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PREVALENCE OF TEACHER CALCULATOR UTILISATION IN MATHEMATICS CLASSROOMS: CASE OF NYANGA DISTRICT SECONDARY SCHOOLS, ZIMBABWE

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ABSTRACT

This study established the prevalence of calculators in mathematics classes at O-level inNyanga district. How they are being used and factors influencing their current application as a basis for the district's schools technology use planning. The study was guided by the pragmatism philosophy to facilitate data collection and presentation by mixed methods. Data was collected from a census of the 34 secondary schools in Nyanga district comprising of 5 boarding and 29 rural day secondary schools. A purposive sample of 43 mathematics teachers and 95 O-level students responded to a questionnaire. 17 mathematics lessons were observed and followed up by in-depth interviews with teachers and students on the use of calculators. Teachers' schemes and ZIMSEC syllabus were analysed. The study found(62%) prevalence for calculator use in mathematics syllabus 4028. Boarding and private colleges'pupils used calculators. More girls than boys had calculators. Although all teachers reported willingto use the calculator, 15 (35%) reported, not have a personal calculator. That doubted the mathematics teacher's interest in using the calculator. Study found five calculator models in use. The majority used the SHARP model. ZIMSEC disallowed the graphic FX-CG50 because of its complexity. Calculators were used for computation (, r2) and evaluation for logarithmsand trigonometry ratios such as(Sin). Factors include; lack of financial resources for day school students, limited teacher commitment for calculator use, low teacher technical know-how of using calculator for instruction, no supportive teacher development material on how to use calculators. ZIMSEC limits use of calculators, mathematics text books do not show how calculators can be used for instruction. Study recommends use of a single calculator model as a district policy, calls for a teacher handbook for the use of calculators for instruction and mathematics teachers' staff development.

Key Words: Calculator, prevalence, teacher, instruction, mathematics.

1. INTRODUCTION

1.1 Background

The key variable in the implementation of any classroom technological innovation is the teacher. Teachers interpret the syllabus, break its' content in their schemes of work, gathers learning materials and guides the learning process. In Zimbabwe, examinations of calculator application

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in mathematics instruction was introduced by syllabus 4024 in 2007 and syllabus 4028 in 2012. Nyaumwe (2006), fears that although learners have calculators in the classroom teachers may be side-lining their use for mathematical instruction and under-playing their contribution to national technology skills development.What actually takes place behind the classroom closed doors is all dependent on the mathematics teacher's level of pedagogical knowledge (Kendal and Stacey, 2002).Burke (2001) reports that, calculators are versatile instructional tools which mathematics teachers find challenging to integrate in their classrooms. In this study, the word prevalence encompasses calculator existence (frequency) and application in mathematics teaching and learning.

Zimbabwe's Science and Technology policy, according to Muchena (2003) aims to develop national scientific and technological self-reliance. This is achieved by promoting technology awareness and literacy. While no specific implementers were nominated, this studywhich regard mathematics as a language for science point at the teacher. It is critical for mathematics teachers to have a national duty to develop children's use of a scientific hand-held calculator to support science and technological innovations. By including calculators in their instruction practical repertory, mathematics teachers will raise not only learners awareness but also its application.

The government of Zimbabwe supported the Science and Technology policy by donating computers to secondary schools in 2009. Regrettably promotion of the use of calculators in schools was surpassed. One can assume that, calculators were considered cheap enough for schools to handle within their budgets. Burkhardt (1981) in Chinamasa (2012, p88) suggests that, a calculator and a computer are all technological gadgets. The dividing line between calculators and computers is blurred. For example, programmable calculators with storage and printing facilities are proper subsets of microcomputers.

Zimbabwe Schools Examinations Council (ZIMSEC) responded to the Science and Technology policy and "proliferation of scientific calculators in Zimbabwe in the mid1980s by introducing mathematics syllabus 4024 in the O-level mathematics curriculum" in 2004 for first examination in 2007 (Nyaumwe 2006, p 39). Its' distinctive feature was the permitting of some candidates to use scientific calculators in national examinations. There was the option of non-calculator paper (4004). Nyaumwe (2006) also informs us that, a mathematics curriculum revision held in mid 1990s maintained but renamed the parallel curricular syllabus 4008/2 and 4028/2. Maintaining the parallel curricular was intended to allow teachers time to develop mathematics instructional skills in which calculators are used. It is the role of this study to find the prevalence of calculators as an indicator of teachers' preparedness for the pedagogical change. One assumes also that, schools were given time to budget for calculators. The prevalence will also show whether calculators are provided by schools or by individual students as suggested by ZIMSEC syllabus 4028/2 point (4.2).

