Demystifying Mathematics: handling learning difficulties in Mathematics among low achievers in Kenyan schools

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Abstract
Mathematics is a compulsory subject in both primary and secondary schools in Kenya. However, learners' poor performance in the subject in Kenya national examinations year in year out remains a serious concern for teachers of Mathematics, parents, curriculum developers, and the general public. This is particularly worrying because of the importance attached to the subject in national development hence the need to find out what could be affecting learning of Mathematics in Kenyan schools. The research on which this paper is based sought to examine the factors that influence performance in Mathematics in Kenyan schools; identify the characteristics of Mathematics learning disabilities; determine how the learners with such learning disabilities can be assessed and identified and interventions for these difficulties implemented. A case study was undertaken on class six learners in a primary school in Nairobi County. The tools used for the research were: classroom observations and an Individualized Education Program (IEP) developed by the teachers with the help of the researcher. This paper therefore highlights the findings from the research, discusses the implications of the findings and suggests the way forward as far as teaching, learning and assessment of Mathematics in Kenyan schools is concerned. Perhaps with the application of the right interventions, poor performance in Mathematics in the national examinations in Kenya will be a thing of the past.

Key Words: Demystifying Mathematics, Individualized Education Program, Learning Difficulties, Assessment

1. Introduction

Mathematics plays an important role in the development of human thoughts and systematic intellectual procedures used in problem solving thus assisting people to be able to foresee, plan, choose and suitably resolve each problem in everyday life (Tatlah, Amin & Anwar, 2017). Granted, Mathematics is considered a fundamental subject in the achievement of Kenya's vision 2030. However, according to Njoroge (2014), learners of Mathematics in Kenya continue to post poor performance in the subject. Reports from Kenya National Examinations Council indicate that many learners both at Primary and secondary schools perform poorly in Mathematics during national examinations (see Kenya National Examinations Council Report 2020).

Table 1: Candidate's Performance in Mathematics Alt A for the years 2015 - 2019

Year	Paper	Candidature	Mean Score	Standard Deviation
2015	1 2	520274	25.53 28.23	20.39 22.81
2016	1 2	570398	23.74 17.84	21.24 21.09
2017	1 2	609525	24.49 26.47	22.03 22.43
2018	1 2	658904	24.07 28.82	21.16 20.85
2019	1 2	694445	31.00 23.00	24.04 20.90

Source: Kenya National Examination Council Report 2020.

Table 2: General performance in Mathematics for the years 2006 – 2010 in KCPE.

Year	2006	2007	2008	2009	2010
National Raw Mean	26.97	24.62	23.58	24.78	26.90
Standard Deviation	10.33	10.38	9.96	10.09	10.26

Source: Kenya National Examination Council Report 2011.

The KCSE results in the table 1 reveal quite a low mean mark (given that the marks are out of 100%) in the last five years and the standard deviation is high. The performance in Mathematics at primary school level in Kenyan schools is equally poor as can be seen in table 2. The causes of such performance needs to be checked and amicable solutions established.

The poor performance in Mathematics is often attributed to learners' negative attitude towards the subject. According to White (2017), the negative attitude arises primarily from negative experiences encountered during learning. The negative affect (the process through which learning occurs) in learners lead to propagation of a culture of negativity towards Mathematics. White (2017) underscores the need for intentional and purposeful use of instructional approaches that promotes affective development while working toward cognitive outcomes that affect the process through which learning occurs. Learning Mathematics is also affected by several factors that include short term memory, long term memory, ability to memorize Mathematics facts, visual and spatial perceptual competences. The differences in the learner's Mathematics learning abilities are as a result of cognitive, affective and environmental factors (Salihu, Aro & Pekka, 2018).

Learning difficulties in Mathematics is a fundamental part of learning Mathematics. Learners who experience learning difficulties in Mathematics are identified by lower learning outcomes obtained when compared with other learners exposed to similar experiences (Sakilah et al., 2018). The learners may have one or more learning difficulties. Approximately 15% to 20% of learners in every school, in every classroom will have a learning difficulty (State of Victoria (Department of

Education and Training), 2019). Mathematics learning disabilities are a subset of Mathematics learning difficulties.

According to Geary (2004), 5% to 8% of learners in a school are identified as having Mathematics disabilities. Mathematics learning disability is an unexpected learning problem that is identified after a classroom teacher or other trained professional has provided a child with appropriate learning experiences over a period of time (Mercer and Mercer, 2001). Appropriate learning experiences refer to practices that are supported by sound research and that are implemented in the way in which they were designed to be used. The time period refers to the time that is needed to help the children learn the skills and concepts, which are challenging for them as they learn. There is, therefore, need to look into Mathematics disabilities more closely more so because much attention has not been given to it as it has been given to the other forms of disabilities like reading and writing.

Teaching Mathematics skills is a complex process which presents the teachers and learners with a range of challenging cognitive demands when planning, organizing, monitoring and evaluating the Mathematics activities (Salihu et al, 2018). As such, teachers of Mathematics experience frustration in teaching Mathematics to learners who have difficulties learning the concepts. Yet Mathematics is a doable subject with great rewards for the learners who do well in it. This is especially so because of the weight given to Mathematics during selection of learners for various university programmes in Kenya. A pass in Mathematics is required for one to join almost every university course. This scenario justifies the need to carry out research that will help in demystifying Mathematics and specifically looking into how learning difficulties in Mathematics among low achievers can be handled so that the learners end up performing better in Mathematics and ultimately enjoying the benefits that success in Mathematics brings.

