Mathematics Letters
2024, Vol. 10, No. 2, pp. 12-18
https://doi.org/10.11648/j.ml.20241002.11

Research Article

Investigation and Analysis on the Interactions Between Mathematics Literacy Skills Using Mathematical Modeling

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Abstract

This study investigated and analyzed the interactions between mathematics literacy skills using mathematical modeling. The study used an ASMD model to represent the population of individuals who have skills on addition (A), subtraction (S), multiplication (M) and division (D). The objectives achieved were that the recruitment parameter and coefficient of leaving any compartments significantly influence the system based on the free-equilibrium analysis of mathematics literacy skills. The study showed that system has direct and indirect dynamics in the three states: subtraction, multiplication and division. It also revealed that addition skill is easier to learn than others. Subtraction and multiplication do not interact and have no inter coefficient. The system showcased that good number of individuals are not efficient and effective in the utilization of these skills from the endemic equilibrium of the model showed that $E_n>1$ (asymptotically unstable). Finally, this study discovered that these elementary skills in mathematics is fundamental to learners, educated and uneducated, support continued inclusive, workable economic growth, full creative employment, decent work and improve academic performance for all at all levels and in the world at large. The study recommends that curriculum planners should give more time to study these skills thoroughly say one academic session, discourage the use of calculator at early stage, student and teacher factors should be taken into considerations and so on.

Keywords

Mathematics Literacy Skills, Mathematical Model, Equilibrium Analysis, Effective Usage Number

1. Introduction

Mathematics literacy skills are the concrete of all subjects and discipline. Globally, it is used by every individual in daily activities and living. In the academic environment, students with the knowledge of mathematics skills have their academic glitches solved [8]. Mathematics knowledge widens students' academic performance in all fields of life. Mathematics literacy is the vital ability to read and write and solve mathematics problem. This study considered the mathematics operations such as Addition (+), Subtraction (–), Multiplication (×) and Division (÷) used in solving everyday problem 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 in farm land. Mathematics literacy is very imperative in the scholastic environment or society [5]. However, [10, 11] studied mathematical literacy as the 21st century skill. In their study, they stated

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Received: 18 July 2024; **Accepted:** 8 August 2024; **Published:** 27 August 2024

that it is important for each individual to know and understand the role of mathematics in real life so that the individual is able to appropriately evaluate and consider the use of mathematics for meeting the needs of being a society member who is constructive, caring, and willing to think. This skill is called mathematical literacy skill. Their work also reviewed seven articles which focus on what competencies indicate that students have mathematical literacy. The competencies consist of mathematical thinking and reasoning, mathematical argumentation, mathematical communication, modelling, problem posing and solving, representation, symbols, and tools and technology. This article aims to describe the mathematical literacy importance to other researchers, teachers, or preservice mathematics teachers on in researches or mathematics learning processes. Based on some earlier studies, the modern society in this century not only requires content knowledge, but also requires skills including critical thinking, problem solving, creativity, innovation, communication, collaboration, flexibility, adaptability, initiative, self-diversion, social, cross culture, productivity and accountability, leadership and responsibility, and information literacy [2, 12, 14]. Mathematical literacy is one of the components needed to construct the 21st century skills. However, [4] argued that the teaching of Mathematical Literacy should focus on the development of key mathematical and statistical skills.

Mathematical literacy is relatively unfamiliar to some people. Previous researches revealed that mathematical literacy is still foreign to some societies, yet it is important for the society in the 21st century [1]. Mathematical literacy is still a major challenge in basic mathematics education and it is a key issue and a trend in mathematics education researches [4]. This is because a person must be able to prepare his role as a subject who studies independently for his or her whole life [13] and to solve real world problem that requires him to use the skills and competencies acquired through experiences in schools and daily lives. The fundamental process on this is called mathematization, a process which makes the students shift from the real world context to the mathematics context and it is required to solve problems. Mathematization enables students to interpret and evaluate problems, then to reflect the solution to believe that the discovered solution matches the real situation of the problem.

Therefore, the unfamiliarity of mathematical literacy must be finished soon and the community must know and master the competencies in mathematical literacy to deal with daily problems. This literacy is an important issue that needs to be discussed. Based on the description, this article describes what competencies indicate that students have mathematical literacy which include mathematical thinking and reasoning, mathematical argumentation, mathematical communication, modelling, problem posing and solving, representation, symbols, and tools and technology [5, 6]. Above all, this study identified the inability of individuals to use and operate with addition, subtraction, multiplication and division skills efficiently as a societal and global problem that must be put together as to clear the doubt about mathematics.

