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Impact of Instructional Resources on Mathematics Performance of Learners with Dyscalculia in Integrated Primary Schools, Arusha City, Tanzania

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Abstract
Learners with dyscalculia in the integrated primary schools in Arusha have been performing poorly in the Primary School Leaving Examination (PSLE). Thus, the journal sought to investigate the impact of instructional resources on mathematics performance of learners with dyscalculia in integrated primary schools found in Arusha city, Tanzania. The main objective of the study were to identify types of instructional resources used by teachers who teach mathematics in integrated schools and to find out the adequacy of instructional resources used to teach Mathematics in integrated schools. The study employed a descriptive design, which was involved with generalized statistics that were abstracted from respondents. The target population was 92 respondents who included head teachers and subject teachers from four schools. A sample size of 52 respondents was obtained through the use of purposive sampling. A questionnaire was used as a major data collection instrument that was administered to head teachers and teachers, and a screening tool checklist complemented it. Data analysis was done manually and computed using Statistical Package for Social Sciences (SPSS). Descriptive statistics was applied to present the findings. The findings revealed that graphic and realia resources to be the most commonly used by teachers. The study also established that all the five main types of instructional resources namely audio, visual, audio-visual, graphic and realia resources were either inadequate or lacking. The study recommends that Government should provide computers and computer software, mathematic kit, radio cassettes and tape recorders which are vital instructional materials in primary schools to enhance effective teaching and learning mathematics. Also, Ministry of Education and Culture should take responsibility in providing instructional resources to schools.
Keywords: Instructional Resources, Learners with Dyscalculia, Mathematics Performance

1. Introduction

UNESCO (2008) states that everyone has a right to education while the United Nations Convention for the Rights of Children (UNCRC) adds that education is a fundamental human right (Wolfenson, 2000). The World Conference forum on Education for All (EFA) which was held in Dakar Senegal (UNESCO, 2000) hailed that the use of instructional resources in primary schools should be mandatory. Hence, the Dakar conference scored the importance of instructional resources (IR) in primary schools for the purpose of improving learners learning. The right to education is universal to all children, youth and adults with difficulties in learning. This right is enshrined in the Convention on the Rights of the Child (UN, 1989) and the Convention on the Rights of Persons with Disabilities (2008).

Learning disability (LD) is an umbrella term used to cover a range of frequently co-occurring disorders. This include: **Dyslexia** which affects the learner's ability to read, spell and write, **Dysgraphia** – here learners have difficulties with written expression, including spelling, handwriting and written composition. As for **Dyscalculia** it deals with problems of understanding mathematics and quantitative thinking while **Dysphasia** is an oral language disorder which affects speech and comprehension (Westwood, 2008). This research, however, deals only with dyscalculia.

Jane (2009) defines dyscalculia as a mathematical disability which causes serious difficulties in learning mathematical concepts and facts. The effects of dyscalculia are either unknown or ignored in many integrated schools. Dyscalculia usually causes general lack of understanding of how mathematical problems are supposed to be organized in a page. Dyscalculia is a brain-based condition that makes it hard for a learner to make sense of numbers and math concepts. It includes inability to understand numbers and numeric manipulation and learners find it learning math facts and other related concepts. Dyscalculia can occur in all the people across the whole Intelligence Quotient (IQ) range. People who suffer from this disorder often have difficulties with time, measurement and spatial reasoning (Adler, 2008).

Dyscalculia has many underlying causes. One of the most prevalent is weakness in visual processing. In order to be successful in mathematics, one needs to be able to visualize numbers and mathematical situations (Butterworth, 2003). Mathematical concepts are introduced at a rapid rate. If students do not have sufficient time

to fully grasp and practice them, they are overwhelmed and confused (Cawley & Foley, 2001). Moreover, teachers need extensive training to help students learn by using different types of instructional resources and apply ideas of current research on teaching students with dyscalculia. A study done in the USA by Kelly, Gersten & Carnine, (1990) note that poor or traditional instruction is the primary cause of math difficulties for many students with learning problems. They support the notion that students with dyscalculia can be taught to improve their performance through the use of appropriate teaching instructional resources. Given the poor performance in maths, the progress of students with learning difficulties in education is hindered. Therefore there is need to improve their performance standards by designing resources and an effective maths curriculum. So then, without better maths instruction and resources by teachers, these pupils may continue to face much frustration and failure (Mercer & Miller, 2003).The study sought to investigate the impact of instructional resources on the academic performance of learners with dyscalculia.

