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A Preliminary investigation of the definition and indicators of Acute Innumeracy Dependence Syndrome (AIDS) among Nigerian Senior High School Students

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Abstract

Innumeracy is pervasive in the world population. Arresting innumeracy through promoting numerical literacy and enhancing basic mathematical skills can aid students to develop a solid foundation for appreciating and comprehending mathematics. Meanwhile, some high school students detest mathematics due to their unpleasant feeling towards it orchestrated by their teachers. This study clarified the definition of acute innumeracy dependence syndrome (AIDS) and developed its indicators. The participants were nine grade 12 students at one senior high school in Lagos, Nigeria. Descriptive qualitative research with a phenomenological approach was adopted and data collected using semi-structured interviews were thematically analysed. Results showed that there were six indicators of AIDS: (1) unpleasant feelings towards mathematics over a prolonged period of time; (2) calculator dependence when solving simple calculation in mathematics to the detriment of mental calculation; (3) difficulty with mental mathematics and estimations; (4) struggle with basic mathematical concepts, such as fractions or percentages; (5) avoidance of mathematical tasks or problems; and (6) decreased confidence in mathematical abilities. The proposed definition of AIDS is a debilitating condition developed from negative past experiences orchestrated by calculator dependence when solving simple calculation in mathematics, difficulty with mental mathematics, struggle with basic mathematical concepts, avoidance of mathematical tasks, and decreased confidence in mathematical abilities. Thus, mathematics teachers must work assiduously to lessen the effects and consequences of AIDS among the students. Students with little or no symptoms of AIDS will realise, like and appreciate the usefulness and beauty of mathematics in real-life contexts.

Keywords: Acute innumeracy dependence syndrome, Mathematics, High school, Student, Phenomenology

Introduction

The term numeracy refers to the individuals' ability to comprehend and work assiduously with numbers, considering numerical concepts, arithmetic operations, and analysis of data. Numeracy is used to connote quantitative literacy (Awofala & Anyikwa, 2014) which involves basic arithmetic of decimals, fractions, division, multiplication, subtraction and addition; numerical concepts of magnitudes, estimates, proportions, ratios and percentages; data analysis of interpreting statistics, tables, charts, and graphs; and problem-solving leading to the application of numerical skills to real-life situations. In practical terms, numeracy is very vital in everyday life affecting career opportunities in industries (Awofala & Lawal, 2022), data-driven decision-making for informed choices in life, citizenship and work (Awofala & Lawal, 2022), health literacy in comprehending medical statistics, research and risks (Center for Disease Control and Prevention, 2023; Sopekan & Awofala, 2019) and personal finance of managing debt, investing and budgeting (Kenton, Boyle, & Velasquez, 2024; Awofala & Lawal, 2022). Numeracy can be cultivated by embracing a growth mindset (Awofala & Akinoso, 2024); seeking resources, like mathematics classes and online tutorial in mathematics (Awofala, Olafare, Awofala, Ojo, Fatade, Arigbabu, & Udeani, 2021; Lawal & Awofala, 2020); developing data analysis skills through statistics and visualisations (Wickramasinghe, 2024); engaging with real-life applications, like health or finance (Awofala, Arigbabu & Fatade, 2019); and practicing basic numerical and arithmetic concepts (Awofala & Anyikwa, 2014). Its cultivation is not in the absence of persistence, patience and constant practice. Research has shown that many people worldwide are not numerate (Bruine de Bruin, & Slovic, 2021; Awofala, Arigbabu & Fatade, 2019; Sopekan & Awofala, 2019) with attendant lack of mathematical thinking style (Sarkingobir, Egbebi, & Awofala, 2023) leading to innumeracy. Innumeracy

is a term used to indicate an individual's lack of numerical or quantitative literacy and an inability to comprehend and work assiduously with numbers. Innumeracy can manifest in avoidance of mathematics-related situations or tasks; difficulty in interpreting charts, graphs and data; trouble with estimating magnitudes and quantities; and difficulty with basic arithmetic operations like fractions, division, multiplication, addition, subtraction, and decimal. The consequences of innumeracy in the world population are numerous. These include limited career opportunities in occupations that need numerical or quantitative skills (Awofala & Lawani, 2020); struggling to make informed decisions based on evidence and data; struggling to comprehend medical research, risks and health statistics; and difficulty with personal finance, investing and budgeting (Awofala & Lawal, 2022; Paulo, 2001; Shahid, Shoker, Chu, Frehlick, Ward, & Pahwa, 2022).

No matter how bad innumeracy is, it can be enhanced with practice and effort. Thus, it is not a fixed trait. People can overcome innumeracy by cultivating a growth mindset that quantitative skills can be enhanced (Awofala & Akinoso, 2024); finding real-life applications that make mathematics more meaningful (Awofala, Arigbabu & Fatade, 2019); seeking mathematics classes, mathematics apps and online tutorials in mathematics (Lawal & Awofala, 2020; Awofala et al., 2021); building confidence with small, achievable steps in mathematics; and practicing basic numerical and arithmetic concepts (Awofala & Anyikwa, 2014). It is important to note that while numeracy is connected with an improvement in mathematics, innumeracy is connected with a deficiency in functional mathematics. Numeracy and mathematics are related but distinct constructs. While numeracy pays attention to practical numerical or quantitative skills for everyday life, mathematics focuses on a broader field of study, encompassing applied and pure mathematics. Numeracy helps in the comprehension and application of basic arithmetic operations, analysis of data, and numerical or quantitative concepts, whereas mathematics is embroiled with advanced subjects like statistics, calculus, geometry, trigonometry, and algebra. Numeracy helps in developing skills for decision-making, critical thinking, and problem-solving, whereas mathematics helps in the development of logical reasoning, problem-solving strategies, and theoretical understanding.

