

# Multi-Directional Mediation and the Use of Screen Readers by Persons with Visual Impairments in Bamenda, Cameroon

Ndzetar Emmanuel Wirmum<sup>1</sup>, Nsagha Sarah<sup>2</sup>

<sup>1</sup>Department of Educational Psychology, Faculty of Education, University of Bamenda, Cameroon

<sup>2</sup>Department of the Sciences of Education, Higher Teacher Training College, University of Bamenda, Cameroon

## ABSTRACT

This study sought to investigate the effects of multi-directional mediation on the use of screen reader soft-wares by persons with visual impairments in Bamenda, Cameroon. The quasi-experimental study used six persons living with visual impairment in the city of Bamenda; that is three (03) in the control group and three (03) in the experimental group. The quantitative data were subjected to inferential statistical analyses using the Statistical Package for Social Sciences (SPSS) version 26. The major finding obtained from the study indicated that the use of assistive technology (screen readers) significantly enhances the quality of information acquired by persons with visual impairments in diverse mediated settings as well equips them with transformative lifelong skills capable of promoting human flourishing for these individuals.

**KEYWORDS:** Multi-directional Mediation, screen readers, and visual impairments

## INTRODUCTION

Individuals living with visual impairments have diverse experiences with respect to the quality of information acquisition and the use of learning management systems. Under normal circumstances, humans should be able to acquire information from the environment through the senses, either by sight, hearing or by complete kinesthetic activities. This has been problematic for many persons living with visual impairments with limited access to ICT tools. Although with the advent of assistive technology tools, it is not easy to acquire, train and use in some countries. That notwithstanding, there have been great strides made by individuals with visual impairment improve upon their capacities to gain access to quality information globally with the use of diverse screen readers softwares. The advent of the COVID-19 pandemic witnessed the complete adoption of learning through various on-line platforms which were not screen reader and visually impaired friendly. Hence, during this emergency, most people living with visual impairment depended solely on the

assistance from their sighted readers or peers who could only help at their own convenience. In this light, this study was carried out to investigate the multi-directional mediated actions of the persons visual impairments, enhanced with the use of screen reader softwares.

### The concept of multi-directional mediation

Mediation explores the nature of socio-cultural forces in shaping the learner's development and learning (Kozulin, 2002). It is a multifaceted concept and has been described in terms of element and process. According to Feuerstein *et al.*, (2010) mediation is an intentional effort to help learners organise and understand information in gradually more effective ways. Through mediation, learners' impulsive, emotional reactions are reinstated by logical, objective, and more controlled responses (Feuerstein *et al.*, 2007).

Tchombe (2019) indicates that, in a multi-directional mediated action, the learner is challenged to reflect,

**How to cite this paper:** Ndzetar Emmanuel Wirmum | Nsagha Sarah "Multi-Directional Mediation and the Use of Screen Readers by Persons with Visual Impairments in Bamenda, Cameroon" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-6, October 2022, pp.186-192, URL: www.ijtsrd.com/papers/ijtsrd51844.pdf



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analyse, synthesis, evaluate, imagine, create, and solve problems not only of cognitive nature but interpersonal in negotiation and resolving conflicts. There is an active rather than a passive role of the learner in the learning process. Learners who experience a Mediated learning climate, exhibits decrease in anxiety of failure and will be more able to develop strategies, search for alternative answers (divergent thinking) and work in a more systematic and planned manner (Feuerstein *et al.*, 2010; Feuerstein *et al.*, 2007; Lomofsky, 2007). During mediation, a special quality of interaction or intervention between a learner and an experienced, active, and intentioned person (the mediator) and cultural tools exist. The mediator selects and organises the world of stimuli for the learner and equips the learners with the cognitive processes to succeed in learning. As such, mediation takes place when the mediator focuses the learners' attention on the task, provides direction, and guides the learners' analysis of questions or information. Hence, through multi-directional mediation, learners are motivated or encouraged to explore and take on challenges and thereby making their engagement in various tasks enjoyable and interesting.