2. A Review of Some of the Factors that Contribute to Poor Performance in Mathematics in Kenyan Schools

There are a number of factors that contribute to poor performance in Mathematics in Kenyan schools. Some of the factors emerging from other researches include:

Learners' attitude toward Mathematics and Mathematics teachers: A negative attitude toward Mathematics interferes with the learners' understanding of the subject. Adino (2015) in her study on factors affecting learner's performance in Mathematics observed that 40% of the learners sampled did not like Mathematics and 36% had a negative attitude towards the subject. In another study on learner's and teacher's attitude factors contributing to poor performance in Mathematics Karigi and Tumuti (2015) found out that 83.1% teachers said that negative attitude towards the subject contributed highly to the performance. Further, 93.8% attributed the poor performance to lack of interest in the subject. According to Adino (2015) some of the learners see their

Mathematics teachers as unapproachable and thus they fear to ask questions during Mathematics class or even outside class. Some of these attitudes are acquired from home or from peers. Nevertheless, the effect is a big blow to the performance in the subject. Ngaruiya (2013) noted that 60% of the sampled pupils from Gatundu district in Kenya did not like Mathematics, hence leading to poor performance in the subject.

Teachers' attitude to Mathematics and learners: The teacher's attitude reinforces the attitudes formed by the learners toward the new concepts and any other consequent concepts built on the current one. A learner would want to learn a new concept depending on how the teacher presents it (White, 2017). If the learners notice that the teacher is not confident and has not mastered the content, they lose hope. A teacher who shows acceptance, clarifies learners' misconceptions, and shows hope in his or her learners creates more positive attitude among the learners, particularly towards the teacher and the subject. Ngaruiya (2013) observed that 67% of the sampled primary school teachers did not choose teaching as their career and hence they had a negative attitude towards teaching. As a result, the teachers in the study hardly adequately prepared materials for teaching which resulted in poor performance of their pupils. In addition, teacher trainees in Kenyan primary teacher colleges do not specialize in terms of subjects like they do in diploma colleges and universities. Each trainee is trained to handle all subjects. Some of these teachers already have a negative attitude towards Mathematics and if they must teach the subject, they may then transfer the same negative attitude to their learners. Such teachers tend to use the traditional methods of teaching where the teacher dominates the lesson rather than use the interactive methods where the ideas are exchanged among the learners and the teacher, and among the learners themselves. There is much learner participation in the interactive methods which promotes their motivation and hence results in good performance (Njoroge, 2014).

Syllabus coverage, Learning materials and teaching aids: With much work to cover within a given short time, a good number of Mathematics teachers work towards coverage of the syllabus. As a result, teaching for understanding rather than for passing exams are compromised. Learning materials such as textbooks, 3-dimension models, geo-boards and a number of reference materials for teachers enhance learning (Githaiga, 2019). These materials need to be equally accessible to all and the teacher in tern ought to ensure proper utility of them by the learners (Mutai, 2010). Lack or shortage of learning materials may contribute to poor results (Karigi & Tumuti, 2015).

Marking of books and immediate feedback lacking: The number of lessons per teacher per day on average in some schools is 7 out of a total of 9. These teachers are left with little or no time to prepare for the lessons and mark the books (Githaiga, 2019). Marking is thus left to the learners themselves or done after a long while. Immediate feedback to both the teacher and the learners, which would otherwise help clarify any misconceptions, ends up lacking. This is compounded by shortage of Mathematics teachers in some of the Kenyan schools as noted by Adino (2015). In addition, the large class size hinders individualized attention. A normal class would be expected to have about 40 learners, some primary and secondary schools have as many as 70 learners in a

class. Small classes are likely to encourage more individualized attention that is necessary especially for learners with disabilities in Mathematics. Large classes hinder the individualized attention and may decrease the teachers' morale for teaching Mathematics, (Finn & Achilles, 1990).

Unsupportive parents: Interpretation and proper guidance on results that the children get in school in terms of report forms, follow-up on homework, practice exercises and appropriate reinforcement at home may motivate learners to have a positive attitude and do more practice in Mathematics. Part of the support that the parents are expected to offer their children include purchase of Mathematics books, geometrical sets and calculators as well as creating space for self-study at home. However, a number of parents either lack ability to do so or they do not bother about their children's performance (Adino, 2015).

Mathematics disabilities: There are some cases where there is evidence that the learners are exposed to the appropriate learning environment for Mathematics, accorded adequate time for practice, given relevant and timely feedback as well as individualized attention and yet some still perform much below average in the subject. This may be a result of a disability in Mathematics learning. In her study on nature and prevalence of learning disabilities among standard three pupils, Rasugu (2010) observed that majority of the learners with learning disabilities had a high level of difficulty in the tests administered in English and Mathematics. Further, Chepkorir (2020) noted in her study that 6.3% of the sampled learners from secondary day schools in Kericho County suffered from disabilities in Mathematics. This she attributed to lack of experienced special needs teachers and lack of cooperation from the relevant stakeholders. Lack of identification and employment of the suitable teaching/learning methods makes the Mathematics disabilities persist leading to poor performance.

3. Causes and Categories of Mathematics learning disability

Disabilities in Mathematics range from mild to severe and they manifest themselves in various ways. The most common are difficulties related to recollection of basic arithmetic facts and written computations (Rajkumar & Hema, 2017). A Mathematics learning disability may stem from problems in one or more of the following areas:

3.1 Memory

Memory problems may affect a child's Mathematics performance in several ways. It can be considered in three stages: Working memory, Long term memory and Sequential memory (White 2017).

Working Memory: Working memory is also referred to as short-term memory. The following are some of the characteristics of working memory deficits. The learner may be unable to "hold" the visual image of the sum he/she is trying to solve. For example: A learner working out 89+43 mentally, may be unable to "hold" the sum of 9+3 as 12 in the memory, carry 1, add (1+8+4),

recall the 2 and put the whole sum together in the right order as 132. In addition, the learner may have difficulties retaining the symbols and their meaning (Rajkumar & Hema, 2017). Symbols such as: <, >, +, –, ×, ÷, may be used interchangeably or may have the same meaning to the learner. Working memory difficulties may even prevent a learner from starting a problem. The learner may simply forget some or all the instructions that the teacher has given. In case the working memory is overloaded, the learner may be left with absolutely no idea as to where to start. The learner may also have difficulties remembering the method to employ to perform a problem in homework even if this method was taught and applied at school the same day. The learner is unable to retain Mathematics facts, may forget steps in an algorithm or may perform poorly on review lessons.