Numeracy is important in navigating modern life, citizenship, health, and personal finance, whereas mathematics is important for careers in science, technology, engineering, and mathematics (STEM). While numeracy is involved with practical application, mathematics is involved with abstract and theoretical concepts. Nevertheless, numeracy and mathematics are interconnected and build upon each other. Strong numeracy skills enhance understanding of mathematical concepts and mathematical knowledge helps in improving numeracy skills. Cultivating both can lead individuals to become adept in analytical reasoning, critical thinking, and problem-solving thereby making innumeracy an obscured construct. In this study, innumeracy is seen as a lack of numerical or quantitative literacy and a deficiency in comprehending basic mathematical concepts which can lead to troubles in the application of mathematical skills to real-life problems and fear or avoidance of mathematics. Mathematics builds upon students' prior knowledge, making it difficult for those with innumeracy to move into progress. Mathematics can be daunting or overwhelming for students who struggle with basic quantitative skills. Innumeracy can lead to an impediment in students' comprehension and appreciation of mathematics, thereby making it harder to pursue careers in STEM; develop problem-solving strategies; apply mathematical skills to real-life problems or situations; and comprehend mathematical concepts. Arresting innumeracy through promoting numerical literacy and enhancing basic mathematical skills can aid students to develop a solid foundation for appreciating and comprehending mathematics.

Mathematics is indispensable and pertinent in everyday life because it helps individuals to engage in systematic and logical thinking (Awofala & Ojaleye, 2018), promotes accuracy in decisions making (Awofala & Ojaleye, 2018) and helps as a filter for other subjects and employment (Awofala & Lawani, 2020). Nevertheless, mathematics is seen negatively as a complex and rigid subject by the students and the world at large (Okunuga, Awofala & Osarenren, 2020). Worldwide, students often show dislike for mathematics because it evokes a lot of negative emotions including anxiety (Sopekan & Awofala, 2019;) and depression (Awofala & Esealuka, 2021). Anxiety is a major factor in students' dislike of mathematics (Awofala & Akinoso, 2017; Awofala & Odogwu, 2017; Awofala, 2019) and mathematics anxiety is described as a perturbing element in students learning of mathematics leading to a decrease or depletion in cognitive functioning (Awofala & Odogwu, 2017; Awofala, Akinoso, Adeniyi, Jega, Fatade, & Arigbabu, 2024). Mathematics anxiety has a negative influence on mathematics achievement/performance (Awofala et al., 2024). Students with higher mathematics anxiety tend to record lower achievement in mathematics. Mathematics anxiety can lead to a negative attitude toward mathematics and both are common phenomena that can have significant consequences. For instance, mathematics anxiety impacts performance, leading to lower achievement and confidence in mathematics (Awofala et al., 2024; Arigbabu, 2006; Arigbabu, Balogun, Oladipo, Ojedokun, Opayemi, Enikanoselu, Owoyele, Owolabi-Gabriel & Oluwafemi, 2012); can result into fear or apprehension about mathematics classes, assignments, and tests (Awofala et al., 2024); can lead to avoidance of mathematics-related tasks and situations (Awofala et al., 2024); and can promote tension, stress, or discomfort when faced with mathematics problems (Awofala et al., 2024). Negative attitude toward mathematics can lead to a fixed mindset, with the presumption that mathematics ability is unchangeable and innate (Awofala & Akinoso, 2024); perception that mathematics is only for geniuses or nerds (Awofala & Akinoso, 2024); belief that mathematics is irrelevant, boring, and difficult; and lack of appreciation for mathematics applications, logic and beauty (Awofala & Ojaleye, 2018).

Mathematics anxiety and negative attitudes can result in increased stress and anxiety in mathematics-related situations (Awofala et al., 2024); difficulty with problem-solving and critical thinking (Ajao & Awofala, 2024b); limited career choices (Awofala & Lawani, 2020); and poor academic performance in mathematics (Awofala & Fatade, 2023). Mathematics anxiety and negative attitudes can be overcome by developing a growth mindset, believing mathematics ability can be developed and cultivated (Awofala & Akinoso, 2024); embracing challenges and view mistakes in mathematics as learning opportunities (Awofala & Akinoso, 2024; Awofala, Ojo, Okunuga, Babajide, Olabiyi, & Adenle, 2019); seeking supportive resources like tutors or online forums in mathematics (Lawal & Awofala, 2020; Awofala, Olafare, Awofala, Ojo, Fatade, Arigbabu, & Udeani, 2021); connecting mathematics to real-life interests and applications (Ajao & Awofala, 2024a); building confidence through small successes and achievable goals in mathematics (Awofala, Arigbabu, Fatade & Awofala, 2013); and practicing relaxation techniques, like deep breathing or visualisation (Ajao & Awofala, 2024b). One construct that may have connection with mathematics anxiety and negative attitudes is acute innumeracy dependence syndrome (AIDS). Arigbabu (2012) coined the word AIDS to mean acute innumeracy dependence syndrome in his inaugural lecture titled "Beyond the cuboid: Imperatives for an AIDS-free, mathematically literate society" delivered at the Tai Solarin University of Education, Ijagun, Nigeria. AIDS was described as the peak of innumeracy (Arigbabu, 2012). In this study, AIDS tentatively refers to a debilitating construct used to describe a condition where an individual is dependent on others to perform mathematical tasks, because of their own deficiency in comprehending mathematical concepts and skills.