Multi-directional mediation is evident in two perspectives: the meta-cognitive mediation and cognitive mediation. Schneider (2008) refers to meta-cognition as the knowledge which people have about their own abilities to process information and knowledge about the nature of cognitive tasks and the strategies used to cope with such tasks. Meta-cognitive mediation refers to children's acquisition of semiotic tools of self-regulation: self-planning, self-monitoring, self-checking, and self-evaluating. Though a complex skill, it remains valuable as it nurtures individuals' learning as well as their self-awareness of the learning process. On the other hand, cognitive mediation refers to children's acquisition of cognitive tools that are necessary for academic concept development. In learning environments, teachers are seen to have an impact on the quality of pupils' discussions in small-groups, and that the nature of the role assumed by the teacher is crucial for the promotion of successful learning and productive discussion (Meloth & Deering, 1999; Mercer & Wegerif, 1999; Rasku-Puttonen, Etelapelto, Hakkinen, & Arvaja, 2002; Blatchford, Kutnick, Baines & Galton, 2003). When teachers provide opportunities for their learners to participate in joint activities in the classroom via an increase in the amount of interaction either with the teacher or peers (another possible human mediator), it enables the learners to increase control over their own process of learning and internalisation (Anton, 1999; Ash &

Levitt, 2003; Gibbons, 2003; Nussbaum, Alvarez, McFarlane, Gomez, Claro & Radovic, 2009). With a good mediation process and tools put in place, persons with visual impairment will be able to complete the activity or task, thereby enabling them to take control of their learning, build their confidence, and increase their self-efficacy/self-worth. Hence the use of screen readers as mediators should stimulate users' feelings and thinking so that they can engage in interactive-mediative processes and as such feel motivated to complete the activity given.

In relation to this study, visually impaired students require mediated learning for the development of understanding the concepts of the world. In forming concepts, vision plays an important role in motivational functions, stimulating and inclusive. In terms of visual impairments, a child may have great difficulty in perceiving using tactile – kinaesthetic and other senses an object in its entirety (Preda, 1993). This is because cognitive skills are likely to grow more slowly or in a different way for visually impaired children than those without visual impairments. The educational process in children with visual impairments with respect to enhanced teaching-learning transactions is successfully achieved by teachers adapting teaching styles and given a number of factors such as location, presentation, experience, expectations, providing information, and speed (Chapman & Stone, 1998). As such using instrumental enrichment programs adapted to various categories of deficiencies, children will learn and develop their intelligence under the impact of intensified teaching strategies, which is formative and stimulating. This aids the learner or child to participate in future educational practices, thereby changing their identities to become experts over the knowledge newly or recently acquired.

### **The role of assistive technology and screen readers**

Assistive technology devices according to IDEA (International Disabilities Education Act (2004) as any item, piece of equipment, or product system, whether acquired commercially or off the shelf modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. Assistive technology devices are great equalizing forces in education and meaningful inclusion of students with disabilities both in terms of access to the general curriculum and in facilitating the ability of students to demonstrate mastery of their areas of study. Mbangwana (2006) postulated that assistive technology promotes greater independence for people with disabilities. These help them to perform tasks that they were formerly unable

to accomplish or had great difficulty in accomplishing that task and by providing enhanced or changed methods of interacting with the technology needed to accomplish such tasks. For instance, screen magnification programs are used to enlarge print for students who are visually impaired. These programs adjust the size of text and graphics and control the number of lines and words per page (Galvin & Scherer, 1996). Mbangwana suggests that assistive technology should offer a levelled playground for students with disabilities vis-à-vis students without disabilities. Screen reader software should be able to open persons with visual impairments to a variety of learning resources, promoting diverse thinking strategies, critical thinking as well as the use of information and learning management systems. Therefore, screen readers as an assistive technology should enculturate and acculturate persons with visual impairments in information and knowledge acquisition, management, creation as well as peer shared knowledge.

Screen readers are software programs that allow the visually impaired users to read the text that is displayed on the computer screen with a speech synthesizer or Braille display (AFB, 2011). Simply put, it allows the visually impaired to easily access electronic information. A screen reader is the interface between the computer's operating system, its applications, and the user. The user sends commands by pressing different combinations of keys on the computer keyboard or Braille display to instruct the speech synthesizer what to say and to speak automatically when changes occur on the computer screen. A command can instruct the synthesizer to read or spell a word, read a line or full screen of text, find a string of text on the screen, announce the location of the computer's cursor or focused item, and so on. In addition, it allows users to perform more advanced functions, such as locating text displayed in a certain colour, reading pre-designated parts of the screen on demand, reading highlighted text, and identifying the active choice in a menu. Users may also use the spell checker in a word processor or read the cells of a spreadsheet with a screen reader. In line with O'Dea (2009), screen reader softwares increase independence, participation and access of persons with visual impairment in their socialisation processes and activities.