An analysis of ZIMSEC mathematics syllabus 4028/2, the calculator version shows that:

a) Aim(2.6). requires learners to develop ability to reason and present arguments logically. One can interpret this to mean that, learners must use pen and paper to show all working and logical arguments not copying answers from the calculator display without showing how it

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got it. This may not support the use of calculators in schools. Although aim (2.8). expect learners to find joy and self-fulfilment in mathematics, it does not specify how. It leaves teachers and learners open to trial and error and trial and success.

b) Assessment objective (3.2) credit students for carrying out calculations and checking the correctness of their solutions. The syllabus did not say how, neither did it suggest use of calculator as a tool for checking computation accuracy. Then its' assessment objective (3.8) underscore the need for learners to give steps and/or information necessary to solve a problem. This again suggests awarding of method marks for correct method shown, which does not promote direct interpretation of answers from the calculator.

c) Syllabus 4028/2, point 4.1 clearly points out that: the efficient use of scientific calculators with trigonometric functions is expected and strongly recommended in paper 4028/2. Then point 4.2 reads, candidates are expected to bring their own instruments. One can assume that, it is the responsibility of candidates to buy their calculators. Hong and Thomas (2006) support learners having their own calculators for improved access and lowering of pressure on schools' departmental budgets. But this part of the syllabus point 4.2 reading, "mathematical tables will be provided in the examination" suggests positive discrimination in favour of non-calculator candidates. It does not support the use of calculators. Schools and learners can avoid costs of calculators by continuing with the non-calculator version.

d) The syllabus Methodology section, point (5.0) is silent on how calculators can be used either for instruction or during examinations. Although point (5.6) reiterates the need for pupils to be taught how to check and criticise their own and another's work, it does not show how calculators come in.

These observations show that, the official national syllabus is not very keen on promoting the use of calculators in mathematics.Actually, by giving a compulsory paper 4028/1, in which calculators are not used and 50% assessment weighting for each of the two papers, ZIMSEC is trying to reduce the effect of calculators on the performance of candidates using it. The situation contradicts Amanyi and Sigme (2016) who require that, the syllabus objectives spell out how the calculators can be used to enhance learners understanding of numerical computation and solve real life problems. Rosenstein (2002) called for a change in mathematics content and assessment methods to accommodate application of calculators.

This study considers a calculator as a technology gadget which can be used in schools to facilitate teaching and learning of mathematics. In fact, its inclusion in the curriculum reflects technology in learners' homes such as; the calculator on their cell phone, wristwatch and every vendor's desk. Present day technological levels require daily use of skills such as estimation, problem solving, interpretation of data, predicting and applying results. Emphasis is no longer on computation. That was left for machines to do. Such a perception calls for the redefining of the mathematical skills that schools are to develop in tomorrow's adults. Computers and calculators demand a shift of teachers' mathematical skills from drill and computation to a social application of problem solving and solution application. Carey (2008) proposes knowledge based confidence building and experience with a wide range of technology. All these are teacher variables hence this study's lenses have their full beam on the secondary school mathematics teacher in the classroom.

Literature argues for the teacher's disposition to the use of calculators for mathematics instruction from different angles. Nyaumwe (2006, p 41) emphasises that, successful integration of calculators in the mathematics classroom requires correct teacher orientations. For an effective orientation to be planned at district level there is need for this study to establish the prevalence of calculator application in Nyanga secondary schools. It is a training needs analysis for the improvement of mathematics instruction.