Students with AIDS may not appreciate the importance of mathematics and its beauty. AIDS can lead to a negative thought in mathematics. Investigation about AIDS is in it infancy stage and is yet to be found explicitly. However, numerous researches have investigated other psychological phenomena in students, such as resilience, dispositions, values, emotions, attitudes, self-efficacy, conceptions, beliefs, and views (Awofala, Lawal, Arigbabu & Fatade, 2022; Awofala & Sopekan, 2020; Awofala, 2020a; Awofala, 2020b; Awofala, Lawani, & Oraegbunam, 2019; Awofala & Ojaleye, 2018; Awofala, 2021; Awofala, 2017b; Awofala, 2016; Fatade, Arigbabu, Mogari, Awofala, 2014; Arigbabu & Oludipe, 2010; Arigbabu, Oludipe, Fatade, & Oworu, 2008; Arigbabu & Oladipo, 2009; Mji & Arigbabu, 2012) that either promote or retard effective mathematics learning. Larkin and Jorgensen (2015) particularly identify attitudes that are important, inseparable, and often related with hopelessness, disability and anxiety as a mark of negative experiences in mathematics when receiving poor quality instruction. There is no doubt that mathematics evokes many negative emotions (Awofala & Odogwu, 2017; Gafoor & Kurukkan, 2015) as students try to learn it. Students often show these negative emotions based on their feelings towards mathematics, such as frustration, boredom, hatred, and wanting to cry whenever they want to learn mathematics (Awofala et al., 2024; Larkin & Jorgensen, 2015). These are impetuses for the investigation of AIDS in high school students especially those having unpleasant feeling towards mathematics. Therefore, this study aims to build AIDS indicators based on high school students' unpleasant feelings towards mathematics. A valid mathematical definition of AIDS was formulated regarding these indicators, which were further scrutinised and developed into an instrument capable of detecting students' perceptions of AIDS.

Research Questions

Two questions were answered in this study and they included:
RQ1. What are the indicators of AIDS related to students' unpleasant feelings towards mathematics?
RQ2. What is a good definition of AIDS in mathematics education?

Methodology

Research Design

This study adopted a qualitative descriptive blueprint with a phenomenological approach aimed at exploring and describing the prejudiced experiences and meanings of a specific event or phenomenon that is sensitive, nuanced, and complex (Adams & Manen, 2017; Creswell, 2014; Mitchell, 2018). This design focused on garnering a profound and thoughtful comprehension of the participants' interpretations, orientations and experiences regarding acute innumeracy dependence syndrome. A phenomenon related to students' unpleasant feelings towards mathematics. In this study, the research design was used to carry out focus groups or in-depth interviews to garner data related to acute innumeracy dependence syndrome; create open-ended questions that promote detailed descriptions of acute innumeracy dependence syndrome; do analysis of transcripts in the identification of patterns and themes; put emphasis on the respondents' prejudiced meanings and experiences of acute innumeracy dependence syndrome; engage in analysis of data which is iterative and cyclical, with coding and identification of themes related to acute innumeracy dependence syndrome; and write a composite description focusing on the essence of acute innumeracy dependence syndrome.

Participants

Twenty-eight senior high school students (16 females and 12 males) were chosen to partake in this study through purposive sampling. These respondents were in grade 12 preparing to take their final examination in mathematics conducted by the West African Examinations Council (WAEC). The respondents were given a paper and pen questionnaire containing two questions. The questions were validated by a panel of three experts in mathematics education, test development, and psychology. The first question asked the respondents about their preference for mathematics, of which there were only two choices: Yes and No. Out of the 28 respondents, 12 respondents did not like mathematics amounting to 42.86%, while the remaining 16 respondents did like mathematics indicating 57.14%. Thereafter, the participants were asked the following question which bordered on the causes of their affinity for mathematics. In this investigation, effort was on respondents who show their

dislike for mathematics based on their unpleasant feelings towards mathematics that influenced their achievement in mathematics. From this, nine participants, amounting to 75%, did not like mathematics due to unpleasant feelings towards mathematics. As recommended by Creswell, the nine respondents were suited for phenomenological studies since it is within the range 5-25 people (Creswell, 2014; Rahiem, 2021). The nine respondents came from different parts of Lagos State in Nigeria, such as Lagos West, Lagos East, and Lagos Central and were primarily Yorubas which dominated the south-west Nigeria. The respondents had similar language, custom, habit and cultural background.