### **Theoretical perspective**

#### **The Mediated Mutual Reciprocity (MMR) theory by Tchombe 2019**

Tchombe (2019) proposed the Mediated Mutual Reciprocity (MMR) theory for cognitive enhancement. This theoretical framework explains that learners initiate and sustain the learning process,

by ensuring that their own significant, dynamic, and sustainable contributions to learning are in a dialectical relationship between the learner and significant other. The MMR takes into consideration the dimension of socio-cultural constructivism enhancements with more accents on the learner's inputs through initiated interactions and actions. This theory advocates for information management approaches that promote co-learning that is non-hierarchical in nature. The co-learning is based on a non-hierarchical principle as both the learner and teacher are engaged interdependently in the learning process, ensuring equity and relevance based on the norms and values of the socio-cultural context. Accordingly, learners understand their roles through their initiated contributions in directing their own learning and development. Since Mediated Mutual Reciprocity is a give and take process, it affects both the behaviour of the learner and the significant other (caregiver, teacher, and other competent others) in the process of knowledge creation, utility, evaluation, and dissemination. The meta-cognitive abilities of the learners have an important role to play given that individuals should be able to monitor, rethink, create and plan their own learning activities which are all interest-driven.

#### **Research Design**

The quasi-experimental research design was chosen for this study. In this regard, two blocks of participants were envisaged in the experiment. The experimental block (people with visual impairments who were exposed to mediated activities and using screen readers) and the control block (people with visual impairments not exposed to mediated actions using screen readers). Both quantitative and qualitative instruments were used to collect data, namely a screen reader practice test and an interview guide. The indicators that were used in the study included: the ability to use new ways of knowledge creation, the ability to apply new knowledge in diverse settings, engage in reflective thinking, engage in independent thinking, work through features of a problem to reach a solution, the ability to increase or decrease tasks, the ability to receive feedback with favourable results, and the ability to give feedback with favourable results.

The accessible population involved persons with visual impairment from higher education institutions and graduates in Bamenda, Mezam Division of the Northwest Region of Cameroon, who are users of screen reader softwares. A purposive sampling technique and a snowball technique were used for the study. In this regard only learners with visual impairment were carefully selected for the study, based on availability and willingness to participate in

the study. The following procedures were adopted for the selection of participants for the study. The first step involved the identification of learners with visual impairment. From a total number of 6 identified persons with visual impairment, 3 were randomly assigned to the experimental group and 3 to the control group. This sample is justified by Goldstein and Pollock (1998) who state that in obtaining best results in any skills training programme, a group of three (3) to six (6) children is appropriate. They maintained that more than six can be too disruptive to control, and thus become counter-productive. Meanwhile, less than three children will lack sufficient social interaction and coordination of ideas. Small groups equally give the learners a chance to observe others, practice with peers and receive feedback. An observation check-list and an interview guide were the instruments used collect quantitative as well as qualitative data for the study.

The training programme was conducted for ten months. The first part involved participants from the experimental and control groups with a series of homework tasks assigned to every participant. These tasks were reviewed carefully to ensure that all the participants were at the same levelled-play ground. After ensuring this basic level of performance, the pretest evaluations were conducted. Thereafter, the participants in the control group were then isolated from further interventions, meanwhile, the experimental group was exposed to different mediated learning activities. These interventions witnessed formative evaluation after one month of training, to enable the researcher to determine if there

#### **Distribution for means scores of pretests-posttests for multi-directional Mediation for the control group and the experimental group**

Control group			Experimental group		
Pre-Test Aggregate Mean score	Post-Test Aggregate Mean score	Difference	Pre-Test Aggregate Mean score	Post-Test Aggregate Mean score	Difference
3.07	3.00	0.07	3.52	5.15	1.63