2. Methodology

2.1. Model Formulation

Mathematics literacy skills in this study are considered to be a diffusing disease. Hence the literacy skills model is an epidemic model with interaction coefficients in each compartment or state which also serves as is the building block of the bio and ecosystem as biomasses are grown out of their resource masses [7, 8]. The interactions of the literacy skills are shown in figure 1. Thus, a mathematical model was formulated and the population was divided into four major compartments as shown in the model diagram below.

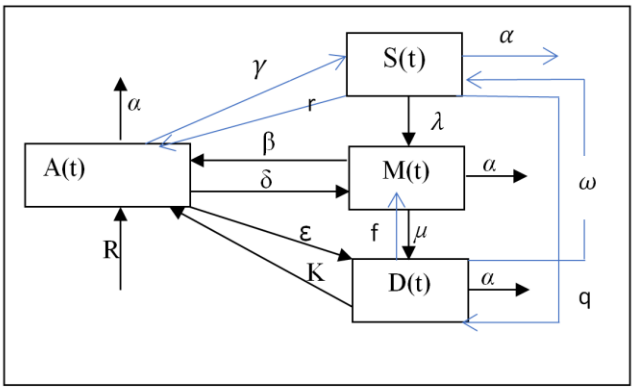

Figure 1. A model or schematic diagram showing the interactions between mathematics literacy skills (Adopted from [6]).

The total population of mathematics literacy skills at time t, is denoted by ML(t) is subdivided into four mutually exclusive compartments of individuals with addition skill (A(t)); individuals with subtraction skill (S(t)); individuals with multiplication skill (M(t)) and individuals with division skill (D(t)) respectively. So that the total population becomes

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

Mathematics literacy skills interaction in the population is modeled using a standard incidence function. From the above schematic diagram, the assumptions were: i). everyone has mathematics literacy skills especially addition; ii). Factors such as age, sex, religion, race, social and economic do not affect the operation of mathematics literacy skills; iii). There is homogeneous mixture of members or population. iv). Total population is 100% with $A = 0.55, S = 0.20, M = 0.15 \text{ and } D = 0.10$. With the initial conditions and positive properties of the solutions of equations (2 – 5) below as $A(0) \geq 0$, $S(0) \geq 0$, $M(0) \geq 0$ and $D(0) \geq 0$, where $A = S = M = D = 1$. Then, possible region $\Omega = \left\{(A, S, M, D) \in R^4 : A + S + M + D \leq \frac{R}{\alpha}\right\}$, positively invariant set for the system (2 – 5). Thus, the model for this study is given as:

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

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

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

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

Table 1. *Showing the description of variables and parameters.*

Dependent variables	Description	Values
A(t)	Population of individuals for Addition skill with respect to time	0.55
S(t)	Population of individuals for Subtraction skill with respect to time	0.20
M(t)	Population of individuals for Multiplication skill with respect to time	0.15
D(t)	Population of individuals for Division skill with respect to time	0.10
T	Time independent variable	In Minutes
R	Recruitment rate or rate of entering A	0.5
α	Rate of leaving any of the three compartments through other means	0.6
γ	Transmission rate from A to S	0.9
r	Transmission rate from S to A	0.1
B	Transmission rate from M to A	0.09
δ	Transmission rate from A to M	0.6
ϵ	Transmission rate from A to D	0.7
K	Transmission rate from D to A	0.4
Q	Transmission rate from S to D	0.135
F	Transmission rate from D to M	0.5
λ	Transmission rate from S to M	0.0045
ω	Transmission rate from D to S	0.25
μ	Transmission rate from M to D	0.2

$$\frac{dN}{dt} = R - \alpha A - \alpha S - \alpha M - \alpha D \leq R - \alpha N \quad (6)$$

So that, $lim_{t\to\infty} \sup N(t) \leq \frac{R}{\alpha}$, (This is in conformity with the region of the system (1–5) given by the set Ω).