Newhouse (1998) in Chinamasa (2012, p 90) discloses that, even teachers in Australia were against the adoption of technology in their classrooms although they had the technological gadgets and skills to use them. Andrew (1995) reports teachers who wanted mathematics calculators to be banned from Australian classrooms. They were convinced that calculators do not contribute to children's learning. These studies did not spell out factors which contributed to such teachers' disposition. A clear inference is that, a group of teachers who subscribe to those technology denials do not promote the prevalence of calculator application in mathematics classrooms for instruction.

Haylock (2004, p 21) attributes the source of teacher resistance to technology in their classrooms to "misconceptions that calculators think" for the child. The calculator provides answers like a magic box. Carey (2008), calls such beliefs unfounded myths. They include such claims as: calculators make students too lazy and dependent to be able to do their real life computational demands. Some teachers consider learners' transcribing answers from the calculator as cheating. Teachers who contribute to these "misconceptions" about calculators cannot promote the prevalence of calculator applications in mathematics without a strong re-orientation program.

Teachers' misconceptions can be reduced by clarification facts such as: calculators are machines which were programmed to act in a particular fixed way. They cannot think and replace learners' knowledge of mathematics concepts and facts. The role of the calculator is to compute. That is not important knowledge in today's world which demands application. What is critical is knowledge of what to input (as demanded by the question), how to input it and what keys to press for the answer. In fact, using calculators require advance knowledge of a systematic schema of the solution. The following mental processes were identified by Haylock (2004) in Chinamasa (2012, p 91):

a) Identification of what is given (contextual analysis) in the problem and what is required. Such is a brain storming exercise which learners can carry out in groups.
b) Thinking of alternatives for the solution (combination of given variables) to get what is required. Here group discussions and evaluation of alternatives is critical.
c) Carrying out the computation using the calculator requires identification of the keys, decision of their operation sequence and the estimation of the solution.
d) Evaluation of the solution appropriateness in the context of the problem is critical motivating step for children.

It is clear then, that more than (75%) of problem solving process is a mental activity which survives on mathematical knowledge. Actually, application of calculators develops problem

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solving skills. Learners can only realise such a benefit if teachers are aware of the cognitive impacts of using the calculator for instruction.

Reznichenko (2007: 6) suggests that, calculators as cognitive support instruments can; (a) support both cognitive and meta-cognitive processes requiring more than nine mind spaces. (b) shares cognitive loads by supporting lower cognitive skills and leaving resources for higher order cognitive demands. (c) allows learners to engage in cognitive activities that could otherwise be unreachable for them. (d) facilitates learner generation and testing of hypothesis in real life contexts. The end results of these benefits include students' development of positive attitudes to mathematics as a life supporting endeavour.

Niess (2006, 200) supports the application of calculator in mathematics for the following reasons: a) they are motivating tools for those learners with computational limitations. (b) they are good at developing number senses in children. (c) they establish mathematical number patterns and relations. (d) they are a direct response to national standards. (e) technological knowledge and skills enhance mathematics application. (f) calculators improved students' interest, performance and confidents in mathematics. These merits can only be realised if the calculator prevalence is high and teachers are using them for instruction.

Statement of the Research Problem

There is limited documented knowledge of the prevalence of calculators in Nyanga district. The knowledge gap makes it difficult for contextualised planning of skills development intervention for the district schools technology implementation. Nziramasanga's (1999) commission reported that, teachers and parents are sceptical about the use of calculators in Zimbabwe's mathematics classrooms. The commission expressed fear of a possible danger arising from schools mathematics failure to train learners to use calculators as life tools. Nyaumwe and Bapoo (2004) found pre-service mathematics teachers keen to participate at a graphic calculators' workshop. They were motivated by the need for technological knowledge and its use in the classroom. Chinamasa (2012) found that (56%) of stakeholders were for the use of calculators at primary school. Teachers had reservations based on limited exposure to calculators and how they are used for teaching. Amanyi and Sigme (2016) concluded that, teachers have positive perceptions towards use of calculators for mathematics instruction, hence can integrate them in mathematics teaching and learning. It is the purpose of this study then, to explore the prevalence of teacher calculator use for mathematics instruction in Nyanga district secondary schools.

Research Questions:

a) What is the prevalence of calculators for mathematics instruction in Nyanga district?
b) How are the calculators being used in mathematics classrooms?
c) What factors influence calculator prevalence in secondary schools in Nyanga district?
d) What can be done to improve the prevalence of calculators in Nyanga district secondary schools?

