature to ATCLD. Conversely, a comparative to mixed methods research approach including waterfall model and evolutionary

prototyping were used during the development of ATCLD. These approaches may be revisited by other scholars.

6.4 Conclusion

Every Namibian child has the right to quality and equitable education (Constitution of human rights, Republic of Namibia, 1990). However, there are circumstances excluding certain individuals from the approved national education, such as inconsistency in the practice of learner placement test, and more learner head per classroom. In line with assistive technologies, ATCLD should be advanced further to cater to an even wider group of users at EGS and afar. Moreover, teacher training related to helping children with learning difficulties and in general should be introduced. It would be more useful for the Ministry of Education to set up a research centre which can handle affairs related to learning disabilities and collaboration with sister organisations from other countries.

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APPENDICES

Appendix A (Letter by the researcher to the principal of Eros Girls School)

P.O Box 1893
Rundu
Namibia
10 June 2016

To whom it may concern:

Dear sir/Madam

The content of this letter states the nature of a research being conducted by Mr. Veiko V as part of his Master's thesis at the University of Namibia.
The researcher will develop a software application intended to remediate the learning practice for upper - Primary School dyslexic students (Grade 5 to 7). The software to be developed will perform text to speech/speech to text for language and mathematical subjects' inputs and outputs.
The software may be used by all sorts of learners with special needs, but at this given moment the specification of the project is focused on learners with dyslexia. In the near future, the researcher will present participant consent forms to teacher and learner participants if the school permits Mr. Veiko V who is the researcher to undertake his study as specified.
This letter serves as a platform for asking for permission from the principal and management of Eros Girls School. If any positive response is given to the researcher, he is looking forward to meeting with the respective head of department (HOD) in order to demonstrate in short what is expected. Moreover, the researcher is conducting the research by working closely with users in order to develop the software according to user requirements. In this case, the users are certain teachers and learners.
The researcher is looking forward to work with learners and respective teacher participants during after school hours; this is to ensure that no teaching and or learning is interrupted. Since the project includes working with minors, the researcher looks forward to getting consent from the parents of learner participants. In addition to the above, only certain learners will be required to take part in the project, preferably learners on remedial. Teacher participants should be constituted by teachers dealing with learning support.

The researcher believes his request will be taken into consideration.

Yours in Education, Mr. Veiko

Appendix B (Supporting letter from the department of computer science)

July 4, 2016

To whom it may concern,

Mr. Kamwimba Veiko is undertaking research within his Master's Degree program in Computing at the University of Namibia. His project involves developing assistive software technologies that aim to facilitate reading for dyslexic learners. For this to be effective he will consult with teachers and, under their guidance, interview students. I am Mr. Veiko's Masters Project supervisor and will guide him about ethically appropriate approaches and methods. To the best of my knowledge, Mr Veiko has shown himself to be a responsible and committed student. Please do not hesitate to contact myself, or the Associate Dean of Computing, Dr Kauna Mufeti, if you have any questions. I may be reached by phone at 081-360-8070 or email at wsverdlik@unam.na

Appendix C (Letter by the researcher to the Khomas education regional director)

P.O Box 1893
Rundu
Namibia
04 July 2016

To who it may concern:

Dear sir/Madam

I have written this letter to ask for permission to conduct my research at Eros Girls School. My name is Mr. Kamwimba Veiko, a Masters Student at the University of Namibia under the Department of Computer Science. In addition to the above, I am a teacher at the Ministry of Education at Michelle Mclean Secondary Project School. I am familiar with the environment of Eros Girls School, because I was a teacher there for 2 years, in the year 2014 and 2015.
I am looking forward to developing a software application intended to remediate the learning practice for upper - Primary School dyslexic students (Grade 5 to 7). The software to be developed will perform text to speech for language and mathematical subjects' inputs and outputs.
The software may be used by all sorts of learners with special needs, but at this given moment the specification of the project is focused on learners with dyslexia.
As a researcher, I am going to interview the respective teacher and learner participants and collect data that I will be using to design and implement the software. I already reached Mrs. /Gaoses the principal of Eros Girls School about the research, she thus referred me to first enquire by the office of the Director.
I chose to conduct my study at Eros Girls School due to the fact that it is the suitable environment that will provide the appropriate population of the study. I am putting more work in this study for the love of the education of a Namibian child, and as a teacher who knows the needs and daily struggles of learners, but not necessarily to only obtain the Master's Degree.