There are different types of instructional resources used in teaching students with dyscalculia. Instructional resources can be made locally or imported, and they make tremendous enhancement of lesson impact if intelligently used. Okogbuo (2000) classifies the types of instructional resources as follows:

Visual resources: pictures, diagram buildings, projectors, teacher themselves, charts, real objects, books, newspapers, magazines, pamphlets, handouts, clock face, simple abacus, coloured objects, puppets, models and chalkboard. Audio resources: tape recording cassette, radio, CD and dramatization. Audio-Visual Resources: television, video recording, motion pictures with soundtracks, slides, films and multimedia, computer and DVD. Graphics resources: charts, picture board, number cards, tracing paper, puzzles, matching cards, picture book, reading board, cartoon books and stacking toys. Realia resources real objects like posters, flags, magazines, plants, water, pictures, graphics, animals, sand, coins and seeds.

Instructional resources play a significant role in the teaching and learning process particularly with students who have dyscalculia. Characteristic of them is the working memory deficit and may be mediated by factors such as intelligence quotient (IQ) or processing speed (Hulme & Snowling, 2009). The executive director (Nate, 2005) Tanzania in Mathematics Advancement Centre (TMC) asserts that many schools do not have visual aids and other equipment necessary in teaching maths calculation. He also adds that some schools ratio of sharing is (1:6) one textbook to six students. Students may not understand complex mathematical concepts like such as multiplication, division and some abstract ones that require implication. Similarly, they do not remember to build on the existing knowledge to help them master what they do not know yet (Butterworth, 2003).

Adequacy and effective use of resources can make a big difference to a school and the learner (Fisher, 1995).Teachers of learners with dyscalculia should not just settle for good enough but seek to do better by ensuring that adequate and effective instructional resources are employed. Orodho, Waweru, Ndichu & Nthinguri, (2013) advise that adequacy of instructional resources such as textbooks enable learners to follow the teacher's sequence of the lesson presentation and subsequently aids in the understanding of the lesson. The teacher's first responsibility is to ensure that his or her class is adequately provided with resources (Edgington, 1998). Availability and adequacy of a wide variety of instructional resources can stimulate the interest and actively engage learners with learning disabilities in mathematics (Herward, 2009). This study was therefore guided by the following research questions:

i. What are the types of instructional resources used by teachers who teach mathematics in integrated schools?
ii. What is the level of adequacy of instructional resources used to teach mathematics in integrated schools?

2 .Objectives of the Study

i. To identify types of instructional resources used by teachers who teach mathematics in integrated schools.
ii. Find out the adequacy of instructional resources used to teach Mathematics in integrated schools.

3. Materials and Methods

This study used a descriptive research design. This design enabled the researchers to make conclusions and obtain information that describes the existing phenomena. The study employed both quantitative and qualitative methods using questionnaires in collecting data to allow the researchers for more probing of the existing phenomena (Golafshan, 2003). To identify learners with dyscalculia and facilitate a broader look at the achievement, a screening tool checklist was prepared. The validity of the data collected was maintained by wide and intense consultation with experts in the field as well as ensuring sufficient content coverage of items in the questionnaire whereas reliability was guaranteed by pre-testing the measuring instrument.The target population for this study was head teachers and teachers of integrated schools in Arusha city. There were 92 teachers who teach mathethematics subject from class one to class seven. Simple random sampling technique was used to select four (4) schools which participated in the study. The sample size included four head teachers and 48 teachers, the total were fifty-two (52) from four schools, class one to class seven to follow the streams in schools participated in the study. This represented 54.17% of the target population. The data collected through

questionnaires was coded and computed in SPSS software. Pie charts, graphs, tables and percentages were used to analyze and present the findings.

4. Result and Discussion

4.1 Demographic Information of the Respondents

About half of the female respondents were within the age bracket above 41 years, and a few of the males were above 41years. Most respondents in the study were females. Only a few teachers were below 25 years of age as shown in Table 4.1

Table 4.1: Teacher's Gender and Age (n=50)

Age	Gender				Percentage
	Male		Female		
	frequency	%	frequancy	%	
Above 41	7	14%	23	46%	30 (60%)
26-40	1	2%	14	28%	15 (30%)
Under 25	2	4%	3	6%	5 (10%)
Total	**10**	**20%**	**40**	**80%**	**50 (100%)**

Table 4.2 shows that almost half of the respondents had no special education training. Nearly a half of the respondents had a grade 'A' certificate in special education. Less than a quarter of the respondents were Diploma and Bachelor degree holders. A large number of teachers in integrated schools were not trained in special needs education. This finding agrees with earlier research study by Tanzania Education Network (2012) that integrated schools have no teachers trained in early childhood education and other exceptionalities.