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Significance of Study

This study is important in that, it is a needs analysis providing a basis for planning quality teaching improvement interventions. Researchers also use it as a monitoring and evaluation activity. By participating in this study, teachers and learners' awareness of calculator use in mathematics classes was raised. Insight into the prevalence, factors contributing to the way teachers and learners are using calculators become targets for staff development initiatives. They contribute content for mathematics teachers' staff development in the district and districts with similar initiatives (improving calculator use in the mathematics class).The study contributes literature on calculator use in secondary schools.

1. METHODOLOGY

Research Design

This study was guided by the pragmatism research philosophy which facilitated the data collection using mixed methods. Pragmatism is used as a prologue to interventions is social science research. This study zips to a case study which is mainly but not entirely qualitative in nature. According to White (2005, p 56), a case study is a type of qualitative research in which the researcher explores a single entity (calculator prevalence) bounded by time and activity (calculator usage) and collects detailed information by using a variety of methods (survey, interviews, observation and document analysis). Additions from Mhlanga and Ncube (2003, p 70) notes that case studies examines a social unit (mathematics teachers and learners in a district) as a whole. Researchers settled for the case study after considering that, case studies employ multiply data collection methods. It calls for the researcher's physical presence in the field. The presence allows researchers to use the environment and their knowledge of participants for data interpretation.

Population and Sampling

The main population for this study was composed of all mathematics secondary school teachers and learners in schools registered in Nyanga district. Teachers are key variables to the use of calculators for instruction. They decide what mathematics is to be taught, seek resources for it and decide how to teach it. In this case, they can use or ignore the use of calculators in their teaching of mathematics. Learners are rich sources of what actually happens (the real curriculum). They experience the need for calculators when exposed. ZIMSEC,O-Level mathematics syllabus requires learners to provide their own materials (calculators). So they become rich sources for factors related to resourcing.

Other none-human populations considered in this study include these documents; ZIMSEC O-Level mathematics syllabus (4028/2) for 2018 -2023. This is the official guide for what is worthy knowledge in mathematics. Specifically, the syllabus showed content, methodology and assessment criterion for the use of calculators in mathematics classes and national examinations. The second set of documents included mathematics teachers' scheme books. These show calculator activities that teachers plan for the class. More important was their evaluations. There was no need for rigorous validation of these documents. Researchers were satisfied by them being the current (2020) documents in use. The head's school stamp was adequate for us to regard the document as valid.

Sampling was purposive. The population was finite and grouped in schools. The inclusion criterion was having knowledge of calculator use (rich source), being available when researchers visited the school and willing to contribute to the study. In qualitative case studies, whose purpose is to understand, sample size does not matter. White (2005) can settle for single detailed case for understanding. Sampling is continued until researchers notice that, they have reached a variable saturation point.

Instruments

The main instrument for the survey was a questionnaire designed by the researchers for this study. It captured participants' possession of calculator, its' model, what they used it for and how they used it. Open ended questions captured participants' examples and insights. A key question asked for an illustration of a formal lesson that they had on the use of the calculator.

Another instrument was a document analysis guide. It focused researchers on syllabus and schemes objectives, activities and evaluations. The observation guide directed researchers' lenses on calculator use. We recorded when calculators were introduced in a lesson and for what purpose. Teacher and Learners' activities were valuable actions for the study.

Data Collection

Data collection was initiated by reading literature for a comprehensive understanding of the problem and its manifestations. This stage facilitated variable identification and instruments structuring. Permission was sought and granted by Nyanga District schools Inspector (DSI) and all school heads of secondary schools in the district. This was a critical ethical consideration enhancing a buy-in, mobilisation of support and study co-ownership.

Researchers visited each school using district education vehicles as part of the inspector's routine visits. Questionnaires were distributed to teachers and pupils. School heads returned them to the district offices when they came for their pay sheet. Volunteering teachers were visited at their school for their schemes of work, lesson observations and interviews.