2.2. Model Analysis

2.2.1. Mathematics Literacy Skills Equilibrium and Effective Usage Number

This study considered mathematics literacy skills – equilibrium free, $E_f = \left(\frac{R}{\alpha}, 0, 0, 0\right)$, this showed that addition is always used by every individual. Taking the Jacobian matrix to analyze the stability of mathematics literacy skills free equilibrium from the system of ODE's (2-5) gives,

$$J(E_0) = \begin{bmatrix} -\alpha & -\gamma + r & -\delta + \beta & \epsilon + K \\ 0 & \gamma - r - \lambda - q - \alpha & 0 & 0 \\ 0 & 0 & \delta - \alpha & 0 \\ \epsilon & 0 & 0 & q - K - f - \alpha \end{bmatrix} \quad (7)$$

The local stability of the mathematics literacy skills-free equilibrium could be determined from the Jacobian matrix (7). From the characteristic equation of *J (A, 0, 0, 0)*, the following eigenvalues were obtained: $\psi_1 = -\alpha$, $\psi_2 = \gamma - r - \lambda - q - \alpha$, $\psi_3 = \delta - \alpha$ and $\psi_4 = q - K - f - \alpha$. ψ_1 is real and negative. since $E_n < 1$, this means that $\gamma < r + \lambda + q + \alpha$, $\delta = \alpha$ and $q < K + f + \alpha$, thus, ψ_2, ψ_3, $\psi_4$are also real and negative. This implies that the system of equations (2) to (5) is asymptotically stable.

The effective usage number E_n, is given by

$$E_n = \frac{q}{K + f + \alpha} \quad (8)$$

Theorem 2.1: The mathematics literacy skills-free equilibrium $E_f = \left(\frac{R}{\alpha}, 0, 0, 0\right)$ of (2 – 5) is asymptotically stable if $E_n < 1$ and unstable if $E_n > 1$.

2.2.2. Endemic Equilibrium

Estimating the equilibrium points of equations (2-5) by equating zero gives:

$$A^* = \frac{r + q + \alpha}{\gamma} = X$$

$$D^* = \frac{1}{(f - \mu)}\left(\beta\frac{r + q + \alpha}{\gamma} - \delta + \alpha\right) = Y$$

$$M^* = \frac{1}{\mu(f - \mu)}\left(\beta\frac{r + q + \alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r + q + \alpha)}{\gamma}\right\} = Z$$

$$S^* = (q+\alpha)R + (q+\alpha)\frac{(\beta-\delta)(r+q+\alpha)}{\mu(f-\mu)\gamma}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r+q+\alpha)}{\gamma}\right\} + \frac{(q+\alpha)}{(f-\mu)}\left\{\frac{\beta r+q+\alpha}{\gamma} - \delta + \alpha\right\}\left(K - \frac{\epsilon(r+q+\alpha)}{\gamma}\right) - \frac{\alpha(r+q+\alpha)(q+\alpha)}{\gamma} = P \tag{9}$$

For the case of $E_n > 1$. At the endemic equilibrium, all the four skills are present in the population. The steady states consider conditions under which all four skills can coexist in the equilibrium. Let $E^* = (A^*, S^*, M^*, D^*)$ as endemic equilibrium of the system (2 - 5) and $(A^* \neq 0, S^* \neq 0, M^* \neq 0, D^* \neq 0)$. From (7), let $A^* = X$, $S^* = Y$, $M^* = Z$, $D^* = P$. Substituting the values of the equilibrium points in (7) into equation (9) yields.

$$J(E^*) = \begin{bmatrix} -\alpha & -\gamma Y + r & -\delta Z + \beta & -\epsilon P + K \\ 0 & \gamma X - r - \lambda Z - q - \alpha & 0 & 0 \\ 0 & 0 & \delta - \alpha & 0 \\ \epsilon & 0 & 0 & q - K - fZ - \alpha \end{bmatrix} \tag{10}$$