Instruments

Semi-structured interviews were used to collect primary data from the nine respondents. The investigators used the Zoom Meeting application to conduct the interview virtually. Each respondent was interviewed personally at a different time. Prior to the interviews, informed consent forms were filled by the respondents and returned to the investigators as they were assured of their confidentiality, comfort, and security. Interviews were carried out in-depth by asking numerous questions to determine the respondents' state of acute innumeracy dependence syndrome orchestrated by unpleasant feelings towards mathematics. Three experts in mathematics education validated these questions before being utilised for the study. The validation outcomes are a question revision, and the final questions utilised included: 1. How do you solve or carry out simple calculations in mathematics? Give detail description. 2. How often do you experience unpleasant feelings towards mathematics? 3. How do you describe your difficulty with mental mathematics or estimation? 4. How do you describe your struggle with basic mathematical concepts, such as fractions or percentages? 5. How do you describe your avoidance of mathematical tasks or problems? 6. How do you describe your decreased confidence in mathematical abilities? Does that lead to mathematics anxiety, negative attitudes and poor mathematics performance?

Data Analysis

One week after concluding the interviews, the nine respondents' video recordings were translated word for word accurately into transcripts and were analysed jointly by the investigators to determine important points (coding) so as to answer the research questions. The guidelines for phenomenological approach relating to analysis enunciated earlier were followed methodically. The interview scripts were analysed and general statements were highlighted and grouped into meaningful themes. Thereafter, the themes were used to write a texture description of what the respondents experienced. Lastly, a composite description that focused on the essence of the acute innumeracy dependence syndrome being investigated was written.

Results

The outcomes of the coding and analysis done based on the questions in the semi-structured interviews were explicated below. Furthermore, the transcript sample for each question would be presented.

Question One: How do you solve or carry out simple calculations in mathematics? Give detail description.

The nine respondents had similar methods of carrying out simple calculations in mathematics. They use calculators or digital technology to carry out simple calculations in mathematics. There is this aura of 'calculator dependence' among the respondents. Calculator dependence in this context indicates heavy reliance on calculators to perform and engage mathematical calculations to the detriment of quantitative comprehension and mental mathematics skills. This is not surprising as the respondents reported weak mental mathematics skills; inability to perform calculations without calculators; troubles with critical thinking and problem-solving; poor understanding of numerical concepts and relationships; and struggles with estimation and approximation in mathematics. Presented thereafter, is the transcript sample during the interview process. The investigators used "R" to represent the researcher and "P1 to P9" to represent the participants.

R: How do you solve or carry out simple calculations in mathematics? Give detail description.

P: Because of my poor mathematical background, I like to use calculator or any other calculating device to carry out simple calculations in mathematics (P1 to P9). Without calculators, I cannot do any meaningful calculations in mathematics (P2, P3, P5, P6, P7, P9). I hate mental calculation and I like to use calculators for estimating numbers (P3, P4, P5, P6, P8). Calculators give me answers quickly without racking my brain (P4 to P9). Calculators help me to do basic problem-solving exercises (P1 to P5). However, my over-reliance on calculators does not make me to know enough mathematics (P6, P7, P8, P9). This reduces my mathematics fluency and ability to problem solve in mathematics (P6, P7, P8, P9).

R: Do you think calculators and technology have helped or hindered your mathematics skills?

P: My use of calculators in carrying out simple calculations in mathematics has both advantages and disadvantages. The advantage is that I do not need to rack my brain when computing simple mathematics problems involving calculations (P1, P2, P3, P7, P8). I get my answer quickly (P4, P5, P6, P9). The disadvantage is that I may not know the process of arriving at answers when solving calculation problems (P1 to P9). Calculator use conceals the processes (P1-P9). Also, it reduces my problem-solving abilities in mathematics and does not allow me to think about the solutions to computational problems in mathematics (P1, P2, P7, P8, P9).

Question Two: How often do you experience unpleasant feelings towards mathematics?

The nine respondents reported that they had experienced unpleasant feelings towards mathematics and it emanated from primary through junior high to senior high school. They felt dizzy, bored, anxious, blank, dejected, rejected, helpless, and unhappy when they were in mathematics class. They were most particular about their high mathematics anxiety and negative attitudes towards mathematics. The anxiety that interferes with their learning of mathematics does not allow

them to learn mathematics effectively. These anxiety and negative attitudes make them to struggle with mathematics. Presented thereafter, is the transcript sample during the interview process.

R: How often do you experience unpleasant feelings towards mathematics?

P: In my primary school days, I often have negative feelings towards mathematics particularly having a heartbeat when it was time for mathematics (P1 to P4). I feel dizzy, bored, anxious, blank, dejected, rejected, helpless, and unhappy when I am in mathematics class (P5 to P9). I managed to pass mathematics in primary school leaving certificate examinations (P1, P4, P7, P9). Reading the multiplication tables offhand was difficult for me and my teacher would flog me if I missed the multiplication tables (P1, P3, P5, P7, P9). In junior secondary school, my anxiety towards mathematics became worse (P1, P2, P8, P9). I just disliked mathematics (P1, P2, P3, P5). It was annoying to me sitting in a class where mathematics was taught (P2, P7, P8, P9). As I moved to senior high school, I began to feel negative attitudes towards mathematics and my mathematics anxiety became worst (P1, P3, P4, P6, P8). I don't even know what to do in mathematics in the external examinations that would be conducted by WAEC this year (P1, P8, P9).