Long term memory: This involves retaining and being able to recall accurately facts and information stored for a long time (Mercer and Mercer, 2001). Long time may be a day, a week, months or even years. A child with long term memory deficit may have problems with: (a) Solving multi – digit calculations that require "borrowing" and "carrying. (b) Understanding commutative property. This can be for example; 8+1=9 and 1+8=9 or 3×4=12 and 4×3=12. (c) Moving from using basic counting strategies to more mature strategies to calculate arithmetic problems. For example, use of rote counting of fingers in carrying out simple additions for a class six learner. (d) Retrieving/remembering basic arithmetic facts quickly to use in a present task. For example, multiplication tables. (e) Forgetting steps involved in solving various calculations (NASET LD report # 3). (f) In the upper grades like class six, long term memory may influence a child's ability to recall steps needed to solve more difficult word problems, to recall the steps in solving algebraic equations and to remember what specific symbols such as <, ≥, +, ÷, ×, π etc. mean, (Mercer and Mercer, 2001).

Sequential Memory: This is the ability to recall a series of events, steps, words or numbers. A sequential memory disorder in Mathematics is the inability to recall a series of numbers, or a sequence of steps. For example, a child may be unable to repeat a mobile phone number, a school admission number or the months of a year in their right order. A child with sequential memory disorder may experience the following difficulties: (a) Have difficulty solving multistep word problems. The child misses some steps along the way. (b) May sometimes forget whether it is morning or afternoon or which day of the week it is. (c) Being unable to judge and allocate the time needed to complete an assignment or task. (d) Telling time; for example, statements like ten minutes to 3pm or quarter to noon may not make sense to the child (Tatlah et al., 2017).

3.2 Cognitive Development

Learners with a Mathematics learning disability may have trouble because of delays in cognitive development. This delay hinders learning and processing of information. This might lead to problems with: understanding relationship between numbers and their operations, for example, addition and subtraction, squares and square roots, fractions and decimals; solving word problems because of having difficulties understanding and interpreting the statements; understanding number systems, for example, the number line; using effective counting strategies (Geary, 1993).

3.3 Spatial Discrimination

Spatial discrimination refers to the ability to accurately perceive objects in space in reference to the other objects (NASET LD report # 3). For example: locating the position of a square among other shapes given in order (□ , ▭ , ○, △), getting the proximity of an object from another, perceiving a glass on top of a table, identifying a rotation or reflection. Learners with spatial difficulties may have some of the following characteristics: (a) Putting decimals in the right place. For example, 3.46 may be written as 34.6; Having difficulty using the number line. (b) Having difficulty discerning differences in size and shape. (c) Having difficulty writing in a straight line across and down the page. For example, 33×42 may be written as 3^3x4^2. (d) Having difficulty copying shapes; for example, > may be written as <, 6 as 9 and 3 as ε. (e) Losing their place on a paper when reading a text (Mercer, 1997).

3.4 Perceptual Figure-ground Discrimination

The term figure here refers to the object a person is focusing on. Figure-ground perception refers to a person's ability to separate an object from its surrounding field. There are two types of figure-ground perceptions: visual figure-ground perception and auditory figure-ground perception.

Visual figure-ground perception (VFGP) refers to the ability to see and distinguish an object from the background field. Learners with problems with visual-ground perception lose focus on the main object and get distracted by whatever else they can see on the background (NASET LD report # 3). They have difficulties such as losing their place on the page and mixing up parts of different problems. They may also experience difficulty reading and using a calculator, differentiating between – and +, × and ÷, copying symbols correctly from the chalkboard to a book or from one book to another or even reading multi-digital numbers and may end up missing on some numbers (Mundia, 2012).

Auditory figure- ground perception (AFGP) refers to the ability to hear a specific sound of one item over the background noise in the environment. Children with the deficit of this are easily distracted by the background noise (conversations, music) and are unable to focus on one sound while ignoring or blocking other sounds. Children with AFGP difficulties experience difficulties doing oral drills or/ and are unable to count on from within a sequence (Mercer, 1997).

4. Assessment and Identification of Learners with Disabilities in Mathematics

Assessment is the gathering of relevant information to help make an informed judgment, identifying strengths and weaknesses so as to make a decision. Assessment of learners with Mathematics disabilities involve collection of information that is relevant in making decisions regarding appropriate goals and objectives, teaching strategies and placement programmes (Learner & Kline 2006). Assessment should be practical and efficient as well as individualized. It goes beyond the administration of a test although a test is an integral part of the assessment process.

Learners are assessed for a different range of reasons such as the following: Motivation, creating learning opportunities, giving feedback (to both learners and teacher), grading and as a quality assurance mechanism (both for internal and external purpose) (Kaplan & Haser, 2019). There are two main types of assessment that will adequately help to identify and place learners with Mathematics learning disabilities. These are: Formal tests and Informal measures.

4.1 Formal Tests

Formal tests usually imply a written document such as a test, a quiz or paper. A formal assessment is usually given a numerical score or grade based on the learner's performance. This assessment may consist of standardized survey tests, group tests and diagnostic Mathematics test. Some are designed for a group administration while others are individually administered. They are based on either a comparison of the learner's present performance with the past or a comparison of the learner's performance with other learners upon which the test was standardized (Kaplan & Haser, 2019).

The formal tests mainly help to determine the learner's level of achievement, general areas of weakness and strength. They can only identify particular areas of weakness to enable the teacher to come up with appropriate individualized strategies. These tests can be either internal (set and marked by the teachers in school) or external (set by a governing body and marked by non-biased personnel such as Kenya National Examinations Council in Kenya).