Let

$$A_{11} = -\alpha,\ A_{12} = \frac{1}{(f-\mu)}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\gamma + r,\ A_{13} = \frac{-\delta}{\mu(f-\mu)}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r+q+\alpha)}{\gamma}\right\} + \beta,$$

$$A_{14} = \epsilon(q+\alpha)R + \epsilon(q+\alpha)\frac{(\beta-\delta)(r+q+\alpha)}{\mu(f-\mu)\gamma}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r+q+\alpha)}{\gamma}\right\} + \frac{\epsilon(q+\alpha)}{(f-\mu)}\left\{\frac{\beta r+q+\alpha}{\gamma} - \delta + \alpha\right\}\left(K - \frac{\epsilon(r+q+\alpha)}{\gamma}\right) - \frac{\epsilon\alpha(r+q+\alpha)(q+\alpha)}{\gamma} + K$$

$$A_{21} = 0,\ A_{22} = (r+q+\alpha) - r - \frac{\lambda}{\mu(f-\mu)}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r+q+\alpha)}{\gamma}\right\} - q - \alpha,$$

$$A_{23} = 0,\ A_{24} = 0,\ A_{31} = 0,\ A_{32} = 0,\ A_{33} = \delta - \alpha,\ A_{34} = 0,\ A_{41} = \epsilon,\ A_{42} = 0,\ A_{43} = 0,$$

$$A_{44} = q - \alpha - K - \frac{f}{\mu(f-\mu)}\left(\beta\frac{r+q+\alpha}{\gamma} - \delta + \alpha\right)\left\{K + f + \alpha - q - \frac{\epsilon(r+q+\alpha)}{\gamma}\right\}$$

putting A_{ij} into (7), the characteristic equation becomes

$$|J(E^*) - \lambda I| = \begin{vmatrix} A_{11}-\lambda & A_{12} & A_{13} & A_{14} \\ A_{21} & A_{22}-\lambda & A_{23} & A_{24} \\ A_{31} & A_{32} & A_{33}-\lambda & A_{34} \\ A_{41} & A_{42} & A_{43} & A_{44}-\lambda \end{vmatrix} = 0$$

$$\begin{pmatrix} A_{11}-\lambda & A_{12} \\ A_{21} & A_{22}-\lambda \end{pmatrix}\begin{pmatrix} A_{33}-\lambda & A_{34} \\ A_{43} & A_{44}-\lambda \end{pmatrix} - \begin{pmatrix} A_{31} & A_{32} \\ A_{41} & A_{42} \end{pmatrix}\begin{pmatrix} A_{13} & A_{14} \\ A_{23} & A_{24} \end{pmatrix}$$

$$=(A_{11}A_{22} - A_{11}\lambda - A_{22}\lambda + \lambda^2 - A_{12}A_{21})(A_{33}A_{44} - A_{33}\lambda - A_{44}\lambda + \lambda^2 - A_{34}A_{43}) - (A_{31}A_{42} - A_{32}A_{41})(A_{13}A_{24} - A_{14}A_{23})$$

$$= A_{11}A_{22}A_{33}A_{44} - A_{11}A_{22}A_{33}\lambda - A_{11}A_{22}A_{44}\lambda + A_{11}A_{22}\lambda^2 - A_{11}A_{22}A_{34}A_{43} - A_{11}A_{33}A_{44}\lambda + A_{11}A_{33}\lambda^2 + A_{11}A_{44}\lambda^2 - A_{11}\lambda^3 + A_{11}A_{34}A_{43}\lambda - A_{22}A_{33}A_{44}\lambda + A_{22}A_{33}\lambda^2 + A_{22}A_{44}\lambda^2 - A_{22}\lambda^3 + A_{22}A_{34}A_{43} + A_{33}A_{44}\lambda^2 - A_{33}\lambda^3 - A_{44}\lambda^3 + \lambda^4 - A_{34}A_{43}\lambda^2 - A_{12}A_{21}A_{33}A_{44} + A_{12}A_{21}A_{33}\lambda + A_{12}A_{21}A_{44}\lambda - A_{12}A_{21}\lambda^2 + A_{12}A_{21}A_{32}A_{43} - A_{13}A_{24}A_{31}A_{42} + A_{14}A_{23}A_{31}A_{42} + A_{14}A_{23}A_{32}A_{41} - A_{14}A_{23}A_{32}A_{41}$$