Question Three: How do you describe your difficulty with mental mathematics or estimation?

The nine respondents reported that although mental mathematics and estimation skills were very important and could serve as building blocks for a strong foundation in mathematics but they had difficulty with them. They maintained that the convenience and ease of use of calculators had led them to depend less on their mental abilities, possibly affecting their fluency with basic arithmetic operations; problem-solving skills, specifically on tasks needing mental calculations; comprehending numerical patterns and relationships; and ability to estimate numbers and quantities. Presented thereafter is the transcript sample during the interview process.

R: How do you describe your difficulty with mental mathematics or estimation?

P: I have difficulty with mental mathematics and estimations(P1, P2, P4, P5, P8). I used calculators as a respite even though mental mathematics and estimation are very important in building a very strong foundation in mathematics (P1, P3, P4, P7, P8, P9). The difficulty I have with mental mathematics and estimation is a threat to my foundation in mathematics (P1, P2, P3, P4, P7, P9). Because of this, I have a weak foundation in mathematics and I am not fluent in basic arithmetic operations (P1, P2, P3, P7). I dislike estimating quantities, like counting objects or measuring distances (P2, P4, P5, P6, P8). I don't like to engage in activities that require mental mathematics, such as Sudoku or math puzzles (P1, P2, P4, P5, P7, P8). I have low ability in estimating quantities and numbers (P1, P2, P4, P6, P7, P9). I find it difficult to understand numerical relationships and patterns (P2, P4, P5, P6, P7, P8, P9).

3.4. Question Four: How do you describe your struggle with basic mathematical concepts, such as fractions or percentages?

The nine respondents reported that they struggle with basic mathematical concepts, such as fractions and percentages. To them, struggling with mathematical concepts is a common phenomenon. They hate seeing mathematical concepts like fractions and percentages; they struggle to represent parts of a whole and cannot add, subtract, multiply, and divide fractions using specific rules. Simplification of fractions is a problem to them and they found it difficult to understand percentages when used to describe increases, decreases, and proportions. Presented thereafter, is the transcript sample during the interview process.

R: How do you describe your struggle with basic mathematical concepts, such as fractions or percentages?

P: I struggle with basic mathematical concepts, including fractions and percentages (P1 to P9). In fact these mathematical concepts are alien to me and truly I hate them with passion (P1, P2, P5, P6, P7, P8). This is because I don't know how to go about them (P1, P2, P5, P6, P7, P8). I often miss the specific rules for adding, subtracting, multiplying and dividing fractions (P3, P4, P5, P6, P9). I struggle to visualize and draw diagrams to represent fractions (P1 to P9). I struggle with real-world examples to understand practical applications of basic mathematical concepts (P4 to P9). I hate complex mathematical concepts (P1 to P9).

Question Five: How do you describe your avoidance of mathematical tasks or problems?

The nine respondents reported that they often avoid mathematical tasks or problems. To them avoiding mathematical tasks or problems is a general behaviour when students struggle with mathematics. The avoidance made them to have increased anxiety and stress when faced with mathematics-related situations thereby potentially making them to struggle in other subjects that depend on mathematics, like engineering and science. They noted that avoidance of mathematics reinforced their negative attitudes towards mathematics. Presented thereafter, is the transcript sample during the interview process.

R: How do you describe your avoidance of mathematical tasks or problems?

P: I often avoid mathematical tasks or problems because mathematics does not appeal to me (P1, P3, P5, P6, P7, P8). Avoidance of mathematical tasks is a general problem for us who struggle with mathematics (P2, P4, P5, P6, P8, P9). If mathematics was to be an elective in senior high school, I wouldn't have taken it as a subject (P4 to P9). But it is a compulsory cross-cutting subject (P4 to P9). I have increased anxiety as a result of my mathematics avoidance and this has made me to struggle with mathematics-related subjects such as physics, economics, and chemistry (P1, P3, P6, P7, P8, P9). Because I don't understand mathematics, I avoid it and this has made me to feel a sense of hopelessness in mathematics thereby contributing to my negative attitudes towards mathematics (P1 to P9).

Question Six: How do you describe your decreased confidence in mathematical abilities? Does that lead to mathematics anxiety and negative attitudes?

The nine respondents reported that they had decreased confidence in their mathematical abilities. Because they see mathematics as vague, fixed, scary, boring, dull, abstract, unattainable, less important, complicated, difficult, many calculations, full with problems and not fun, they lost confidence in their mathematical abilities. Their low confidence in mathematical ability made them to avoid mathematics-related tasks and activities; made persevering through challenging mathematics concepts a mirage; increased their fear of failure or making mistakes; increased their anxiety and stress when faced with mathematics problems; and heighten their self-doubt and negative self-talk and attitudes in mathematics. The low confidence in mathematics undoubtedly led to their poor performance in mathematics. Presented thereafter, is the transcript sample during the interview process.

R: How do you describe your decreased confidence in mathematical abilities? Does that lead to mathematics anxiety, negative attitudes and poor mathematics performance?