4.2 Informal Measures

Informal measures of assessment do not necessarily contribute to the learner's final grade. They offer an alternative way to obtaining information about the learner's performance and abilities in Mathematics. They involve examining the learner's daily work samples like homework, practice exercises in class, assignments, class participation, peer and self-evaluation, inventories, rating sales, class discussions and observations of the learner's behavior while working out a Mathematics problem (Jobes & Hawthorne, 2018). The informal measures are essential for frequent monitoring of the learner's progress and making relevant teaching decisions regarding individual learners. This helps remediate the errors and areas of difficulties before they get compounded (Earl, 2003). Through informal measures, a teacher can get such information as: (a) *Prerequisite knowledge*: This refers to the previous knowledge that the learner is bringing to the present task. Is the learner equipped with it or not? How well and quick can the learner recall the previously learnt facts? (b) *Accuracy and completion of ideas*: The extent to which the learner expresses complete and accurate ideas. (c) *Readiness*: What is the learner ready to learn at present based on what he or she has already learnt? and (d) *Strategy*: What type of strategies does the learner employ to solve the given problems?

Depending on how the learner performs in the above areas, then the teacher can come up with the information for basic assessment decisions and placement. Some of the commonly used informal

measures of assessing Mathematics disabilities include: Analysis of Mathematics errors, Informal inventories and Curriculum–Based Assessment (CBA)

5. Guidelines for Conducting Mathematics Error Analysis

To conduct an error analysis, the following guidelines may be employed: (a) selecting tasks for assessment that provide an opportunity for a variety of errors to occur (b) encouraging learners to attempt all the questions and to show all the steps in their working (c) trying to gain insight into the learner's method of solving the problem by noting patterns (d) trying to get as many examples of meaningful errors as possible (e) categorizing the errors or correcting them by content, behavior, condition or thought process (fact, concept, rule or strategy) (f) asking yourself (or the learner) "How did you arrive at this answer?" (g) noting and categorizing skills that were not displayed.

Once the teacher establishes an error pattern, he/she can confirm it by predicting the sort of mistake a learner will make and then giving a specific assessment to see if the pattern occurs (Mercer and Mercer, 2001). This may involve the use of either the informal inventories or a curriculum based assessment.

5.1 Informal Inventories

These are tests that are devised or set by the teacher to assess the learner's skills in Mathematics and are not meant for grading (Jobes & Hawthorne, 2018). They help the teacher to identify the general area of Mathematics difficulty for each learner, after which a more extensive diagnostic test in the particular area can be given. They aim at determining the learner's areas of weaknesses and strengths. From the results obtained, the teacher can come up with appropriate remediation strategies.

5.2 Curriculum- Based Assessment (CBA):

Curriculum Based Assessment ensures that the tasks prepared by the teacher for assessment are in line with what is provided in the Mathematics curriculum at that level. The procedure provides a useful way to measure Mathematics learning and progress, closely linking assessment to the material that is being taught in the Mathematics curriculum (Meese, 2001). CBA begins by assessing an entire class with a survey test of a number of appropriate skills based on the Mathematics curriculum. The results of the survey test are used to make instructional decisions for individual learners otherwise known as Individualized Educational Program (IEP). The steps followed in creating a CBA for the learners are:

a. Identifying target skills: Target skills are identified from the Mathematics curriculum.
b. Determining the objectives to be met: These objectives must be; Specific, Measurable, Achievable, Realistic and Time bound (SMART).
c. Developing test items to sample each skill: This may involve setting of different questions to cover different areas in the syllabus.

d. Developing criteria to measure achievement: This should be specific and measurable.

After preparing the CBA and carrying it out, the results obtained are then used to make appropriate instructional decisions. By use of both the formal tests and informal measures, the teacher is able to assess the learners and identify those that are experiencing Mathematics difficulties and those with disabilities in Mathematics. The most appropriate instructional method(s) for the individual learner are then chosen and implemented. These individualized instructional methods are prepared in form of the IEP (NASET LD report # 3).

6. Individualized Education Programme (IEP)

An IEP is designed to meet the unique educational needs of one learner, who has been assessed and identified to have a disability, in this case a Mathematics learning disability (NASET LD report # 3). These education needs should be met in the least restrictive environment for the learner. It is intended to help learners with disabilities to reach educational goals more easily than they otherwise would. It is tailored to the individual learner's need as identified by the IEP evaluation process and must especially help teachers and related service providers to understand the learner's disability and how the disability affects the learning progress. An IEP is meant to give the learner a chance to participate in a "normal" school program and academics as much as possible and at the same time receiving specialized assistance when it is absolutely necessary. The IEP should describe: How the learner learn, what teachers and service providers will do to help the learner learn more effectively and how the learner best demonstrates the learning given. This enables the learner to enjoy the freedom of interacting with and participating in the activities of his or her more general school peers. After an IEP is developed and appropriate placement is determined, the learner's teachers are responsible for implementing all educational services, program modifications or supports as indicated by the individual education plan. The outcome of the IEP development process is an official document that describes the education plan designed to meet the unique needs of a learner with disability (Meese, 2001).