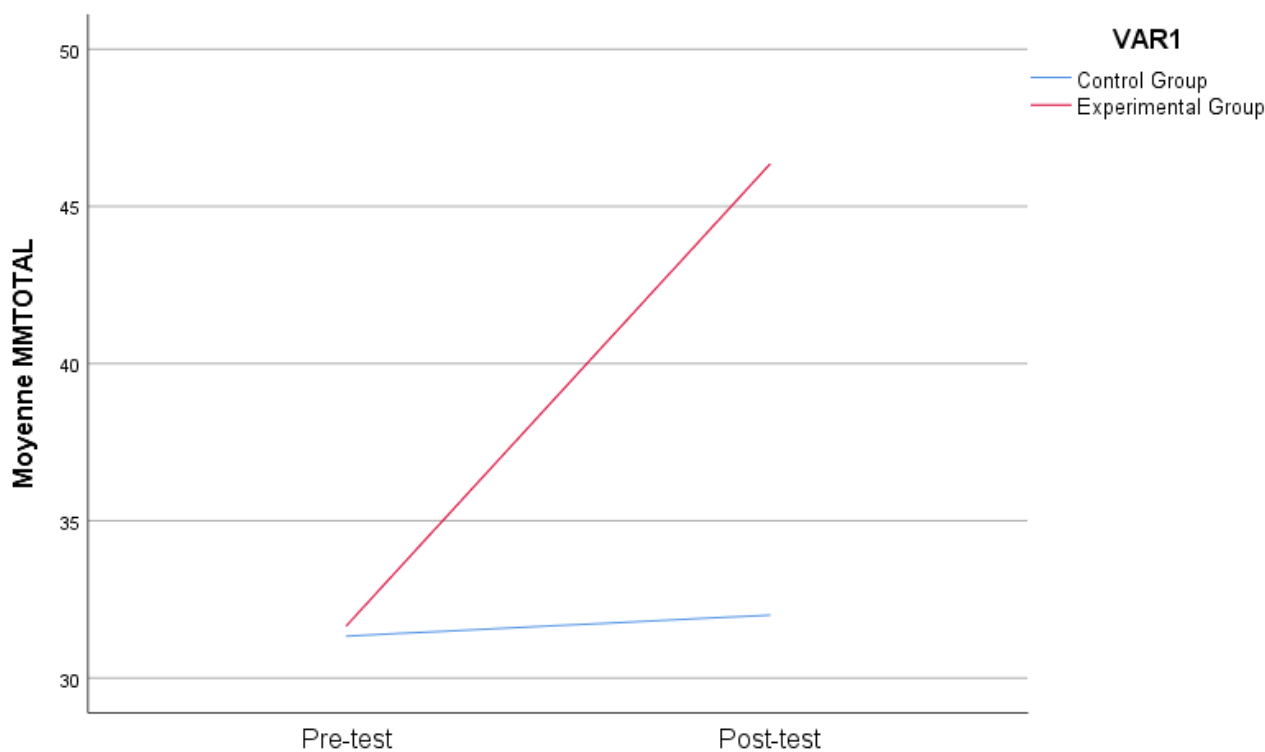
The table above presents the distribution of the pre-test and posttest comparisons of the indicators in the multi-directional variable with respect to the use of screen reader software. The aggregate mean scores for the control group indicated a negative difference (0.07), meanwhile, the aggregate scores for the experimental group indicated a positive difference of 1.63. This difference is illustrated in the figure below.

The figure above illustrates that at the pre-test, participants at the for the study were at the same level for both the control group and the experimental group. At the Posttest, there is a significant increase in the mean scores of the experimental group as compared to the mean scores of the control group.

was an improvement in participants' performance. The training then continued, and participants were encouraged to collaborate or interact with peers. At the end of the second month, the last formative evaluation was conducted to know if there was a change or improvement in performance in tasks assigned using screen reader software. The best and straightforward way to judge success in the programme (posttest) was to repeat the evaluation conducted at the beginning of the training programme. The post test at the end of the exercise was administered to both the experimental and control groups such that the results were compared for any significant improvements. The instrument designed to monitor and follow-up the participants was used to determine if the skills acquired could be generalised in situations different from the training session.

#### **Data Analysis**

Data collected for the study was analysed using the Statistical Package for Social Sciences (SPSS) Version 26. multiple response set was automated with respect to the weight attached to the indicators. The mean scores for the pretest and posttest performance of the participants were also generated in to ascertain if there was a difference in performance whilst comparing the experimental and the control group. The T-test was used to check the effects of multi-directional mediation on the use of screen reader software, at an 0.05 significant level ( $\alpha=0.05$ ). Again, Cohens's test was used to verify the magnitude of the effect. The results were then presented using tables, and figures to facilitate the discussions.