P: I have a decreased confidence in my mathematical ability (P1 to P9). This is because mathematics is scary, boring, dull, abstract, unattainable, less important, complicated, difficult, many calculations, full with problems and not fun (P1 to P9). I am not hungry for mathematics and if possible I avoid doing mathematics (P3, P4, P7, P8, P9). I find it difficult to persevere on challenging mathematics concepts (P2, P3, P4, P7, P8). I have increased fear of failure, anxiety, and stress when faced with mathematics problems (P2, P3, P5, P6). The low confidence in mathematics heightens my self-doubt and negative self-talk and attitudes in mathematics (P1, P4, P5, P6, P7, P8). I see mathematics as a vague and fixed subject meant only for geniuses (P1, P2, P3, P4, P5, P8, P9). Because I have low confidence in mathematics, my mathematics performance is generally poor (P1 to P9).

Table 1. Indicators of AIDS with descriptions and supporting participants

Indicators	Description Supporting participants
Unpleasant feelings towards mathematics	-Negative feelings towards mathematics particularly having a heartbeat when it was time for mathematics (P1 to P4). -Feeling dizzy, bored, anxious, blank, dejected, rejected, helpless, and unhappy in mathematics class (P5 to P9). -Anxiety towards mathematics became worse (P1, P2, P8, P9). -Disliked mathematics (P1, P2, P3, P5). -Feeling negative attitudes towards mathematics orchestrated by mathematics anxiety (P1, P3, P4, P6, P8).
Calculator dependence	-Using calculator due to poor mathematical background (P1 to P9). -Without calculators, I cannot do any meaningful calculations in mathematics (P2, P3, P5, P6, P7, P9). -I hate mental calculation and I like to use calculators for estimating numbers (P3, P4, P5, P6, P8). -Calculators give me answers quickly without racking my brain (P4 to P9). -Calculators help me to do basic problem-solving exercises (P1 to P5). -Over-reliance on calculators does not make me to know enough mathematics (P6, P7, P8, P9). -Calculator dependence reduces my mathematics fluency and ability to problem solve in mathematics (P6, P7, P8, P9).
Difficulty with mental mathematics and estimations	- Struggle to perform basic arithmetic operations (P1, P2, P4, P5, P8). - Difficulty with mental mathematics and estimation is a threat to foundation in mathematics (P1, P2, P3, P4, P7, P9). -Weak foundation in mathematics and not fluent in basic arithmetic operations (P1, P2, P3, P7). -Low ability in estimating quantities and numbers (P1, P2, P4, P6, P7, P9). -Difficult to understand numerical relationships and patterns (P2, P4, P5, P6, P7, P8, P9).
Struggles with basic mathematical concepts	-Struggle with basic mathematical concepts, including fractions and percentages (P1 to P9). -Don't know how to go about mathematical concepts (P1, P2, P5, P6, P7, P8). - Missing the specific rules for adding, subtracting, multiplying and dividing fractions (P3, P4, P5, P6, P9). -Struggle to visualize and draw diagrams to represent fractions (P1 to P9). -Struggle with real-world examples to understand practical applications of basic mathematical concepts (P4 to P9). -Struggle with complex mathematical concepts (P1 to P9).

Avoidance of mathematical tasks or problems	-Avoiding non-appealing mathematical tasks (P1, P3, P5, P6, P7, P8). -Avoidance of mathematical tasks is a general problem for people that struggle with mathematics (P2, P4, P5, P6, P8, P9). -If mathematics were to be elective in senior high school, I wouldn't have taken it as a subject (P4 to P9). - Having increased anxiety as a result of mathematics avoidance (P1, P3, P6, P7, P8, P9). -Avoidance of mathematics leads to less understanding and sense of hopelessness in mathematics (P1 to P9).
Decreased confidence in mathematical abilities	-The scary, boring, dull, abstract, unattainable, less important, complicated, difficult, many calculations, full with problems and not fun lead to decreased mathematical confidence (P1 to P9). -Not hungry for mathematics (P3, P4, P7, P8, P9). -Lack of perseverance on challenging mathematics concepts (P2, P3, P4, P7, P8). -Increased fear of failure, anxiety, and stress when faced with mathematics problems (P2, P3, P5, P6). -Heightened self-doubt, negative self-talk and poor attitudes in mathematics (P1, P4, P5, P6, P7, P8). -Seeing mathematics as a vague and fixed subject meant only for geniuses (P1, P2, P3, P4, P5, P8, P9). -Low confidence in mathematics leads to poor mathematics performance (P1 to P9).

Discussion

The results of this study revealed that students who show unpleasant feelings towards mathematics are "calculator dependence" when solving simple calculations in mathematics. It was observed that the unpleasant feelings towards mathematics make student to have difficulty with mental mathematics and estimations. They struggle with basic mathematical concepts, such as fractions or percentages; engage in the avoidance of mathematical tasks or problems; and have decreased confidence in mathematical abilities. These lead to mathematics anxiety (Awofala & Odogwu, 2017; Awofala et al., 2024; Awofala & Awolola, 2011), negative attitudes (Awofala, 2016; Awofala, 2017b) and poor mathematics performance (Awofala, 2017a; Awofala Fatade, 2023) among the students. This experience often damages the students' perspective of mathematics (Dirgantoro, Soesanto, & Yanti, 2023) and mathematical problem-solving proficiency (Malasari & Awofala, 2022; Awofala, 2002) thereby leading to innumeracy.