Data Analysis and Presentation

Data analysis started by screening questionnaires for completeness and answering of key research questions. This was followed by coding responses according to research question themes (calculator availability, model, how it is used, factors, any calculator lesson taught in mathematics). Analysis of syllabus and schemes was done and findings recorded under calculator topics, objectives, activities and evaluation.

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Data presentation depends on the nature of the variable. Calculator model frequency and mathematics topics are quantitative discrete variable. They are presented on bar graphs to show the distribution of the single variable.

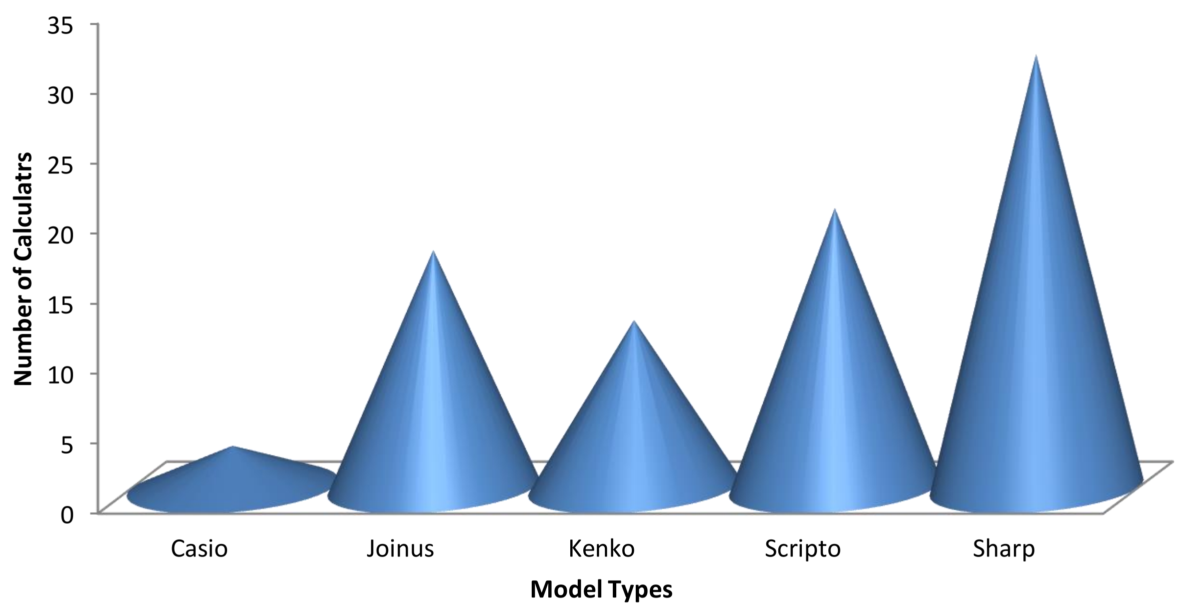
Data from document analysis, interviews and observations is qualitative. It is presented in tables with direct quotations to enhance the presentation of reality.

2 .FINDINGS AND DISCUSSION

2.1 Calculator Prevalence

Findings presented in this study were analysed from 138 respondents, 17 observed lessons, interviews, ZIMSE O-Level mathematics syllabus (4028/2)and 13 mathematics teachers' schemes for content analysis. Out of 138 respondents, 86 reported that they had calculators which they use for mathematics. This was a (62%) calculator prevalence rate. 15 mathematics teachers had no personal calculators. Participants had five calculator models namely : Kenko S.U.P.E.R. (KK-82MS), *Scripto* 925 Scientific calculator, SHARP (EL-531WH) with D.A.L, JOINUS (JS-82MS-3) and Casio (FX-CG50) graphic calculator. These were distributed as shown in Figure 1, below. The majority (36%) had the SHARP (EL-531WH) model.

Figure 1.Distribution of Calculator Models N=86



Asked why most of them have the SHARP (EL-531WH) model:

Teacher X, said: *These Sharp calculators are commonly available in shops and Supermarkets*.

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Student D, said: *They are the cheapest scientific calculators*

These responses support Nyaumwe (2006) who refuted the cost of calculators as a factor for their non use in schools. The teacher's response did not focus on its' utility values, such as the statistical functions. It raised doubt whether that teacher used it for mathematical teaching and learning.

