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MATHEMATICS LITERACY AS PANACEA FOR SUSTAINABLE DEVELOPMENT GOALS AND ITS MATHEMATICAL MODEL

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Abstract
This paper focuses on mathematics literacy as a panacea for sustainable development goals. In this paper, addition, subtraction, multiplication and division (+,−,×,÷) are identified as the mathematics literacy that will ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. The paper revealed that the basic operation in mathematics is the key to promoting sustained inclusive and sustainable economic growth, full productive employment and decent work for all. However, this study pointed out factors that enhance the teaching and learning of mathematics literacy which in turn improves the student academic performance in mathematics, sciences and all subjects. Such factors are as follows teacher factor: methodology, poor salary, expertise skill, personality quality, lack of in-depth knowledge of the subject matter, teacher and student relationship; family background: marital conflict; environmental factor: school site and facilities; lack of finance, curriculum factor: giving short time to learn basic operations and lack of attention to the concepts multiplication and division; use of calculators at early age (6years old); technological factor: distraction from telephones and computers; student factor: undeveloped intelligent quotient, poor study habit, attitude, peer pressure, hatred for the teacher and subject, laziness, reading mathematics like textbook instead of solving mathematics, misconception "mathematics is difficult", lack of concentration, anxiety, fear, tension, lack of motivation, emotional upset, confusion, resentment, frustration, and stress; students and teachers internal well-being (health); and drug abuse on the side of the teachers and students. This study revealed that when these factors are resolved and utilized adequately, improves the students' academic performance thereby satisfying all the 17 points for sustainable development goals in the life of an individual, society and the world at large. Lastly, four compartmental deterministic systems were developed which consist of the population for addition A(t), subtraction S(t), multiplication M(t) and division D(t) respectively. This study also considered two initial conditions and the total population of individuals that had mathematics literacy skills.

Keywords: Mathematics Literacy, Sustainable development goals, mathematical model

Introduction

Presently, the world is undergoing globalization and mathematics being termed as the mother of sciences is a subject that determines the huge percentage of students' academic performance in all fields of life. Mathematics is the foundation of all professions and it is inevitable in all courses of study. In the world of education environment, students with the knowledge of mathematics skills have half of their academic problems solved. This study considered MATHEMATICS as an acronym which means ‘‘Man’s Ability to Teach and Handle everyday arithmetic in real-life situations with Empathy in order to develop Mental Activity with his Talent to Improve Computation Skills. It is a subject that is applied in man's daily activities to support his survival, and business in the society and world at large. The knowledge of mathematics helps in the development of student's reasoning which makes them fit in the world because everybody solves mathematics either knowingly or unknowingly. Mathematics literacy is as essential as the ability to read and write and goes beyond solving problems associated with mathematics. Mathematics literacy in this context implies the use of the basic operations (+,−, ×, ÷) to solve everyday problems of life. The knowledge of mathematics without its rudiments is like a farmer who goes to the farm without farm implements and products to cultivate on farmland. Mathematics literacy or basic operations is very important in the scholastic environment or society. Students grounded in mathematics literacy fear no problem posed by other

subjects they are studying in life. Mathematics literacy builds students' skills in how to handle and solve problems in mathematics, sciences and also in arts. Computation skills are the process of calculating an answer mentally or by the use of a machine using basic operations. The issue of mathematics is difficult has become a great concern to mathematics teachers and lovers of education in society.

Concept of mathematics literacy

Mathematics Literacy in this context is the four fundamental operations (+, −, ×, ÷) on numbers which are Addition, Subtraction, Multiplication and Division. The study carried out by (Mabbott & Bisanz, 2008) on the knowledge and skill in multiplication for late elementary grade students with Mathematics Learning Disabilities (MLD) resulted in typically achieving age-matched peers, low-achieving aged-matched peers and ability-matched peers by examining multiple measures of computational skill, working memory, and conceptual knowledge. Poor multiplication fact mastery calculation fluency and general working memory discriminated children with MLD from typically achieving aged-matched peers. They also investigated the same study for children with MLD who were slower in executing backup procedures than typically achieving aged-matched peers (Hughes et al., 1999). Their findings showed the performance of children with MLD on multiple measures of multiplication skill and knowledge was most similar to that of ability-matched younger children. MLD may be due to difficulties in computational skills and working memory when improved mathematics literacy leads to a panacea for sustainable development goals for employment for all.