Acute innumeracy dependence syndrome (AIDS) often arises when an individual: 1. experienced unpleasant feelings towards mathematics over a prolonged period of time. 2. is calculator dependence when solving simple calculation in mathematics to the detriment of mental calculation. 3. has difficulty with mental mathematics and estimations. 4. struggles with basic mathematical concepts, such as fractions or percentages. 5. engages in the avoidance of mathematical tasks or problems. 6. has decreased confidence in mathematical abilities. In line with these indicators, AIDS was defined as a debilitating condition developed from negative past experiences orchestrated by calculator dependence when solving simple calculation in mathematics, difficulty with mental mathematics, struggle with basic mathematical concepts, avoidance of mathematical tasks, and decreased confidence in mathematical abilities. This definition is based on the unpleasant feelings towards mathematics experienced from primary to senior high school level and teachers can potentially create unpleasant experiences in mathematics learning. Figure 1 shows the factors of AIDS.

Unpleasant feelings towards mathematics can manifest in feeling nervous or apprehensive when faced with mathematical problems or situations; feeling stuck or unable to understand mathematical concepts, and leading to feelings of frustration and helplessness; and finding mathematics uninteresting or un-engaging, leading to a lack of motivation or enthusiasm (Adebiyi, Awofala, & Malik, 2024; Awofala & Odogwu, 2017; Awofala et al., 2024; Awofala & Awolola, 2011; Awofala, & Ogunsanya, 2025). Unpleasant feelings could also manifest in feeling overwhelmed by the complexity or volume of mathematical materials, leading to feelings of stress and anxiety; and simply not enjoying mathematics or finding it unpleasant, often due to past experiences or negative associations. Calculator dependence refers to the reliance on calculators or other electronic devices to perform mathematical calculations, often to the point of struggling with or avoiding mental mathematics or basic arithmetic operations. Over-reliance on calculators can limit the development of problem-solving skills and critical thinking. Relying too heavily on calculators can make it difficult to perform calculations without access to technology. Excessive calculator use can impact cognitive abilities, such as working memory and attention.

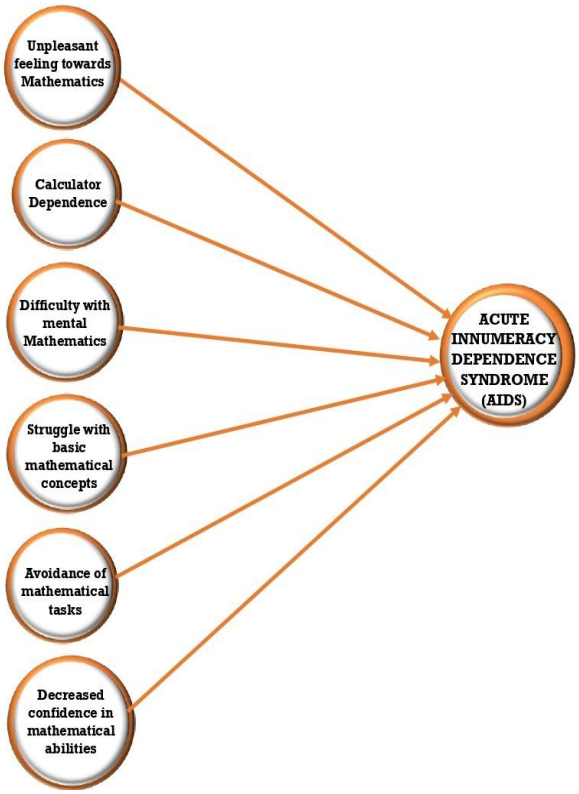

Figure 1. Acute Innumeracy Dependence Syndrome and its factors

Difficulty with mental mathematics and estimation can manifest in having trouble with simple calculations, such as addition, subtraction, multiplication, and division, without the aid of calculator or other tool; struggling to make accurate estimates of quantities, such as numbers, sizes, or amounts; and having difficulty performing calculations in one's head, such as calculating change, tips, or discounts. Struggles with basic mathematical concepts can manifest in difficulty with arithmetic operations; trouble with fractions and decimals; struggling with percentages; difficulty with ratios and proportions; and trouble with mental mathematics. Avoidance of mathematical tasks or problems can manifest in procrastination by putting off mathematical tasks or problems; lack of engagement and interest in mathematical activities; difficulty starting tasks; and seeking shortcuts or easy ways out rather than putting in the effort to understand and solve mathematical problems (Awofala, Olaguro, Fatade, & Arigbabu, 2024). Decreased confidence in mathematical abilities can manifest in self-doubt by questioning one's ability to solve mathematical problems; lack of faith in calculations by doubting the accuracy of one's calculations; fear of failure or making mistakes in mathematical tasks; and avoidance of challenging mathematical tasks due to fear of failure or lack of confidence.