I believe and trust that your good office will grant me permission to conduct my study at Eros Girls School in the next four months with the consent of learners' parents as well as the staff of Eros Girls School.

Yours in Education, Mr. Kamwimba V, kamwimba@gmail.com, +264814396561

Appendix D (Permission letter from the Khomas regional office, for the researcher to conduct the study in Khomas region)

REPUBLIC OF NAMIBIA
KHOMAS REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE

Tel: [09 264 61] 293 4410
Fax: [09 264 61] 231 367/248 251
Enquiries: Ms. H.N. Imene

Private Bag 13236
WINDHOEK

12 July 2016

File No: 12/3/10/1

Mr V. Kamwimba
P.O.BOX 1893
Rundu
E-mail: kamwimba@gmail.com

Dear Mr Kamwimba

RE: PERMISSION TO CONDUCT A RESEARCH IN SCHOOLS IN KHOMAS REGION

Your letter dated 04 July 2016 is hereby acknowledged.

Permission is hereby granted to you to conduct a research at Eros Girl's School with regard to "developing a software application intended to remediate the learning practice for learners with dyslexia" with the following conditions:

- The school Principal must be contacted before time and agreement will be reached between you and the principal.
- The school programme should not be interrupted.
- Teachers and learners who will take part in this exercise will do so voluntarily.
- School should not be forced to take part in the programme.
- Khomas Education Directorate should be provided with a copy of your findings and eventual thesis.

We wish you a success in your research.

Yours sincerely

MINISTRY OF EDUCATION
ARTS AND CULTURE
PRIVATE BAG 13236 WINDHOEK
12 07 2016

GERARD N. VRIES
DIRECTOR OF EDUCATION, ARTS AND CULTURE

Appendix E (Teacher participant questionnaire)

Dear Participant,

Good day! The researcher is dedicated to developing an educational assistive technology for students with special needs. Through this brief survey, your answers will be helpful in contributing to user requirements for system development. Your response will only be used for survey purposes. In case you have any questions regarding the survey, please call Mr Veiko Veiko at +264814396561. Thank you very much for your time and suggestions.

Q1: Do you use the software as a teaching resource?
Mark with [x] in the appropriate box
Yes ☐ No ☐

Q2: State the name of the software, if the answer in Q1 is yes.
_____

Q3. Which technology does Eros Girls School use for teaching dyslexic students?
_____

Q4. How does the current technology support
a. Inclusive education?

_____
_____
_____

b. Learner Centred Education?

_____
_____
_____

Q5. Dyslexic learners' educational problems at Eros Girls School.
Check off by indicating with [x], the first one has been done for you.

Educational Problem	**Yes**	**No**	**State reason if neither Yes nor No**
Reduced computer skills	X		
Reading difficulties			
Writing difficulties			
Reduced Mathematical abilities			
Poor English proficiency			

Q6. Which techniques or technologies do you use to improve dyslexic students
a. Computer skills?

_____

b. Reading skills?

_____

c. Writing skills?

_____

d. Mathematical stills?

_____

e. English proficiency?

_____

Q7. Suggest ways in which you would prefer to improve the current teaching techniques to assist dyslexic learners.

_____
_____
_____

Q8. Do dyslexic students at Eros Girls use software to carry out tasks?
Mark with [x] in the appropriate box
Yes ☐ No ☐

Q9. State the name of the software, if yes.

_____

Q.10 State the current technology or technique dyslexic students use to achieve

a. Learner Centred Education at Eros Girls School.

_____

_____

Q.11 List features and/or functions of the technology in Q.10 a.

_____

_____

_____

_____

Q12. Suggest ways in which you would prefer to improve dyslexic learner's current educational technology.

_____

_____

_____

_____

Thank you for sharing your thoughts with the researcher

Appendix F (Learner participant questionnaire)

Dear Participant,

Good day! The researcher is dedicated to developing an educational assistive technology for students with special needs. Through this brief survey, your answers will be helpful in contributing to user requirements for system development. Your response will only be used for survey purposes. In case you have any questions regarding the survey, please call Mr Veiko Veiko at +264814396561. Thank you very much for your time and suggestions.

