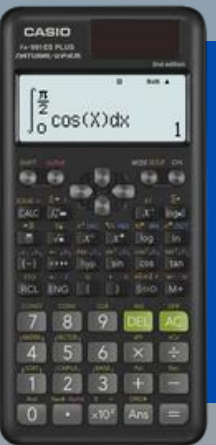


CASIO

UTILIZATION OF SCIENTIFIC CALCULATORS IN MATHS CLASS

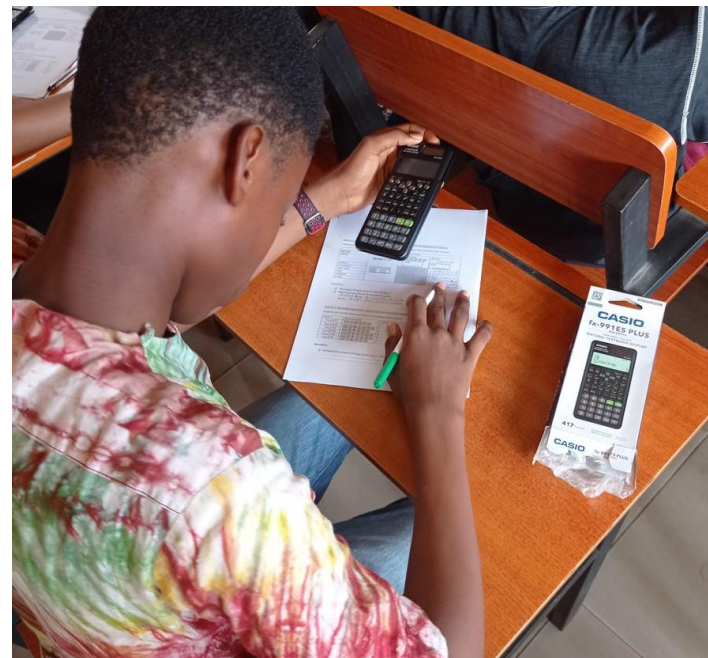
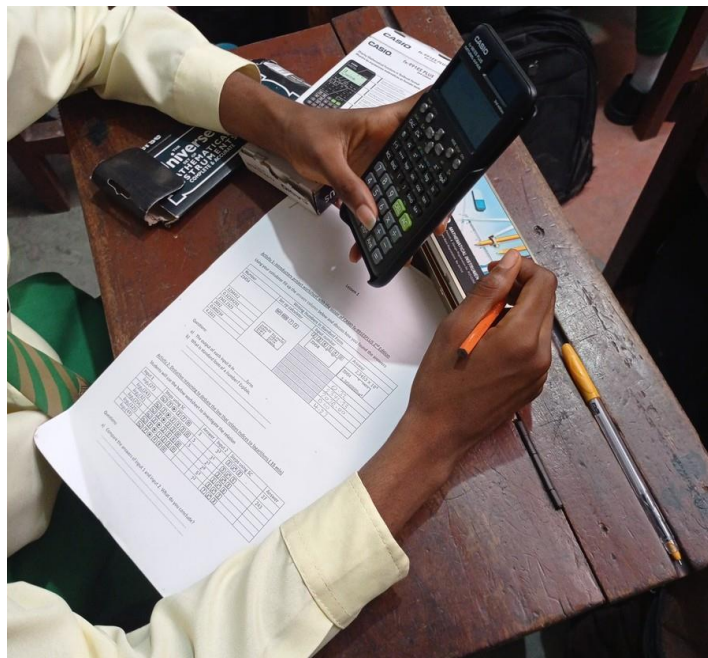
Model School Report

By Dr. Adeneye O. A. Awofala



LAGOS STATE, NIGERIA.





OVERVIEW OF THE CASIO MODEL SCHOOL PROJECT

The CASIO Model School Project was designed In collaboration with the Ministry of Education to improve the academic skill and performance of students using genuine CASIO scientific calculators and inquiry-based learning.