Hayati and Ulya (2018) noted that during instruction, teachers often make students to have the belief that mathematics is difficult and complicated. Also, students' perceptions of mathematics can lead to poor learning experiences (Dirgantoro, Soesanto, & Yanti, 2023) regardless of the teacher's factor. However, teacher is an important factor that influences students' anxiety, emotions, self-efficacy, attitudes, beliefs, feelings, views, motivation, resilience, dispositions, conceptions, and performance (Awofala, 2023; Awofala et al., 2022; Awofala, 2021; Awofala, 2017b; Awofala, Lawani & Adeyemi, 2020; Awofala, Lawal, Isiakpere, Arigbabu, & Fatade, 2020; Awofala, Olabiyi, Awofala, Arigbabu, Fatade & Udeani, 2019; Awofala, Akinoso & Fatade, 2017; Oladipo, Awofala & Osokoya, 2020; Awofala, 2020a; Awofala, 2020b; Arigbabu & Mji, 2005; Arigbabu, 2007; Arigbabu, Mji, Fatade, Rufai, Oladipo & Lawani, 2011; Oladipo, Arigbabu & Rufai, 2012; Awofala, Johnson, & Akinoso, 2025).

The nascent AIDS regarding the unpleasant feelings towards mathematics is a source of concern, especially for senior high school students. This is because the consequences for them are far reaching including: negative effect on overall academic performance and future prospects, decreased confidence in mathematics abilities, lower academic achievement and grades in mathematics, over-reliance on technology such as calculators, and hindering mental mathematics abilities. Other consequences are: limited career options and opportunities, struggles with STEM subjects at the university, weak analytical and reasoning skills, difficulty with problem-solving and critical thinking, negative attitude towards mathematics, and mathematics anxiety and phobia.

In general, there is no discussion found on acute innumeracy dependence syndrome (AIDS). Until this far, studies have been centred on emotion, attitude, conception, belief, view and anxiety that promote or block students' understanding of mathematics learning. In essence, the present study results are expected to ginger further research in mathematics education regarding AIDS. AIDS can be resolved by developing a growth mindset towards mathematics (Awofala & Akinoso, 2024); encouraging critical thinking, problem-solving skills, and creativity (Ajao & Awofala, 2022; Awofala & Lawal, 2022; Okunuga, Awofala & Osarenren, 2020; Awofala et al., 2019; Awofala & Fatade, 2015); building confidence in mathematical abilities (Ajao & Awofala, 2022); practicing and reinforcement of basic mathematical skills (Ajao & Awofala, 2024a); and engaging in mathematical education and training (Ajao & Awofala, 2024a; Ajao & Awofala, 2024b).

Conclusion and Recommendations

The indicators of acute innumeracy dependence syndrome (AIDS) among senior high school students in this study consisted of: (1) unpleasant feelings towards mathematics over a prolonged period of time; (2) calculator dependence when solving simple calculation in mathematics to the detriment of mental calculation; (3) difficulty with mental mathematics and estimations; (4) struggles with basic mathematical concepts, such as fractions or percentages; (5) avoidance of mathematical tasks or problems; and (6) decreased confidence in mathematical abilities. Thus, the proposed AIDS definition is a debilitating condition developed from negative past experiences orchestrated by calculator dependence when solving simple calculation in mathematics, difficulty with mental mathematics, struggle with basic mathematical concepts, avoidance of mathematical tasks, and decreased confidence in mathematical abilities. When this AIDS is not resolved, the consequences can be damaging

including limited career options and opportunities, struggles with STEM subjects at the university, weak analytical and reasoning skills, difficulty with problem-solving and critical thinking, negative attitude towards mathematics, and mathematics anxiety and phobia. One major limitation of this study is the small sample size which was just nine participants, therefore, this study findings may not be generalisable.

Nevertheless, the findings of this study could serve as a spring board for other studies in reducing AIDS among students. Teachers must work assiduously to lessen the effects and consequences of AIDS among students. Students with little or no symptoms of AIDS will realise, like and appreciate the usefulness and beauty of mathematics in real-life contexts. The implications of AIDS in the population are numerous. Struggling with numeracy can limit career opportunities, particularly in fields that require mathematical skills such as science, technology, engineering, and mathematics (STEM). AIDS can make make it challenging to manage finances, understand budgets, and make informed financial decisions. AIDS can affect daily life, including tasks such as cooking, shopping, and understanding medication instructions. AIDS can limit problem-solving skills and critical thinking, making it more challenging to navigate complex situations. AIDS can lead to feelings of frustration, anxiety, and low self-esteem.

This study introduced a novel conceptual framework—**Acute Innumeracy Dependence Syndrome (AIDS)**—and attempts to define and identify its indicators among high school students. The AIDS provides a unique lens for examining numeracy challenges and mathematics aversion and thus could enrich discussions on math anxiety and digital dependence in education. While it is acknowledged that the acronym "AIDS" may raise ethical and sensitivity concerns due to its overlap with a serious medical condition- acquired immunodeficiency syndrome, the AIDS in mathematics education is different and not in no way related to medical AIDS. Future research on AIDS in mathematics education should not be misconstrued to mean medical AIDS to avoid misinterpretation or stigma. Future researches in mathematics education should come up with scales on AIDS since its indicators has been determined.

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