7. The Case Study

a) Description of Study Population

The study was carried out in a private primary school in Nairobi, Kenya. This school uses the same curriculum employed in Kenyan public schools. The learners involved were class 6 pupils in the school. Class six was a single stream with a total of 35 learners. There was one Mathematics teacher for this class who was a diploma graduate of a teacher's college in Kenya.

b) Objectives of the Study

The study had the following objectives:

- Identifying and analyze the Mathematical errors performed by class six learners in the school

- Assess and identify any Mathematic disabilities among the class six learners in the school
- Prepare and implement an appropriate IEP for the identified learners in the class.

c) ***Study Methods***

i) Identification of Mathematical errors

To help identify the Mathematical errors among the class six learners in the school, both formal and informal measures were used. The Mathematics teacher in conjunction with the researcher prepared diagnostic standardized tests, quizzes, assignments and exercise for the whole class at first and gradually individualized tests. The learners were encouraged to demonstrate their working step-by-step as clearly as they could. From their working, the various Mathematical errors demonstrated in a variety of areas especially computational skills were identified. These errors were then categorized and then analyzed.

ii) Assessing and identifying Mathematic disabilities

A formal internally prepared survey test was first administered to the whole class. The Mathematics teacher and the researcher ensured the survey test and any other test included a variety of skills that were in line with the provisions of the class six curriculum. The CBA steps outlined in section (5.2) were employed. In addition, informal measures were also used. A combination of the formal and informal tests was used to assess and identify both Mathematical learning difficulties and disabilities. The appropriate remediation strategies for the Mathematical learning difficulties were created by the researcher and the Mathematics teacher and implemented by the teacher. For each Mathematics learning disability identified, an IEP was prepared and implemented appropriately.

iii) Application of IEP in the study

Once a learner was assessed and identified as having a Mathematics learning disability, an IEP was prepared by the teacher with the help of the researcher and the appropriate team constituted. The learner's entry behavior was noted and the progress upon implementation of the IEP recorded.

The key factors that were considered in developing an IEP for this study included: (a) assessing learners in all areas connected to the known disabilities (b) concurrently taking into consideration the ability to access the general curriculum (c) taking into account how the disability influences the learner's learning (d) developing goals and objectives that relate to the needs of the learner and (e) choosing a placement setting with the least restrictive environment possible for the learner. The placement was done mainly in the mainstream class and in specialized class only when necessary where a special education teacher was involved.

The IEP team members were: The learner and the learner's parent(s) / guardian(s), a special education teacher (as the case manager), one regular education teacher, the store keeper (a

representative of the school who is familiar with the resources that are available in the school) and the school counsellor (an individual who could interpret the instructional implications of the learner's evaluation results). The school personnel took the lead in ensuring that the IEP included the services that the learner needed.

d) *Study Results*

A number of Mathematical errors, and areas of Mathematical learning difficulties were identified in the areas that were assessed. One case of Mathematics learning disability was also identified among the 35 class six learners in the school. Some of the common Mathematical errors identified are presented below. The Mathematical learning difficulties were remediated accordingly and an IEP was developed and implemented for the Mathematics learning disability case.

i) Mathematical Errors Identified Among the Learners and their Analysis

There were different types of arithmetic errors that were identified among the learners. They include:

1) *Using wrong order of operations*: For example, being unable to apply BODMAS in operations involving integers, fractions and decimals. For example, 4+8(13-10) = 36 The wrong order of operation is used. The correct order in this case should be; brackets first i.e. 13-10=3, then multiplication i.e. 8(3) and then addition 4+24=28.

2) *Reflective Errors*: Errors showing no tendency to serious and careful thought about the tasks given. The response given being out of guess work and full of careless mistakes. In some cases, steps given by the learner in solving the problem were not carefully thought out and some steps were even skipped. Characteristics of reflective errors included: ignoring details of the question given; selecting wrong operations; leaving out facts in the information given; acting without a plan and failure to check the work after doing it.

3) *Obvious Computational Errors*: They included computational error patterns in addition, subtraction, multiplication and division. Here are some examples.

Arithmetic	**Example**	**Possible Explanations**
Addition	34+ 97 = 1211	- no regard for place value and failure to master the concepts of "carrying".
Subtraction	187 – 34 = 1413	- Using regrouping when it is not required
Multiplication	64 × 8 = 632	- Learner's steps: 4×8=32 and 6 is simply dropped

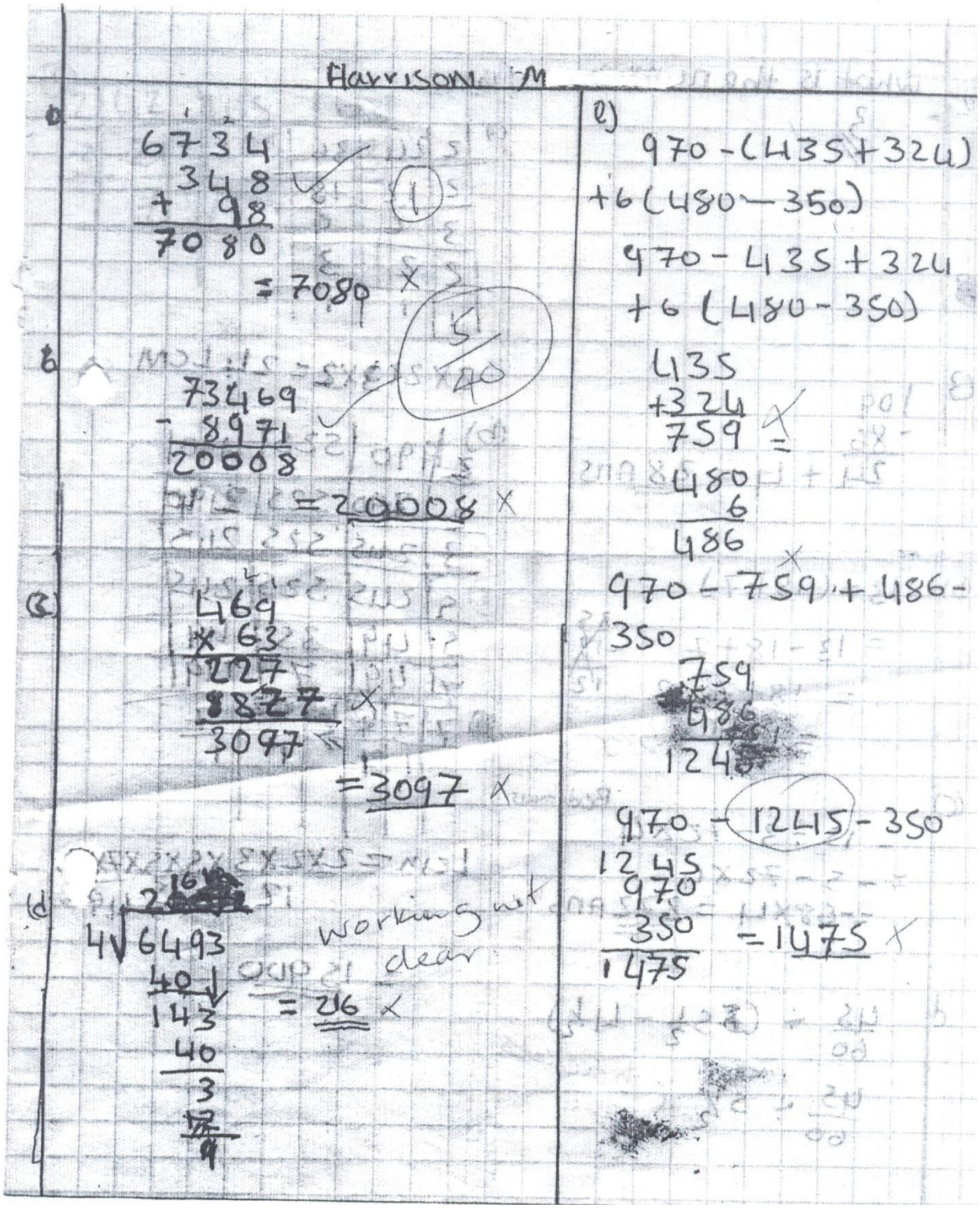
4) *Random Responsive Errors*: These were errors that were often detected in learners' work but could not be pinned down to any particular reason. The answers or responses given could not show much relationship to the question. The learner just gave responses anyhow without much thinking.