$$= \lambda^4 - (A_{11} + A_{22} + A_{33} + A_{44})\lambda^3 + (A_{11}A_{22} + A_{11}A_{33} + A_{11}A_{44} + A_{22}A_{33} + A_{22}A_{44} + A_{33}A_{44} - A_{34}A_{43} - A_{12}A_{21})\lambda^2 - (A_{11}A_{22}A_{33} + A_{11}A_{22}A_{44} + A_{11}A_{22}A_{44} + A_{11}A_{33}A_{44} - A_{11}A_{34}A_{43} + A_{22}A_{33}A_{44} - A_{12}A_{21}A_{33} - A_{12}A_{21}A_{44})\lambda + (A_{11}A_{22}A_{33}A_{44} - A_{11}A_{22}A_{34}A_{43} + A_{22}A_{34}A_{43} - A_{12}A_{21}A_{33}A_{44} + A_{12}A_{21}A_{32}A_{43} - A_{13}A_{24}A_{31}A_{42} + A_{14}A_{23}A_{31}A_{42} + A_{14}A_{23}A_{32}A_{41} - A_{14}A_{23}A_{32}A_{41})$$

put

$$B_1 = A_{11} + A_{22} + A_{33} + A_{44}$$

$$B_2 = A_{11}A_{22} + A_{11}A_{33} + A_{11}A_{44} + A_{22}A_{33} + A_{22}A_{44} + A_{33}A_{44} - A_{34}A_{43} - A_{12}A_{21}$$

$$B_3 = A_{11}A_{22}A_{33} + A_{11}A_{22}A_{44} + A_{11}A_{22}A_{44} + A_{11}A_{33}A_{44} - A_{11}A_{34}A_{43} + A_{22}A_{33}A_{44} - A_{12}A_{21}A_{33} - A_{12}A_{21}A_{44}$$

$$B_4 = A_{11}A_{22}A_{33}A_{44} - A_{11}A_{22}A_{34}A_{43} + A_{22}A_{34}A_{43} - A_{12}A_{21}A_{33}A_{44} + A_{12}A_{21}A_{32}A_{43} - A_{13}A_{24}A_{31}A_{42} + A_{14}A_{23}A_{31}A_{42} + A_{14}A_{23}A_{32}A_{41} - A_{14}A_{23}A_{32}A_{41}$$

So that the characteristic equation becomes

$$\lambda^4 - B_1\lambda^3 + B_2\lambda^2 - B_3\lambda + B_4 = 0 \quad (11)$$

By Routh – Hurwitz criterion. It showed that all eigenvalues of the characteristic equation (11) has negative real part if and only if:

$$B_1 > 0,\ B_2 > 0,\ B_4 > 0,\ B_1B_2B_3 - B_4 > 0 \quad (12)$$

Theorem 2.2: E^* is asymptotically stable if and only if the inequalities (12) is satisfied.

2.2.3. Global Stability of the Equilibrium Points

(i). Global Stability of the Mathematics Literacy Skills Free Equilibrium Free, E_f

This study proves the global stability when $\varepsilon \le \alpha$.

Theorem 2.3: The global stability E_f is asymptotically stable in the region

$$\Omega = \left\{(A,S,M,D) \in R^4 : A + S + M + D \le \frac{R}{\alpha}\right\} \text{ if } \varepsilon \le \alpha \text{ (note that } \varepsilon \le \alpha \text{ implies } E_n < 1).$$

Proof: It should be noted that A < 1 in Ω for time *(t)* >1. Consider the Lyaponov function, L:$L = S + M + D$

$$\frac{dL}{dt} = (\gamma A - r - q - \alpha)S + (\delta - \beta A + f - \alpha)M + (\varepsilon A - K - f + q)D$$

$$\le (\gamma A - r - q - \alpha)S + (\delta - \beta A + f - \alpha)M + (\varepsilon A - K - f + q)D \quad (13)$$

$\frac{dL}{dt} < 0$ For $\varepsilon \le \alpha$ and $\frac{dL}{dt} = 0$ only if $S = 0, M = 0$ and $D = 0$. Therefore, the only trajectory of the system in which $\frac{dL}{dt} = 0$ is E_f. Hence, Lasalle's invariance principle, E_f is globally asymptotically stable in Ω [1].

(ii). Global Stability of the Endemic Equilibrium (E^*)

To determine the global stability of the endemic equilibrium, the first and third equations of the system (2)-(5) were considered. That in the region $\Omega^* = \{(A,D) \in R^2 : A + D \le I, A > 0, D > 0\}$. Then, Ω^* is positively invariant, that is, every solution of the model (2 – 5), with initial conditions in Ω^* remains there for time, $(t > 0)$. Considering $\Omega^{**} = \left\{(A,D): A + D\left[\frac{\alpha+k+f-q}{\alpha}\right] = 1, A > 0, D > 0\right\}$ where $\Omega^{**} \subset \Omega^*$ and Ω^{**} is positively invariant, $E^* \in \Omega^*$ and $R = \varepsilon$.