VAR2

**T test comparing means scores of Multi-Directional Mediation**

Logistic parameter	Control Group		Experimental		t (10)	p	Cohen's d
	M	SD	M	SD			
Maximum asymptote, proportion	31.67	.816	39.00	8.124	-2.200	.000	1.17

The Table above, shows the means and standard deviations (31.67, 0.816) for the control group and (39.00, 8.124) for the experimental group. There was statistically enough evidence ( $t = -2.200, p = 0.000$ ) that multidirectional mediation significantly affects the use of screen reader software,  $p < 0.05$  for persons with visual impairments. Cohen's d test was used to measure the magnitude of the effect of the difference on the two groups. The Cohen d value here was 1.17, implying a large effect. Therefore, the null hypothesis that there is no significant relationship between multi-directional mediation and the use of screen readers by persons with visual impairments was rejected while the alternate hypothesis that there is a significant relationship between multi-directional mediation and the use of screen readers by persons with visual impairments was retained.

**Multi-directional mediation and the use of screen readers**

The findings showed that multi-directional mediation is influenced using screen reader software used by persons with visual impairments in Bamenda. This indicated that multi-directional mediation enhances the use of screen reader softwares. As such, this exposure or experience enables learners or individuals with visual impairments to organise and understand the information in gradually more effective ways. Therefore, individuals with visual impairments using screen readers with diverse mediated actions are bound to perform and attain their learning goals more than those who are not exposed to such experiences. This finding is in line with Pacheco, Yoong, & Lips, (2017) who established that recent technologies play several enabling roles that help students to manage diverse transition challenges. They asserted that by incorporating in the analysis the potential of digital tools, updates and expands the understanding of the

role played by ICTs in higher education, drawing from the experiences and views of young people with vision impairments. The findings indicated that assistive technologies do not only compensate for their impairments and facilitate information gathering, communication, and learning, but on other hand, it also creates opportunities for collaboration, support arrangement, and social connection and participation. Also, this study confirms the findings of Eligi & Mwantimwa (2017), that ICTs support innovative learning, encourage independent learning, and promote participatory and collaborative learning. Also, Aoife, Casey, Desmond & Gallagher (2019) in their systematic review ascertains that assistive technology can promote educational, psychological, and social benefits for students with disabilities. Although challenges such as inadequate AT training, inadequacies of devices, assistive technology enhances support to enable persons living with visual impairments to negotiate for multiple information

sources. This implies that appropriate training, and use of assistive technology as well as a good presentation of learning materials in a screen reader friendly manner, influence the structural cognitive development of persons with visual impairments. Potential adaptation of information acquisition tools and modification of learning materials, relating to their own experiences in moments of direct learning, scaffolds persons living with visual impairments to acquire new knowledge.

To elucidate, the findings of this work equally showed that persons with visual impairment opined the use of assistive technology promotes or fosters progressive acquisition of skills and knowledge for future diverse learning management systems. The use of assistive technology for diverse mediated actions is therefore seen or considered to promote the acquisition and development of skills that are required for lifelong learning activities. This view is similar to Olukotun (2004) who asserted that technology has impacted positively on the lives of persons with disabilities with regard to information use, education, and lifelong learning; as such it does not only expand the world of the visually impaired students, as it also serves as a great equalizer. It is seen here to have decreased discriminatory practices in communities as it uncorks access to knowledge in extraordinary and diverse ways. These psychological tools therefore should be able to improve the quality of life by improving efficiency and enhancing effectiveness in different socio-economic spheres that promotes human flourishing for these individuals living with visual impairments.

### Conclusion

The study revealed that multi-directional mediation is significantly enhanced using screen reader software for persons with visual impairments. This implies that persons with visual impairments equipped with required skills on the use of screen reader software engage in a combination of learning and developmental processes through a supportive learning environment that challenges but facilitates their learning. This is in concurrence with the Cultural History Activity Theory (CHAT) by Vygotsky (1978) who strongly opined that consciousness emerges from human activity mediated by artifacts (tools) and signs. It is also in agreement with the Mediated Mutual Reciprocity (MMR) theory by Tchombe (2019) who sees learners initiate and sustain the learning process, by ensuring that their own significant, dynamic, and sustainable contributions to learning are in a dialectical relationship between the learner and significant other, thus a socio-cultural constructivism enhancement

with learner's inputs through initiated interactions and actions. Hence, they can initiate and control their own learning with the use of assistive technology and as such build their capacities with transformative lifelong skills capable of promoting human flourishing for these individuals.

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