Only three students had the Casio (FX-CG50) graphic calculators. Asked why they bought that model.

Student B, said: *This was bought for me by a brother. Unfortunately, I do not know how to*

use it. My teacher cannot also use it. I will have to sell it and buy another.

Student T, said: *This type of calculator was disallowed by my teacher. She explained to me*

that, ZIMSEC does not accept it. They said it shows all graphs, and you just copy.

We tallied these sentiments with the ZIMSEC's assessment objectives which credit showing of working. This could be the point that the teacher wanted to stress. Unfortunately in this case, the official curriculum as expounded in the syllabus has barred learners from using advanced technology because they are unable to use it themselves.

An education officer supported the student by saying, such calculators puts this candidate at an advantage over others during examinations. He further pointed out that under graphs; the syllabus emphasis is on practical drawing. For example we were referred to these objectives under ZIMSEC O-Level syllabus point(6.5) Graphs and Variation

Table 1, O-Level Graphs and Variation, Content and Objectives

Content	**Objectives**
6.5.1. Coordinates	Use Cartesian coordinates to interpret and infer *from graphs* and to *draw graphs from given data*
6.5.2. Kinematics	*Draw and interpret* velocity, displacement-time *graphs*
6.5.3. Variation	*Draw and interpret graphs* for partial, direct, inverse variation
6.5.4. Functional graphs	*Draw and interpret graphs* given functions Solve simultaneous equations *graphically* Estimate gradient of curve *by drawing tangents* to curve
6.5.4.Area under a curve	Estimate area by *counting squares*

Yes, we agreed that, the syllabus is still emphasising the drawing skills not the form of the graph as shown by the graphic calculator. We noted that summative Norm-referenced national examination which is used for screening learners is a limitation to innovation. We concluded that, the national assessment models have not yet changed to allow technology application in education. Specifically, it currently does not allow graphic calculators to be used in mathematics at secondary school level. This finding contradicts Amanyi and Sigme (2016) who require syllabus objectives which use calculators to enhance understanding of numerical computation and solve real life problems.

Analysis of calculator prevalence by Gender revealed that, 49 (57%) Female participants had their own calculators. One student reported that at form one level, everybody had a calculator. Boys either lost or sold their calculators. They survived by borrowing calculators for tests and examinations. We inferred that, girls were more careful at keeping their calculators. Another perception was that, they kept them securely because to them (girls), calculators provide a lifeline in mathematics.The ZIMSEC policy for learners to bring their own material had school internal management challenges.

Since each calculator has its unique features and is programmed differently, it is not possible for teachers to know them all and assist each student as per student's calculator model. We strongly recommend the use of one calculator model per school, so that teachers can support learners more effectively.

2.2 Calculator Usage in mathematics

Respondents did not supply any example of a lesson on the use of calculators. This suggested that, no teacher taught learners how to use calculators in mathematics. None of the 17 teachers whose schemes of work was analysed had a lesson scheduled for the use of the calculator. Interviews showed that, they took it for granted that learners know how to use calculators. None of them had also schemed as assumed knowledge, checking of learners' calculator skills. We inferred that, while teachers saw pupils using calculators, they did not accord learners' calculator operation skills an equal weighting to that of the mathematics content that they were teaching. On the contrary, learners were taught how to use logarithm tables before they used them.

We recommend that, calculator skills be done as an introduction for all lessons in which the calculator is applied. For example, identification of the square- root ($\sqrt{\ }$) sign, on the calculators' keys must be done as part of the introduction for solving quadratic equations using the formula. The meaning of an Error 2, response must be explained. Learners must try evaluating the square-rootsof at least five numbers including 2 negative numbers as a lesson introduction.

Figure 2.Topic in which Calculators were Applied N =17

Topic	Frequency																
Quadratic Equations	•	•	•	•	•	•	•	•	•	•	•						
Consumer Arithmetic	•	•	•	•	•	•	•	•									
Mensuration	•	•	•	•	•	•	•	•	•	•	•	•	•				
Trigonometry	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Matrices	•	•	•														
Statistics	•	•	•	•	•	•	•										

The dot plot shows that, all (17) teachers whose scheme books were analysed recorded calculator for a teaching learning aid for trigonometry. Calculators were also required for mensuration and quadratic equations. Only three teachers indicated calculators as a teaching aid for matrices. Table 2, shows how the calculators were applied.