Addition: Addition is the process of bringing together or combining two or more numbers into one number. Adding or summing up any number with zero gives the same number. Addition - is a mathematical operation that represents combining collections of objects into a larger collection. It is signified by the plus sign (+).

Subtraction: Subtraction is the reverse process of addition. Here from a given number we take away a smaller number and find out the remainder. Subtracting zero from any number gives the same number. Subtraction - is one of the four basic arithmetic operations; it is the inverse of addition, meaning that if we start with any number add any number and then subtract the same number we added, we return to the number we started with. Subtraction is denoted by a minus sign (-).

Multiplication: Multiplication is the repeated addition of the same number. In multiplication, any number multiplied by zero gives zero. Multiplication is the mathematical operation of scaling one number by another. It is one of the four basic operations in elementary arithmetic which is denoted by (×).

Division: Division is a repeated process of subtraction of the same number and the remainder is found. The division algorithm is Dividend = quotient × divisor + remainder. Dividing any number by zero is not defined. Division in mathematics especially in elementary arithmetic is the inverse of multiplication and is denoted by (÷).

17 Point sustainable development goals

1. End all forms of poverty everywhere
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained inclusive and sustainable economic growth, full productive employment and decent work for all.
9. Build resilient, infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlements inclusive, safe and resilient and sustainable.
12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts
14. Conserve and sustainably use the oceans, seas, marine resources for sustainable development

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15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage the forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access for justice for all and build effective accountable and inclusive institutions at all levels
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

Mathematical Model Formulation

This study is an opinion paper with a mathematical modeling design. The researcher developed a deterministic four-structured mathematical model of Addition (A(t)), Subtraction (S(t)), Multiplication (M(t)) and Division (D(t)). An SIR-type of model that incorporates mathematics Literacy Skills (MLs(t)) as shown below:

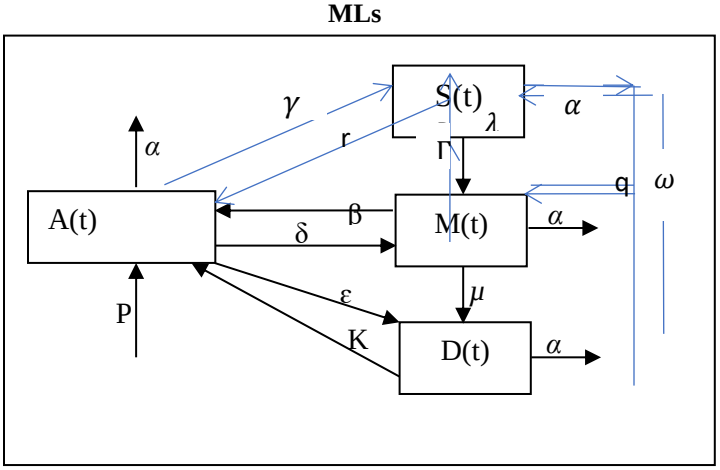

Figure 1: A schematic diagram showing the interactions between the population size of students studying mathematics literacy skills model

Thus, the total population size ML(t) at time t, is given by

$$ML(t) = A(t) + S(t) + M(t) + D(t) \quad (1)$$

From the above schematic diagram, the assumptions were: i). everyone has mathematics literacy skills; ii). Factors such as sex, religion, race social and economic do not affect the operation of mathematics literacy skills; iii). There is a homogeneous mixture of members or population. With the initial conditions $A(0) > 0$, $S(0) > 0$, $M(0) > 0$ and $D(0) > 0$, where A =1, S=1, M =1 and D=1. Thus, the model for this study is given as equations (2) – (5):

$$\frac{dA}{dt} = P - \gamma AS + rS + \beta M - \delta AM - \varepsilon AD + KZ - \alpha A \quad (2)$$

$$\frac{dS}{dt} = \gamma AS - rS + \Gamma M - \lambda MS + \omega D - Sq - \alpha S \quad (3)$$

$$\frac{dM}{dt} = \lambda MS - pM - \beta AM + \delta M - \mu D + fMD - \alpha M, \quad (4)$$

$$\frac{dD}{dt} = \varepsilon AD - KD - fD + \mu M - \omega SD + qD - \alpha D \quad (5)$$