Table 4.2: Teachers' professional qualification and experience (n=50)

Teachers' professional qualification	Frequency	Valid Percent	Cumulative Percent
No special need education	22	44	44
Grade 'A' Certificate in special need education	20	40	84
Diploma in special need education	5	10	94
Bachelor degree in special need education	3	6	100

4.2 Types of Instructional Resources used in teaching mathematics

It was the aim of the journal to find out the types of instructional resources used to enhance better mathematics performance for learners with dyscalculia in their schools. All of the respondents (Table 4.3) indicated that visual resources (books and mathematics kit) were available in their schools. Three quarters of the respondent from Meru and Mwangaza schools indicated that realia resources (stoppers) and graphic resources (diagrams) were available in their schools. Half of the respondents from Ngarenaro and Kaloleni indicated they had written and counting numbers (number cards and seeds) in their schools. Audio-Visuals resources were the most unavailable resources in almost all schools. The unavailability of such resources may have affected the teaching and learning of counting, measurement and classification of numbers. This finding of the study supported by the research of Tanzania Education Network (2012) which states that inadequate teaching and learning materials pose a great challenge to the primary education resulting in poor performance in math.

Table 4.3: **Headteachers responses on the types of IR (n=4)**

SCHOOLS	Types of instructional resources in percentage				
	Visual resources	Graphic resources	Realia resources	Audio-visual resources	Audio resources
Meru	100	75	25	25	0
Mwangaza	100	75	75	25	0
Ngarenaro	100	50	25	0	0
Kaloleni	100	25	50	0	25

The study also sought to establish the availability of instructional resources used to teach mathematics to learners with dyscalculia in the sampled schools. Table 4.4 indicates that the most available instructional resources were the textbooks, followed by chalkboard, number cards and stones. According to the findings, number cards, charts and mathematics kit were fairly available. Most of the respondents indicated that audio-visual aids (computer and television) were not available. These findings agree with earlier research study (Piaget theory, 1983) which suggested that the different resources in the class assist the learners to perform well in a subject. Head teachers also indicated that teachers in their schools used realia to teach math. The least available resources were audio and audio-visual resources. There is therefore a need to avail various kinds of instructional resources for learners with dyscalculia.

Table 4.4: Teachers' responses on availability of IR

Available of instructional resource	YES		NO	
	N	%	n	%
Visual resources				
Textbooks	38	83	8	17
chalkboard	30	65	16	35
Puzzle and Sudoku	9	20	37	80
Abacus	2	4	44	96
Graphic resources				
Number cards	30	65	16	35
Chats	25	54	21	46
Mathematics kit	24	52	22	48
Realia resources				
Stones	29	63	17	37
Stoppers	18	39	28	61
Seeds	12	26	34	74
Audio-Visual resources				
Computer	3	7	43	93
Television	2	4	44	96
Audio resources				
Radio	3	7	43	93

4.3 Adequacy of Instructional Resources Used in Teaching Mathematics

Instructional resources are important in teaching mathematics as they help the learners with dyscalculia to remember rules, instruction and formulas. Therefore, the study sought to find out the level of adequacy of instructional resources. Table 4.5 shows that half of the respondents gave their opinions those instructional resources for teaching mathematics were inadequate, while slightly more than a quarter of the respondents indicated that the materials were slightly adequate. Very few of the respondents indicated that instructional resources were adequate in their schools. This study finding agrees with earlier studies by Orodho, et al. (2013) which state that adequate instructional resources such as text books are essential for teaching learners with dyscalculia as they enable learners to follow the teacher's sequence of lesson presentation and subsequently aid in understanding of the lesson.

Table 4.5: Teachers' responses on the level of adequacy of IR (n=46)

Responses	Frequency	Valid Percent	Cumulative Percent
Inadequate	25	54.3	54.3
Slightly adequate	15	32.6	87
Adequate	4	8.7	95.7
None	2	4.3	100
Total	**46**	**100**	

Further the study sought to find out the head teachers' opinion on how they rate the adequacy of instructional resources in their schools. Figure 4.1 shows those three quarters of the respondents indicated that there was an inadequacy of instructional resources in their schools with only one of the respondents indicating that instructional resources were adequate. This study finding agrees with the study by the executive director (2005) of Tanzania who asserts that many schools had not visual aid and other equipment in schools used in teaching mathematical calculation.