Table 2,Mathematics Topic, Content and Example for Calculator Application

Syllabus Topic	Content	Example of where Calculator is Used
Quadratic Equations	Solution using formula	Finding Square-roots $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ Identification of imaginary roots, calculator says Error 2
Consumer Arithmetic	Water and electricity bills Bank accounts	Addition of costs, Calculations of percentages (interests)
Mensuration	Lengths and Area of sectors Volume of pyramids cylinders Area of triangles	Evaluation of formula values $A = \frac{1}{2} ab \sin \theta$
Trigonometry	Ratios	Numerical values of say Tan θ
Statistics	Measures of central tendency	Mean = $\frac{357}{13}$ division
Matrices	Calculation of determinants	Evaluation of determinant

Table 2 examples show that calculator use was limited to the four basic operations and computation. In matrices and consumer arithmetic, calculators were used for addition and subtraction. For trigonometry and mensuration, calculators were used for the numerical values of trigonometric ratios and the multiplication. In fact, they were taken as replacement for logarithm tables. Those students who had calculators had no log-books. While the calculator has the statistics mode for computing the mean, variance and standard deviation, learners were not taught to use them.

When one teacher was quizzed on why they did not show students how to compute mean directly from the calculator, the teacher said that he wanted students to show their working so that they get method marks. As a national examiner in mathematics, the teacher drills students to maximise marks by presenting every part of an answer that national examiners award marks for.

We inferred that, mathematics teachers are teaching for examinations more than learners understanding of mathematics concepts. Such a perception (teaching for examinations) violates the achievement of learner understanding of mathematics for higher levels. Such teachers require mind set re-orientation.

2.3 Factors promoting calculator prevalence

The following factors were considered as promoting the prevalence of calculators in secondary schools in Zimbabwe:

a) The National Science and Technology policy calls for mathematics educators to contribute by teaching learners how to use calculators in mathematical situations in their day-to-day lives.
b) The presence of a ZIMSEC, O-Level mathematics syllabus 4028/2, is a direct provocation for both teachers and learners of mathematics to learn how to use the calculator in mathematical tasks in class and their every-day lives.
c) The school environment (authorities, teachers and students) have a positive disposition to the application of calculators in mathematics. Teachers allow students to bring calculators in their classrooms.
d) Parents are keen and can buy calculators for their children.
e) Teachers who participate in the marking of national examinations can influence the scoring of examination answers to reward students who show ability to use calculators.

Factors affecting Calculator Prevalence

a) National examinations have not yet accommodated calculators in their assessment models. Teachers who are oriented to teaching mathematics for students to pass examinations concentrate on the use of pen and paper solutions which show each stage of working to gain method marks.
b) National mathematics syllabus which emphasise the use of physically drawn graphs compel teachers and students not to use graphical calculators. Actually, graphs are now being drawn by computers in the real world. So such a syllabus, textbooks and teachers are equipping learners with obsolete skills. Shame!!
c) Mathematics textbooks used in secondary schools have nothing on how to use the calculators.
d) Teachers' colleges did not teach students how to use calculators. The ripple effect is that, teachers cannot apply calculators for instruction in mathematics. They have limited knowledge of how the calculator works, what it can and cannot do and how to use it to develop students' understanding of mathematics.

How to Improve Calculator Prevalence

Calculator prevalence (availability and use) can improve if the following recommendations are implemented:

a) The district can set a policy which advocates for the use of one model of calculator in its schools. The district can ask the company to donate calculators for those students who cannot afford.
b) District Education Officer, recruit experts on a part-time contract to write modules on how to use the calculator for different topics in the syllabus.

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c) District officer mounts workshops to teach their mathematics teachers how to use calculators in mathematics classrooms. Each teacher can be given a school handbook on how to use the calculator.
d) Lesson observations by District Schools Inspector can focus on the use of calculators in mathematics instruction.
e) Teachers whose lessons on calculator use are good, can be resource persons for their cluster of secondary schools. They can present the good lessons for others to learn.

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