Theorem 2.4: The endemic equilibrium point E* of model (2 – 5) is globally asymptotically stable if $E_n > 1$, (This means that $K \le \varepsilon$).

Proof: From theorem 2.1, if $E_n > 1$ in Ω^{**}, then E_n is unstable. Also Ω^{**} is positively invariant subset of Ω^* and the ϑ –limit set of each solution of model (11) is a single point in Ω^{**} since there is periodic solutions, loops and oriented phase polygons inside Ω^{**} if $K \ge \varepsilon$. Then, E* is globally asymptotically unstable [3, 9].

3. Results of the Research

i). Mathematics literacy skills-free equilibrium E_f is asymptotically stable if $E_n < 1$ and unstable if $E_n > 1$. Stable implies that only addition operation is well mastered and used by every individual globally while unstable means that few individual can cope with subtraction, multiplication and division operations or skills. The endemic equilibrium showed that $E_n = \frac{q}{K+f+\alpha} = 1.125 \rightrightarrows E_n > 1$ which implies unstable system.

ii). The recruitment parameter P and coefficient of leaving any compartments,α significantly influence the system based on the equilibrium analysis of mathematics literacy skills free– equilibrium, $E_f = \left(\frac{R}{\alpha}, 0, 0, 0\right)$.

iii). Amongst all the skills, it was observed that the addition skill is easy to learn than others.

iv). The system has direct and indirect dynamics.

The study explored the nature of the model by conducting sensitivity analysis of the effective usage number (E_n).

(a) The effective usage number E_n, is given by $E_n = \frac{q}{K+f+\alpha}$ at mathematics literacy skills free equilibrium $q = 0.135, f = 0.6, K = 0.4$ and $\alpha = 0.5, E_n = 0.09 < 1$. If the value of q remains and the values of K, f and α are increased $E_n > 1$.

(b) At the endemic equilibrium, $q = 0.135, f = 0.02, K = 0.04$ and $\alpha = 0.06$, $E_n = 1.125 > 1$. If q is reduced to 0.35 while α, K and f are maintained, $E_n < 1$.

4. Discussion and Interpretation of Results

The study adopted a four-compartmental model (ASMD) to study the interactions between mathematics literacy skills as an endemic because of its wide spreading nature. The existence and stability of mathematics literacy skills-free and endemic equilibria and the sensitivity analysis of the effective usage number were discussed. From the data in Table 1, the effective usage number of mathematics literacy skills free equilibrium was estimated to be $E_n = 1.125 > 1$. This implies that population for addition is the only one that is normally distributed while others reduces to zero from equilibrium free $E_f = \left(\frac{R}{\alpha}, 0, 0, 0\right)$ given that S= 0, M = 0 and D= 0 respectively. These also determine massive influx and outflow of individuals and effective utilization number which enhances the system significantly.

The system is asymptotically unstable because $E_n > 1$ and satisfied theorem 2.1. The findings depicts that the rate of utilization is 25% that at some time, t there would be withdrawal from learning directly or indirectly. These results also showcased that the knowledge of curriculum experts about mathematics literacy in line with government policies are not properly implemented. These results conform to [4, 5, 8, 13] on the study mathematical model of predator-prey relationship with human disturbance and skilling fishery management which showed that at time, t one of the species would go extinction while the other recuperate making the system unstable.

5. Conclusion

The model shows that mathematics literacy skills epidemic should be given serious attention at all levels of education from primary, secondary and tertiary schools as to reduce the rate of poor performance at school. This study will help mathematics teachers, learners to enhance the understanding of mathematics literacy skills by spending time to impart knowledge. Hence, this paper recommends that curriculum planner should give more time to teaching and learning the concept of mathematics literacy skills, trained teachers of mathematics should teach the learners effectively and efficiently from simple to difficult concepts and mathematics teachers should not look down on mathematics literacy skills as been simple to learn.

Abbreviations

ASMD	Adition, Subtraction, Multiplication and Division
En	Effective Usage Number

Author Contributions

Nkuturum Christiana: Conceptualization, Formal Analysis, Methodology, Writing – original draft

Nwagor Peters: Conceptualization, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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