Examples	**Possible explanations**
2+6=14	1. Inadequate fact mastery
	2. Failure to apply learned strategies like counting on.
	3. Reversal, the learner interprets 2 as 5 and 6 as 9.
33×14=1245	1. Place value
	2. Has not mastered the concept of "Carrying"
	3. Incorrect alignment of addends.

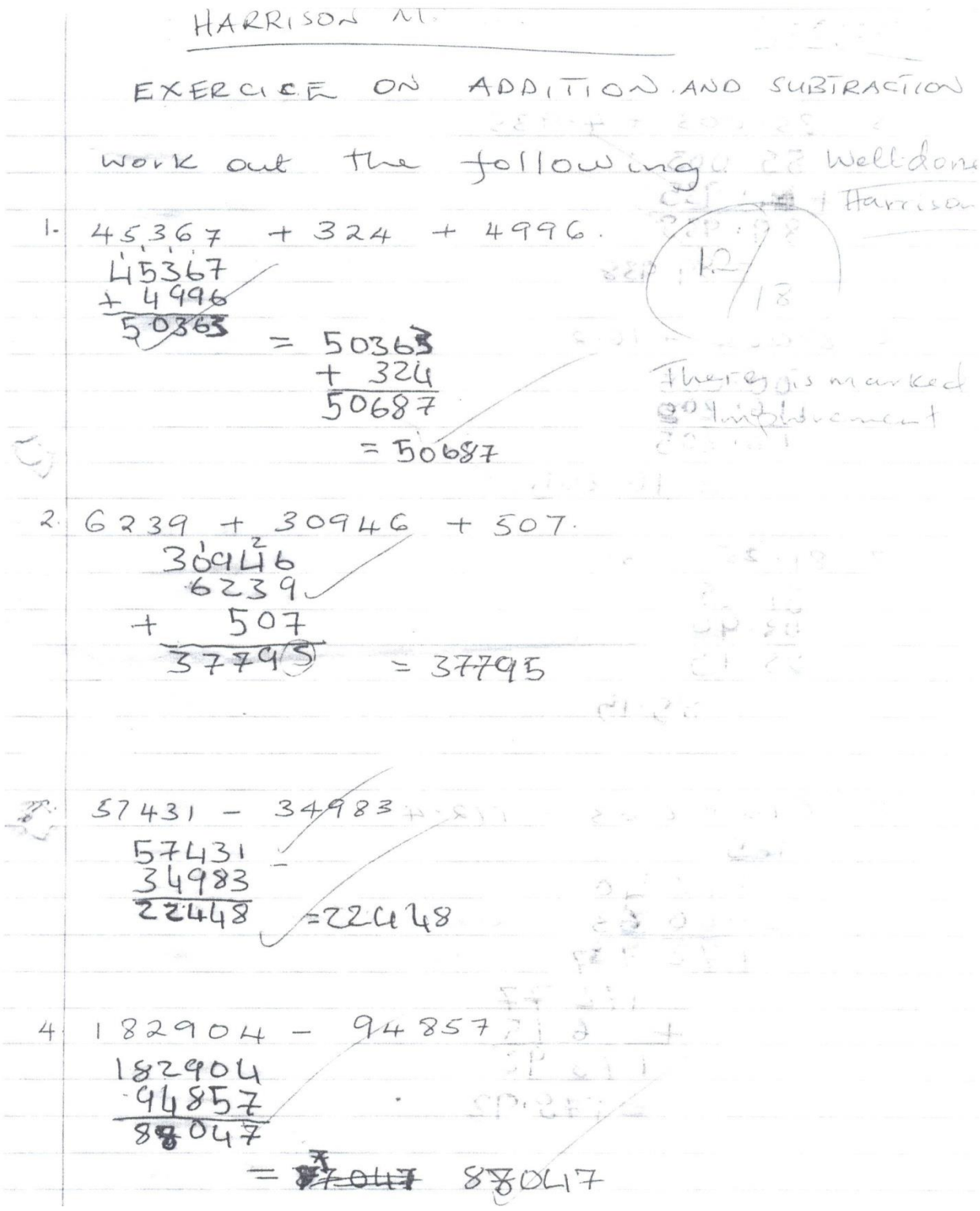
ii) Sampled Work of a Learner with Learning Disabilities

First sample: the learner's work at the start of the IEP. Some of the working and the answers given may not be clearly explained. The name given is not the real name of the learner

concerned.