Addition (A(t)), Subtraction (S(t)), Multiplication (M(t)) and Division (D(t)). An SIR-type model that incorporates mathematics Literacy Skills (MLs(t)) as shown below:

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Description of parameters	
MLs(t)	Mathematics Literacy Skills
A(t)	Addition
S(t)	Subtraction
M(t)	Multiplication
D(t)	Division
$\frac{dA}{dt}$	Rate of change in Addition w.r.t. t
$\frac{dS}{dt}$	Rate of change in Subtraction w.r.t. t
$\frac{dM}{dt}$	Rate of change in Multiplication w.r.t. t
$\frac{dD}{dt}$	Rate of change in Division w.r.t. t
P, δ, μ, Γ	Intrinsic growth rate of each population (A, S, M, D)
r, K, γ, q	Intra-population coefficients of A, S, M and D
t	Time
$f, \beta, \lambda, \omega$	Inter-population coefficients of A, S, M and D
α	Rate of leaving any of the populations
P	Rates of entering population A

Table 1 shows dependent, and independent variables and parameter description

Factors that enhance the teaching and learning of mathematics literacy skills

However, mathematics literacy can be traceable to so many factors. The following points are discussed under factors that enhance the teaching and learning of mathematics literacy which in turn improves the students' academic performance in mathematics, sciences and all subjects. When these factors are available and adequately utilized improve the students' academic performance for sustainable development goals in the world at large and in converse militate against the students' academic performances. Such factors are as follows:

Teacher factor: The teacher is the major contributory factor in teaching and learning mathematics literacy and this includes methodology: individual method, summary test, feedback, years of experience and academic qualification, lack of in-depth knowledge of the course, mode of dressing, personality quality, lack of appropriate use of the word, the teacher should carry the students along, poor salary, family background, drug abuse and marital conflict.

Methodology. Mathematics teachers should be able to adopt some methods of teaching mathematics literacy to help the learner become grounded in mathematics for sustainable development. Such methods to be considered in this study are individual methods, summary tests, discovery methods, problem-solving methods etc.

Individual method: The individual method of teaching and learning mathematics literacy by the teacher is a situation whereby the teacher teaches the learners one at a time; which in turn can be called a home lesson (Nkuturum & Moses-Amini, 2020a). Teachers need adequate time to focus on and interact personally with learner and their families. If the teachers are unable to spend time interacting with individual children, the benefits of their expertise will be limited to the learners

(Russell, 2013). By this method, introvert learners study better in solving problems and it brings out the best in them for sustainable development goals. This method is effective in planning for early childhood programs which leads to effective grouping practices or participation in classroom settings and at home. Research indicates that non-graded, mixed-age grouping is particularly appropriate for young learners (Miru, 2013). Within the classroom setting, teachers can use flexible grouping ranging from whole class to small groups to individual work to facilitate learning.

Summary test: The assessment of mathematics literacy could be done by the use of summary test evaluation. This method helps the teacher and learner assess the level of understanding of each concept taught (Nkuturum & Amini-Moses, 2020).

Feedback method: This is a situation whereby the teacher gives the learners some mathematics problems to solve, the teacher marks and makes corrections for the learners to take note and study

more.