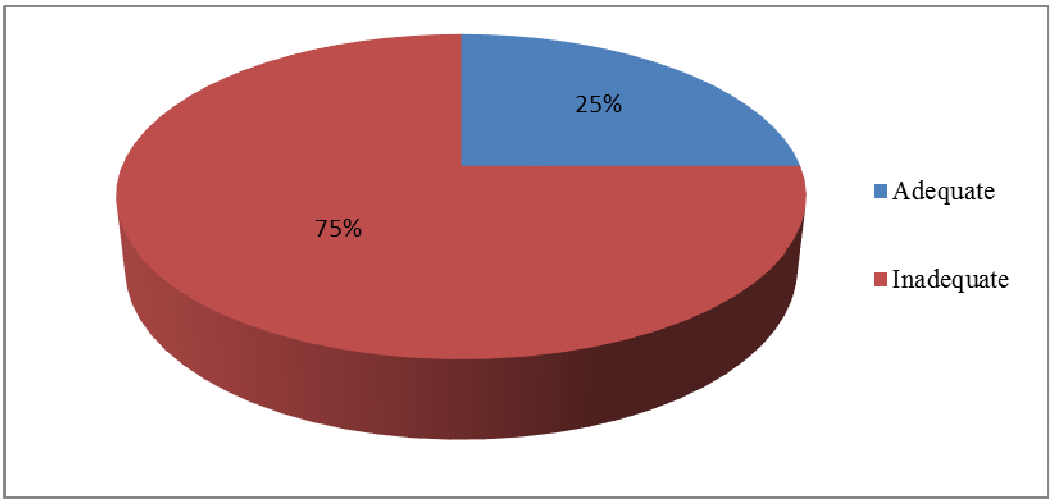

Figure 4.1: Head teachers' responses on the adequacy of IR

According to Figure 4.2, majority of the respondents indicated that the availability and adequacy of resources affected mathematics performance of learners with dyscalculia. This is because the availability of resources enables learners to use more senses which help to improve memory and ability to recall different formulas. The Government has tried to supply mathematics kits and other resources for each school to help learners but this was not enough. Instructional resources help learners with dyscalculia to understand easily during teaching and learning process because they enable learners to use five senses in learning.

Nevertheless, learners with dyscalculia need audio-visual resources like television, computer or DVDs or other resources apart from mathematic kit. This finding agrees with Heward (2009) who posts that availability and adequacy of a wide variety of IR can stimulate the interest and active engagement of learners with learning disabilities in maths. Some respondents felt that adequacy of instructional resources could be remedied if primary teachers are trained on assistive technology and seminars to equip them on improvisation as well as short courses on learning disabilities. Also teachers argued that the problems of learners with dyscalculia resulted from a difficulty to follow instruction and lack of motivation from stakeholders.

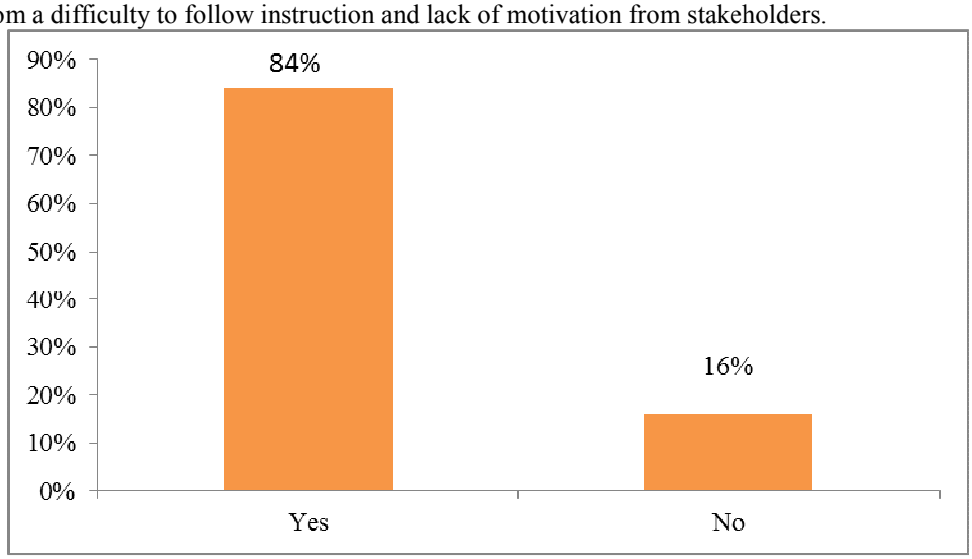

Figure 4. 2: Teachers' response on the effect of the adequacy of IR on math performance of learners.

4.4 Responsibility of Ensuring IR

The study also sought to find out teachers' opinion on whose responsibility is to ensure adequacy of instructional resources. The teachers' responses are captured in Table 4.6. Majority of the respondents' opinion were that the Ministry of Education and Culture should take responsibility in providing instructional resources to schools. The study finding concurs with study finding by Talaka (2009) who posits that education has an intrinsic value and is an instrument for social development, so schools need resources to improve the mathematics performance.