Second sample: the level attained by the learner after one month of implementation of IEP.


HARRISON M.

EXERCICE ON ADDITION AND SUBTRACTION

Work out the following

Well done Harrison

1. 45367 + 324 + 4996.

45367
+ 4996
50363

= 50363
+ 324
50687

= 50687

12/18

There is marked improvement

2. 6239 + 30946 + 507.

30946
6239
+ 507
37795

= 37795

3. 57431 - 34983

57431
34983
22448

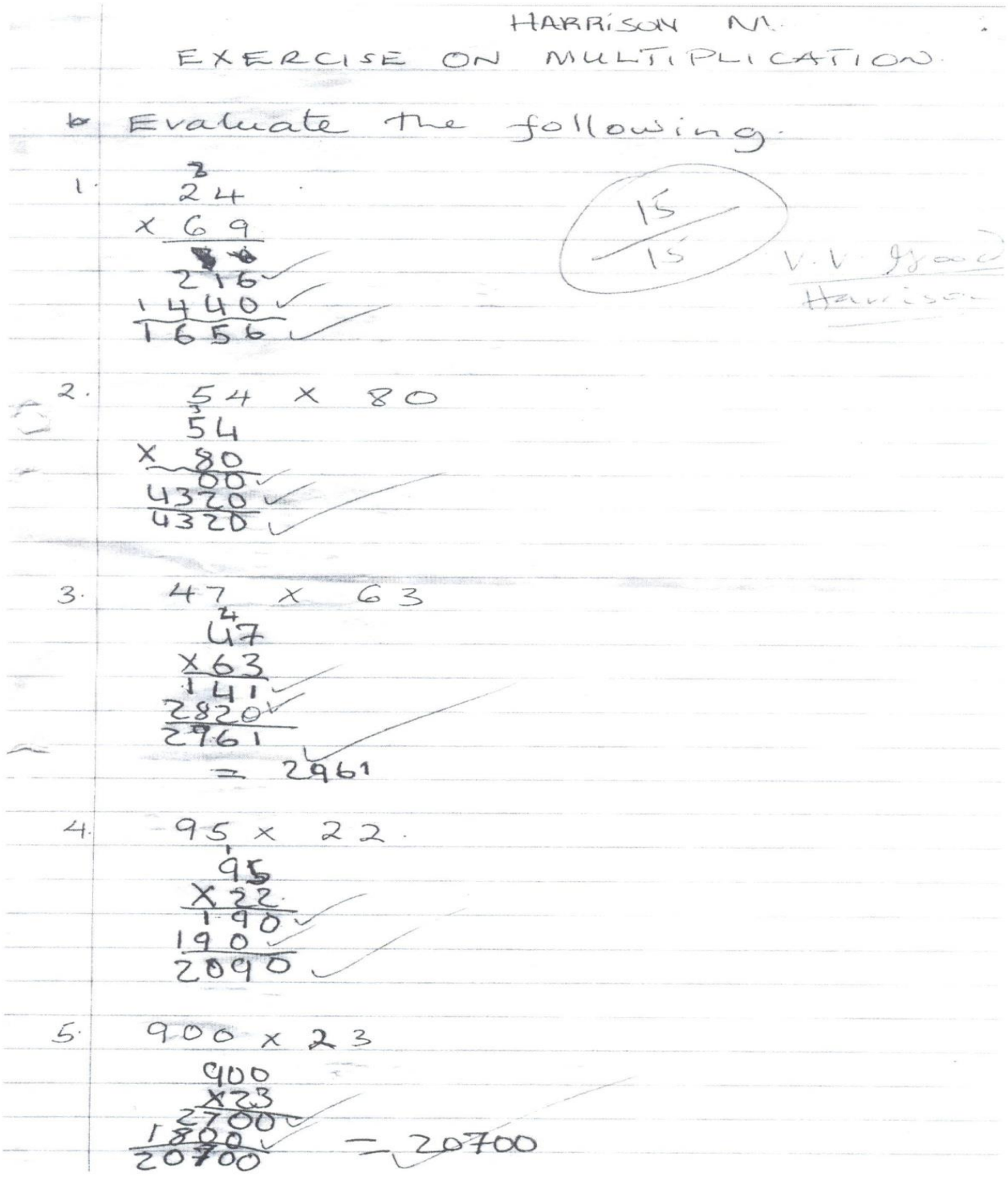
= 22448

4. 182904 - 94857

182904
94857
88047

= ~~87047~~ 88047

Third sample: obtained after two months into the implementation of the IEP.



These results confirm that if the learner's needs and disabilities in Mathematics are identified and the appropriate program prepared and implemented any learner can be helped.

e) Discussion of the Study

There were several computation errors that were identified among the class six learners in the school. These errors and Mathematical learning difficulties are not an isolated case for these learners but similar cases were also reported by Earl (2003). Possible causes may include fear and anxiety that many learners experience during the Mathematics lessons and exams. There was one observed case of Mathematics learning disability in this school. The learner after being taken through the IEP showed marked improvement and was gradually able to fit within the expected Mathematics level according to the curriculum. This observation resonates what was reported by Learner and Kline (2006). It is important for the Mathematics teachers to be trained to identify and handle learners with Mathematics difficulties and disabilities. This may call for review of the policy in the training of the teachers in teacher training colleges. It also calls for consulted effort by Mathematics teachers, parents and guardians, the government and any other stake holder to work towards demystifying Mathematics. Some intervention strategies have been proposed as below.