NUMBER AND NAMES OF PARTICIPATING SCHOOLS

6 - BABS Fafunwa; ISL Lagos; ST Timothy College; Mate College; Prudence School; Western College



MAIN ACTIVITIES UNDERTAKEN DURING THE MODEL SCHOOL PROJECT

- Introduction of Inquiry-based learning with quality lesson material;
- Workshop for teachers and students
- Actual lessons at the mathematic classes
- Evaluation of students with and without genuine CASIO scientific calculators.



SUPPORTED BY

Ministry of Education - Lagos State Education Resource Centre

ORDER OF PROJECT ACTIVITIES



School Selection & MOE Collaboration

Collaboration with the Ministry of Education and selection of participating secondary schools.



MOU with Schools

Engagement and agreements with the selected schools.



Teacher Selection & Facilitator Appointment

Selection of participating teachers, PMs and MOE facilitators.



Training of Teachers & Students

Training 12 teachers and 12 PMs on lesson plans and inquiry based learning.



Launching Model School Lessons

Commencement of the Model School Lessons at the participating secondary schools.



Report of Model School Project

Assessment and evaluation of model school project.



Babs Fafunwa Millennium School

Babs Fafunwa Millennium Senior Grammar School was established on the 18th October, 2011 as a new division of the former school Babs Fafunwa Millennium Senior Secondary School along Ogunnusi Road, Ojodu Lagos .



Mate Comprehensive College

Mate Comprehensive High School (MCHS). The schools were established in 1973 and 2000 respectively by the visionary Ven. & Mrs. V.S. Adenugba. Mate Schools have remained the trailblazer in Nigeria's private educational sector.



Prudence City College, Yaba

Prudence City College is designed to be a first class College, a high notch institution established to produce rounded students, soul and body. The College is located in the central business district of Yaba.



St. Timothy's College, Iwaya

St Timothy's college is a secondary school located at Timothy bus-stop in iwaya. The progressive school mission is to raise vessels of honor to impact positively on the society and the Country in general.



Western College, Yaba

Western College, Yaba was founded in 1959 as a co-educational secondary school. It is located at 9/11Ajayi Street, Onitiri Yaba. The school is divided into two main blocks, consisting of modern classrooms, laboratories and staff rooms



ISL, Lagos

International School, University of Lagos, otherwise known as ISL, was founded on November 9th, 1981 as a day school and has educated many generations of young men and women.

This study, conducted in Lagos state, aimed to investigate the influence of scientific calculators on high school students' learning outcomes in mathematics. A quasi-experimental research design was employed, involving two distinct groups:

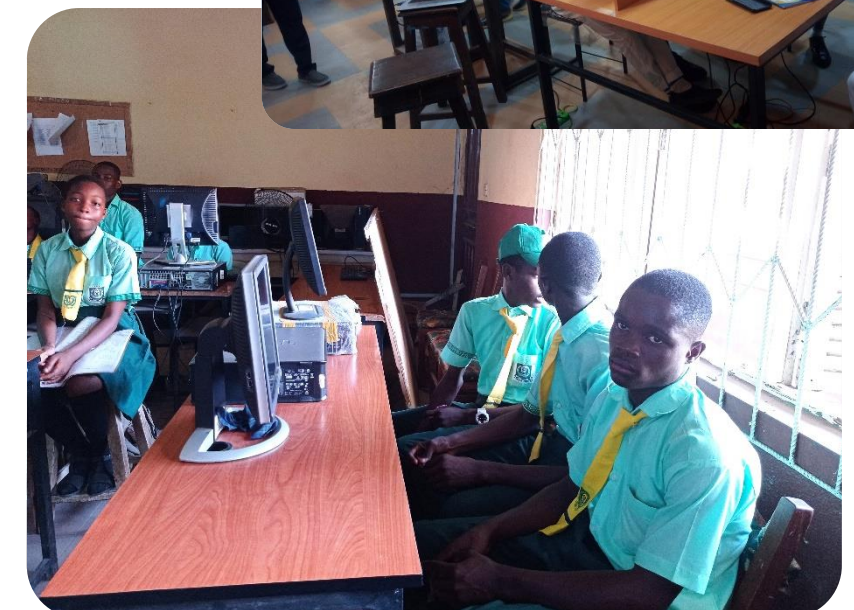
- Experimental group: 92 students using calculators
- Control group: 89 students without calculators