Q1. Do you use a computer to study?

Mark with [x] in the appropriate box

Yes ☐ No ☐

Q2. How do you use the computer for school work? If the answer in Q1 is yes.

_____

Q.3 How do you currently study?

_____

_____

Q.4 State Yes or No for the following:

Ability	**Yes**	**No**
Can read properly		
Can write properly		
Ability to perform in Mathematics class		
Can speak English properly		

Q5. What do you want to improve your

a. Reading_____

b. Writing _____

c. Mathematics_____

Q5. How do you want your teacher help improve your

a. Reading_____

b. Writing _____

c. Mathematics_____

Mark with [X] for each of the following questions:

Q6. How would you classify your teachers teaching speed?

Fast ☐ Moderate ☐ Slow ☐

Q7. Would you prefer your teacher to keep repeating topics in class?

Yes ☐ No ☐

Q8. How do you prefer the size of letters and numbers in subject content?

Big ☐ Small ☐

Q9. Are you able to see small letters and numbers?

Yes ☐ No ☐

Q9. Do you prefer studying content that is made up of different colours?

Yes ☐ No ☐

Q10. List educational problems you currently have.

_____

_____

_____

_____

Thank you for sharing your thoughts with the researcher

Appendix G (Informed consent form)

ASSISTIVE TECHNOLOGY FOR STUDENTS WITH LEARNING DIFFICULTIES: DYSLEXIC STUDENTS

INTRODUCTION

You are invited to join a research study to look at suitable study methods and improved ways of helping dyslexic students. Moreover, to contribute to the design and development of a remedial and accommodative software application for dyslexic students. Please take whatever time you need to discuss the study with your colleagues, potential students' and even with family and friends, or anyone else you wish to. The decision to join, or not to join, is up to you. In this research study, we are investigating/collecting data/designing/implementing/testing//evaluating aspects of the research study.

WHAT IS INVOLVED IN THE STUDY?

If you decide to participate you will be asked to complete questionnaires and attend to interviews. We think this will be taking few minutes per selected slots.

The investigator/s may stop the study or take you out of the study at any time they judge it is in your best interest. They may also remove you from the study for various other reasons. They can do this without your consent. You can stop participating at any time. If you stop you will not lose any benefits.

RISKS

This study involves the following social risks; interaction between staff members and amongst students. On negative social risks, it might require sponsorship in order to acquire the hardware for running the software to be developed. Thus this resultant

technology might be expensive to put in place. Moreover, unpredictable risks might occur.

BENEFITS TO TAKING PART IN THE STUDY

It is reasonable to expect the following benefits from this research: a software application for dyslexic learners for scribing examination, tests, and tasks. Learners will have access to advanced technology, new teaching methods for teachers according to the technology, improved assessment approach. However, we can't guarantee that you will personally experience benefits from participating in this study. Others may benefit in the future from the information we find in this study.

CONFIDENTIALITY

We will take the following steps to keep information about you confidential, and to protect it from unauthorized disclosure, tampering, or damage: Names, ages, and genders of participants will not be disclosed but rather kept as a secret. No register will be kept for participants personal information, rather the information to be collected will hardly relate to any person as no name will be attached to questionnaires etc.

INCENTIVES

Teacher and learner participants will be receiving free refreshments and something to eat from the researcher during in between breaks

YOUR RIGHTS AS A RESEARCH PARTICIPANT?

Participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled, and it will not harm your relationship with your colleagues, learners, and the parent community.

CONTACTS FOR QUESTIONS OR PROBLEMS?

Call Mr Veiko Veiko at 081 4396561 or kamwimba@gmail.com if you have questions about the study, any problems, unexpected physical or psychological discomforts, any injuries, or think that something unusual or unexpected is happening.

Contact Prof. William wsverdlik@emich.edu if you have any questions or concerns about your rights as a research participant.