8. Demystifying Mathematics: Interventions

To demystify Mathematics, the following interventions were proposed by the researcher based on the study outcomes and in reference to Learner & Kline (2006).

I. Teacher-based interventions

It would be pointless for a teacher or an educationist to assess his or her learners' Mathematics disabilities but end up doing nothing about them. After the assessment of the learners using the methods stated above, the teacher needs to come up with interventions or appropriate remediation strategies. Some of these interventions may include:

a. Avoiding introducing new ideas too quickly: When developing a topic, early stages should be given ample time for practice before introducing new ideas and techniques.
b. Ensuring that differing aspects of the content are quickly distinguished: For example, negative sign "-" in the context of integers should be pointed out. Taking -2 for instance, the sign "-" and the digit '2' are part of one complete symbol which represents the integer negative two.
c. Avoiding unnecessary notations that complicate the concepts.
d. Re-explaining the general principles behind the skill introduced. Where necessary, the teacher should go through the steps he or she has taught a number of times for they are to be mastered by the learners. This is necessary especially if the feedback from the exercises given show the concept was not understood.
e. Employing varying methods of teaching and using visual aids as much as possible.
f. Using peer group teaching and group discussions as found necessary.

g. Whenever there is a mistake in the learner's method, it should be pointed out in good time and the correct method demonstrated.
h. Giving feedback to the learners as soon as possible and revising through the exercise for corrections.
i. Demonstrating to the learners how to check correctness of an answer: Building in the learners the practice of checking the accuracy of their work not only at the conclusion of a calculation but also in suitable intermediate points.
j. Modifying the content: Altering the type and amount of information presented to the learners and substituting the content where necessary.
k. Modifying the nature of teacher input: This can be done by repeating or simplifying instructions. For example, the teacher can read the questions instead of telling the learners to read (Reisman & Kuaffman, 1980).
l. Adjusting instructional place or sequence: The teacher can alter the length or frequency of instructional periods: For example, slowing down the rate of presentation or providing more frequent reviews of the tasks.
m. Altering the demand of the task: For example, the teacher can allow the use of calculators or allow the learners to give oral responses rather than written responses.
n. Making new learning meaningful by relating practice of subskills to the performance of the whole task, and by relating what the learner has learned about Mathematical relationships to what the learner will learn about Mathematical relationships.
o. Reducing processing demands by pre-teaching component skills of algorithms and strategies, and by teaching easier knowledge and skills before introducing more complex ones.
p. Ensuring that skills to be practiced can be completed independently with high levels of success.
q. Using computers to aid Mathematics learning: Computer-based tools such as spreadsheets and graphing programs can help learners with disabilities in Mathematics to explore important Mathematical relationships. Computers may aid learning in the following ways: the spreadsheets make it easier for learners to see how numerical relationships change when variables are changed; the spreadsheets can help the learners to learn place values, decimals, making calculations, working with large numbers, Geometry and graphical representations with ease and they can also provide an interesting, motivating environment to the learner by providing visual representation of Mathematical concepts.

II. Government-based interventions

a. Specialization in terms of subjects at Primary Teacher Training Colleges (PTTC): Teacher trainees at PTTC do not specialize in subjects but rather are trained to teach all subjects in the curriculum. Specialization may help train for Mathematics only those trainees who have

excelled and desire to pursue Mathematics. Such teachers will have a positive attitude toward the subject and will propagate the same to their learners.

b. More schools and classes to be put up: The population of pupils in most primary schools per class is above the recommended class size of 40 learners. This has mainly been as a result of shortage of classrooms within the school and the low number of schools within a given location. To reduce congestion in the classes and increase teacher's efficiency in the teaching, more classes need to be put up.
c. Train and employ more teachers: The ratio of learners per teacher is too high for any effective teaching/learning process to occur. Thus, it is important that the government trains and employs enough teachers for the subject.
d. Equip teacher trainees with skills to handle Mathematics disabled children: The teacher trainees need to be equipped with relevant skills to assess and prepare relevant individualized program for the learners with Mathematics disabilities.
e. Review Mathematics syllabus: The Mathematics syllabus may need to be reviewed in such a way that learners will have enough time for practice and application.
f. Book writers to give more practical examples: Those who write Mathematics text books should give examples that equip learners for life time skills and also those that are familiar to them.

III. Parents-based interventions

There is a special place for parents in demystifying Mathematics. They need to:

a. Be patient and supportive of their children, offering help where they can. The parents could follow up on the homework and other tasks given in Mathematics. Many of these children may just require some encouragement and to hear their parents tell them, "You can make it". Generally, they need to be positively involved in their children's walk in Mathematics.
b. Keep open communication with both child and teacher so that they can understand the challenges that their children are going through and get help from the trained teachers who can handle such challenges.
c. Relate problems given with the interest of the child so as to clarify the problem to the child and create interest in the task. The interest could be for example in sports. A parent can create a similar problem, to the one assigned to the child, by relating to the child's favorite sport.
d. Use manipulatives where possible to help the child concretize ideas and the tasks given, especially for the smaller children. Those who can may then help the child to move to semi concrete and then abstract levels.

Conclusion

The paper has highlighted a number of Mathematics difficulties that learners are likely to face while learning Mathematics. It has demonstrated how IEP can be applied in the teaching of

Mathematics to learners with Mathematics learning disability and as the results show, marked improvement in performance is reported. It has emerged that if the right interventions are put in place, the learner with such disabilities can improve and end up performing better in Mathematics and move from being low achiever to high achiever in Mathematics. For this to happen, all stakeholders must be involved: parents, policy makers, curriculum developers, teachers, learners and teacher trainers. When this is done, there is a likelihood that learner's performance in Mathematics in internal and external examinations will improve.

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