Years of experience and qualification: The teachers teaching mathematics are trained teachers who have undergone some series of training with a good number of years to become professionals in the same field of study (mathematics). They have acquired the right skills suitable for teaching and learning mathematics at all levels of education. Years of teaching experience means the equivalent of years in full-time employment which is the term of full-time teaching using a valid teaching certificate (Nkuturum & Amini-Moses, 2020a). Experience does not have to be accumulated through full-time teaching. For example, a teacher who teaches halftime for a full year can accumulate four years over eight school years. The years are not required to be consecutive (Chico & Koch, 2013). Teachers unions and other staff associations have to look into the functional response of a teacher and may be resistant to changes in teachers' hours, schedules, duties, procedures for selection, carrying capacity (number of courses taught per teacher) and hiring as to enable teachers to come up with effective and efficient productivity (Nkuturum, 2018). With this, the assessment of mathematics literacy will be effectively carried out for sustainable development goals. In education, teacher experience is probably the key factor in personnel policies that affect current employees: it is a cornerstone of traditional single salary schedules; it drives teacher transfer policies that prioritize seniority and it is commonly considered a major source of inequity across schools and therefore a target for redistribution. The underlying assumption is that experience promotes effectiveness (Rice, 2012). The years of experience of teachers teaching mathematics has a positive impact on the learners' academic performance and their teacher evaluation which in turn with many innovations promotes such teachers and makes them experts in the field.

Lack of in-depth knowledge of the course: In-depth knowledge here means that mathematics teachers should try as much as they can to study their subject and be versatile in knowledge to withstand fiery doubts wherever they are found. Thus, before entering the class one must be able to understand the mathematics you are about to teach. You need to have a strong level of understanding above your students or some expertise about the topic or concept you will be teaching. Whether the topic is simple or difficult, you still need to understand the concept yourself before teaching it.

Teachers' mode of dressing: Teachers' mode of dressing in general is the term used to include everything put on the body that is meant for the satisfaction of human needs and desires. Here, the teacher is not supposed to dress shabby to work and class during lecture time.

Environmental factor: The environment comprises factors that play important roles in the academic performance of students. This environment which could be physical or socio-physical contributes to students' upbringing before and during school ages. All these environmental factors have a direct or indirect relationship with students' academic performance. School site and facilities: the location of the school and the facilities available in the school also contribute immensely to students' academic performance. For instance, students whose school is located at the up lands devoid of natural disasters like floods, earth quakes, rivers, oceans, war or jihad equipped with all the social amenities and learning facilities are bound to perform excellently well without complaints whereas those found in the reverse location will experience some ups and downs in their academic performance.

Lack of finance: Financial constraints have continued to have an impact on the effective teaching and learning in the life of both teachers and students at different levels say: local, state, federal and the world at large. This factor affects both teachers and students respectively. This could be attributed to debt-situation and ongoing projects at different levels of life. At the macro level, the State has suffered from a heavy debt burden following its pursuit of the World Bank and International Monetary Fund fiscal policies such as the Structural Adjustment Programs. It is reported that these debt-servicing programs are partly responsible for a significant reduction in government funding for subsidized education, health care and school-related expenses (Rice, 2012). The result has been that families bear more responsibilities in sending their children and wards to school at an early stage. Parents and the school community have to meet educational costs in terms of providing teaching and learning resources. This has continued to hurt the quality and effective mathematics literacy of students' academic performance.

Curriculum factor: Curriculum is one of the most important factors that affect students' academic performances which could be negative and positive (Tom, 2004). Curriculum comes into play when the curriculum planners overlook the time frame for a particular content to be covered; thus, giving out a short time for a large content to be covered is always a problem to the learners because it makes them become half-baked learners in that concerned subject area or field of study. The planners should not be given a short time to learn basic operations that are found

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in all disciplines and lack of attention to relevant concepts on the part of both the curriculum planners and teachers should be eschewed because it is cheating on the learners' part.

Technological factor: The world is going global so also the people. Since the inception of computers and mobile telephones, students' rate of concentration in class is near to the ground because they are highly involved daily with the use of these electronic gadgets which in turn keeps them away from studying their books and paying attention to the teacher in class. Thus, some resort to watching pornographic pictures and browsing while learning in class thereby causing distraction from telephones and computers (Nkuturum & Mbah, 2021);
Student factors: undeveloped intelligence quotient, poor study habits, attitude, peer pressure, hatred for the teacher and subject, laziness, reading mathematics like a textbook instead of solving mathematics problems, misconception "mathematics is difficult", learning habit, lack of concentration, anxiety, fear, tension, lack of motivation, emotional upset, confusion, resentment, frustration and stress (Tom, 2004).