Consent of Subject (or Legally Authorized Representative)

Signature of Subject or Representative Date

_____ _____

Appendix H (Ethical Clearance Certificate)

UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FOS/170/2017 **Date: 28 March, 2017**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: Assistive Technology For Students With Dyslexia At Eros Girls School-

Nature/Level of Project: Masters

Researcher: Veiko Veiko

Student Number: 200713141

Faculty: Faculty of Science

Supervisors: Prof William Sverdlik(Main) Dr. V. Hashiyana (Co)

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.

(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.

(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.

(d) The UREC retains the right to:

(i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,

(ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Prof. P. Odonkor: UREC Chairperson

Ms. P. Claassen: UREC Secretary

Appendix I (Research permission letter)

CENTRE FOR POSTGRADUATE STUDIES

University of Namibia, Private Bag 13301, Windhoek, Namibia
340 Mandume Ndemufayo Avenue, Pioneers Park
☎ +264 61 206 3275/4662; Fax +264 61 206 3290; URL.: http//www.unam.edu.na

UNAM
UNIVERSITY OF NAMIBIA

RESEARCH PERMISSION LETTER

Student Name: Veiko Veiko

Student number: 200713141

Programme: MSc Information Technology

Approved research title: ASSISTIVE TECHNOLOGY FOR STUDENTS WITH DYSLEXIA AT EROS GIRLS SCHOOL

TO WHOM IT MAY CONCERN

I hereby confirm that the above mentioned student is registered at the University of Namibia for the programme indicated. The proposed study met all the requirements as stipulated in the University guidelines and has been approved by the relevant committees.

The proposal adheres to ethical principles as per attached Ethical Clearance Certificate. Permission is hereby granted to carry out the research as described in the approved proposal.

Best Regards

Dr Marius Hedimbi
Director: Centre for Postgraduate Studies
Tel: +264 61 2063275
E-mail: mhedimbi@unam.na

Centre for Postgraduate Studies
Office of the Director
2017 -04- 05
University of Namibia
UNAM

Appendix J (Acceptance letter from journal (IJSBAR))

International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Manuscript Information	
Manuscript Number (ID)	7106
Title	ASSISTIVE TECHNOLOGY FOR CHILDREN WITH LEARNING DISABILITIES (ATCLD) AS AN ARTIFICIAL INTELLIGENCE SYSTEM

Congratulations! The review process for the International Journal of Sciences: Basic and Applied Research (IJSBAR) has been completed. The journal during its journey which started in 2009 received submissions from 55 different countries and regions, which were reviewed by international experts.

Based on the recommendations of the reviewers and Based on the editorial board decision, we are pleased to inform you that your paper identified above has been accepted for publication in **peer reviewed and indexed** [Ulrich, Google Scholar , Directory of Open Access Journals (DOAJ),Ulrich's Periodicals Directory, Microsoft academic research, University of Texas (USA),Stanford University (USA), State University Libraries of Florida (included in 11 universities libraries in Florida)(USA), University of Cambridge (United Kingdom), Simon Fraser University (Canada), University of South Australia (Australia),OAIster database, PubZone (ACM SIGMOD), Research gate, OCLC World Cat, IE Library (Spain), Elektronische Zeitschriftenbibliothek (Ezb germany), Simpson University (USA), Technische Universität Darmstadt (Germany), University of Gronignen (The Netherlands), University of Liverpool (UK), Universität Wurzburg (Germany), Academic research (ourGlocal), Issuu, Researchbib, Journal seek, docstoc, ProLearnAcademy, ectel07, University of Canterbury (New Zealand), University of Hong Kong, Queen's University (Canada), Universität Mainz (Germany), University of Saskatchewan (Canada), The Hong Kong University of Science & Technology, University of Manitoba (Canada), Auckland University of Technology (New Zealand), scribd, prorch, slideshare, mendeley, academia, Genamics JournalSeek, Internet archive, Ebookbrowse, CiteSeer, Physikalisch Technische Bundesanstalt (Germany), University of Twente (The Netherlands), Universität Osnabrück (Germany), Universität Marburg (Germany) , University of IOWA (USA), etc] **International Journal of Sciences: Basic and Applied Research (IJSBAR)** (ISSN 2307-4531). The acceptance decision was based on the internal and external reviewers' evaluation after internal and external double blind peer review and chief editor's approval.

Finally, we would like to further extend our congratulations to you.
Yours sincerely,
IJSBAR editorial board