Table 4.6: Teachers' response on the supply of Instructional resources

Supplier	frequency	percentage
MOEC should supply the resources	38	83%
Government should provide	32	70%
Teachers should improvise	12	26%
Parents should be involved	10	22%

4.5 Financial constraints to acquire IR

Figure 4.3 shows that slightly more than half of the respondents agreed that schools were unable to acquire instructional resources due to financial constraints whereas a quarter of the respondents strongly felt that financial constraints did not contribute to lack of instructional resources. A few of the respondents disagreed with the opinion that financial constraints made it impossible for schools to acquire instructional resources. This study finding contradict prior research and Analysis Working Group (RAWG, MKUKUTA Monitoring System & Ministry of Finance and Economic Affairs, (2009) that assert that over 70% of the annual budget of education in Mainland Tanzania is allocated to basic education activities, of which more than 50% is spent on primary education.

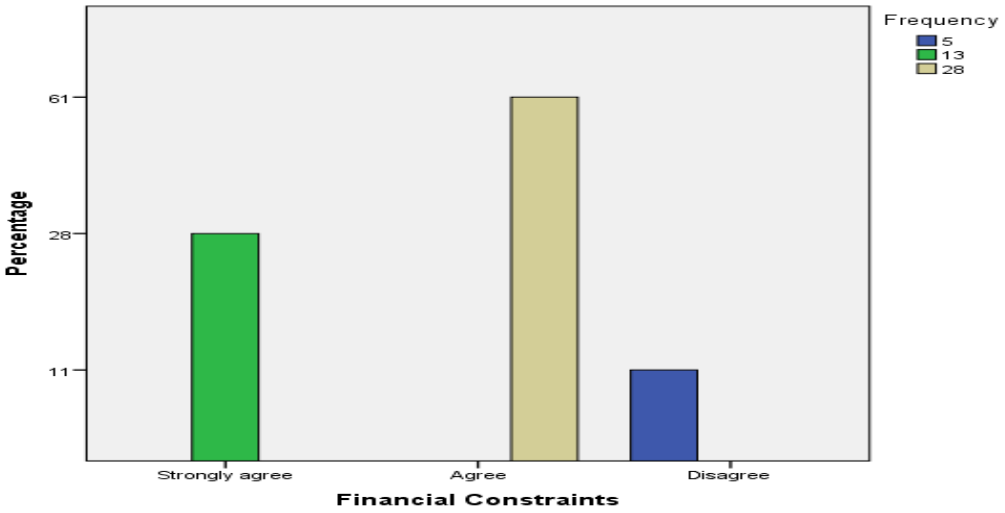

Figure 4. 3: Teachers' response on the financial constraints (n=46)

5 Conclusion

The study revealed that slightly more than half of the teachers had special education training at different levels but not in learning disabilities making this a major hindrance for them to effectively teach learners with dyscalculia or even improvise instructional resources. Most used instructional resources were books with audio-visual resources either lacking or used in only one school. Many of the respondents recommended the need for the government to set aside more funds for buying instructional resources since their use in teaching was of utmost importance.

The study concluded that visual resources (books and mathematics kit) were available in the schools. Audio-Visuals resources were the most unavailable resources in almost all schools. The unavailability of such resources may have affected the teaching and learning of counting, measurement and classification of numbers. It was also conclusive that there was an inadequacy of instructional resources in the various schools under study.

There is serious lack of instructional resources especially audio-visual resources according to the results of the study. The findings established that almost all of the respondents indicated that the instructional resources in schools are not enough. This trend is partly caused by low-level awareness by the integrated schools on the educational requirement for learners with dyscalculia. Lack of finances was also noted as a major setback in the acquisition of instructional resources particularly high technology resources such as computers.

6 Recommendations

- Government should provide computers and computer software, mathematics kit, radio cassettes and tape recorders which are vital instructional materials in primary schools to enhance effective teaching and learning mathematics.
- In addition, Ministry of Education and Culture should take responsibility in providing instructional resources to schools.

- The government should partner with NGOs and International Organizations such as UNICEF and UNESCO to provide instructional resources for instance computers, tape recorders, projectors and film projectors.
- Findings showed that teachers are not trained in assistive technology (AT). There is therefore a need for the Ministry of Education and Culture to introduce AT courses in Teacher Training Colleges.
- A similar study should be carried out in other regions of Tanzania to establish whether the study findings apply to other areas to enable generalization of the findings of this study.

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