Use of calculators at an early age: The use of a calculator at the early stage of a child's development hinders a child's computational skill in the sense that the child now focuses on the use of machines for both large and small numerical calculations and by the time such child is asked to the use of machine you see him failing mathematics assuming that it is difficult to study (Molly, 2013). For instance, the practical occurrence is during the pre-operational period of a child in psychology (Age 2-7 years) this is also called the child's intellectual development. This stage is divided into two that is Pre-conceptual stage (Age: 2-4years) and the Intuitive stage (Age: 4-7years) (Oladele,2004). At this stage, when a child is introduced to the use of a calculator at age 4 years that child finds it difficult to think when posed with mathematics problems because at this stage a child's thinking is irreversible. The child has one way of doing things and solving problems. When a learner learns a task by the use of a machine he gets the results right but without the machine, such a learner fails because the mind is well trained and developed on how to handle computations with his or her brain. This fact is a problem that is difficult for the teacher to correct in the life of learners because mathematics literacy is a predator on a prey which requires attention and quality time to rescue the leaner from the predator of underdevelopment (Nkuturum, 2017; Nkuturum, 2018).

Socio-economic factors for both teachers and students: Malnutrition and ill-health are factors associated with the socio-economic factor. These factors can significantly lead to damage mechanisms of the body tissues and the cognitive processing ability of both teachers and learners (Nkuturum,2018; Oyesanya & Nkuturum, 2019). Children whose processing capacity is impacted by ill health and malnutrition may require more hours of instruction to learn various concepts and skills in mathematics. As such, the mathematics literacy of students under this condition may prove critical, especially for those from low-income families. Socio-economic differences affecting effective mathematics literacy also cut across regions, with some being labelled 'marginalized' or arid and Semi-Arid Lands (Hughes et al., 1999; Nkuturum & Amini-Moses, 2020b). Regional disparities have a significant role in facilitating mathematics literacy in the life of students in early childhood education where enrollment levels in rural and downgraded areas are low in comparison to those in urban areas. Children from marginalized communities in rural Arid and Semi-Arid Lands suffer from a lack of access to early childhood education. One typical example is the nomadic Awara (Wawa) community in Imo State, which is one of the communities experiencing the least access to early childhood education because of their way of life and regional disparities.

Conclusion

Mathematics literacy is as vital as the ability to read and write and goes beyond solving problems associated with mathematics into real-life situations. Mathematics literacy implies the use of the basic operations (+,−, ×, ÷) in solving everyday problems of life. The knowledge of mathematics without its fundamentals is like a farmer who goes to the farm without farm implements and products to cultivate on the farmland. Hence, MATHEMATICS is an acronym for ''Man's Ability to Teach and Handle everyday arithmetic in real-life situations with Empathy to develop Mental Activity with his Talent to Improve Computation Skills which will leverage the world into sustainable development goals. The interaction model of mathematics literacy skills is in line with the model formulation in Nkuturum and Paago (2023), Nkuturum (2017) and Nkuturum (2018) which showed a well-posed model that can be solved both analytically and numerically as to obtain the exact solution, existence and uniqueness of the model solutions with the steady state solution. This same study can be carried out by considering the sex, religion, race social and economic factors. It can also be extended to a homogeneous mixture of members.

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Suggestions

This paper is penned down to help mathematics teachers, students or those who wish to help and coach someone to have a better understanding of mathematics. Whichever way, this article is written to help you be yourself when it comes to teaching and learning mathematics. As someone who has an interest in teaching and learning mathematics, this paper recommends the following:

1. First of all, understand the mathematics concept or topic you are about to teach above your students whether it is simple or difficult before teaching it.
2. Teach the contents in bits to suit the learner's carrying capacity and administer a summary test at the end of each objective. You must not teach all at the same time because it is overloading.
3. Teachers should know that understanding comes when a learner knows "how, why and when" the procedure or process is applied.
4. Curriculum planners should allocate enough time (say one term – two terms) to mathematics literacy.

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