Both groups focused on the study of logarithm and its applications, with the experimental group utilizing scientific calculators. Data was collected using five evaluative instruments and analyzed through descriptive and inferential statistics.

Key findings from the study include:

- A significant difference in favor of students who used calculators was observed for most test questions in the assessments.
- No notable difference was detected in the pre-attitude towards mathematics between the two groups.
- A substantial difference in post-attitudes towards mathematics was identified, favoring the calculator-using group.

In conclusion, the use of scientific calculators in activity-based mathematics instruction has been shown to positively impact students' achievements and attitudes towards mathematics. These findings offer valuable insights for educators in developing strategies to support struggling learners.



This research aimed to investigate the impact of using or not using calculators on student performance in basic mathematics calculations and their attitudes towards mathematics. The study employed an action research design with an embedded quasi-experimental study.

Research Goals

Assess the effect of calculator usage on student performance in basic mathematics calculations.

Evaluate the impact of calculator usage on student attitudes towards mathematics.

Methodology

Action research was used to solve classroom problems and improve professional practices.

Instructions on using scientific calculators to solve basic math problems were provided.

A quasi-experimental study with a pretest-posttest design was conducted.

The control group (89 students) solved mathematics problems without any technological device, while the experimental group (92 students) used scientific calculators as learning aids.

Data Collection

Five evaluative instruments were developed:

Mathematics Assessment 1 (MA1) - 3 questions on logarithm and its application

Mathematics Assessment 2 (MA2) - 4 questions on logarithm and its application

Final Mathematics Assessment (FMA) - 4 questions on logarithm and its application

Pre-Attitude towards Mathematics Scale - 9 items

Post-Attitude towards Mathematics Scale - 19 items

Reliability

Kuder-Richardson 20 was used to assess the reliability of the assessment tests, yielding the following coefficients:

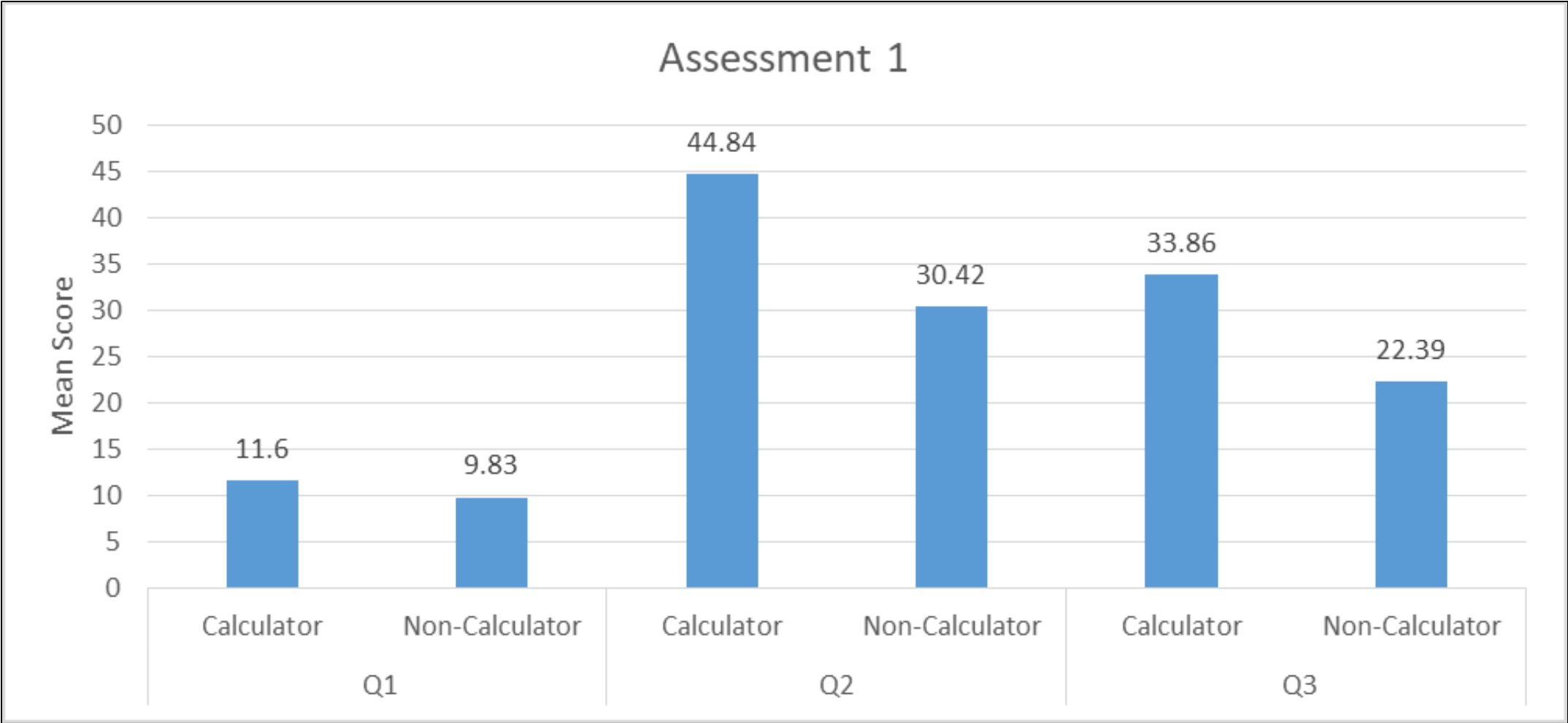
MA1: $\alpha=0.84$

MA2: $\alpha=0.86$

FMA: $\alpha=0.85$

Pre-Attitudes towards Mathematics Scale: $\alpha=0.89$

Post-Attitudes towards Mathematics Scale: $\alpha=0.88$



Assessment/Test Question	Group	Mean Score	Conclusion
Q1	Calculator	11.6	Significant difference in favor of students who used calculator
	Non-Calculator	9.83	
Q2	Calculator	44.84	Significant difference in favour of students who used calculator
	Non-Calculator	30.42	
Q3	Calculator	33.86	Significant difference in favour of students who used calculator
	Non-Calculator	22.39	

Question 1: (2.5 marks)

To measure the Richter Magnitude, students will use the formula $M = \log\left(\frac{I}{I_0}\right)$ where I is the intensity of earthquake and I_0 is the standard intensity .

Suppose that $I = 9800I_0$. Calculate the Richter Magnitude.

.....

.....

.....

Question 2: (10 marks)

Given $A: 8 = 10^{0.9031}$, $B: 10000 = 10^4$, $C: 84 = 10^{1.92428}$, and $D = 8.9$

- a) Write A, B and C in logarithmic form.
.....
.....
.....
- b) Calculate logarithm of D. (Round your answer to nearest thousandths)
.....
- c) Calculate logarithm of 8900. (Round your answer to nearest thousandths)
.....
- d) Compare the integer and decimal fraction parts of $\log D$ and $\log 8900$
.....

Question 3: (7.5 marks)

a) Complete the table below, to calculate the height of a plant in cm after given number of weeks

Use formula $h = \log(w)$, where 'h' is the height of the plant and 'w' is the number of weeks

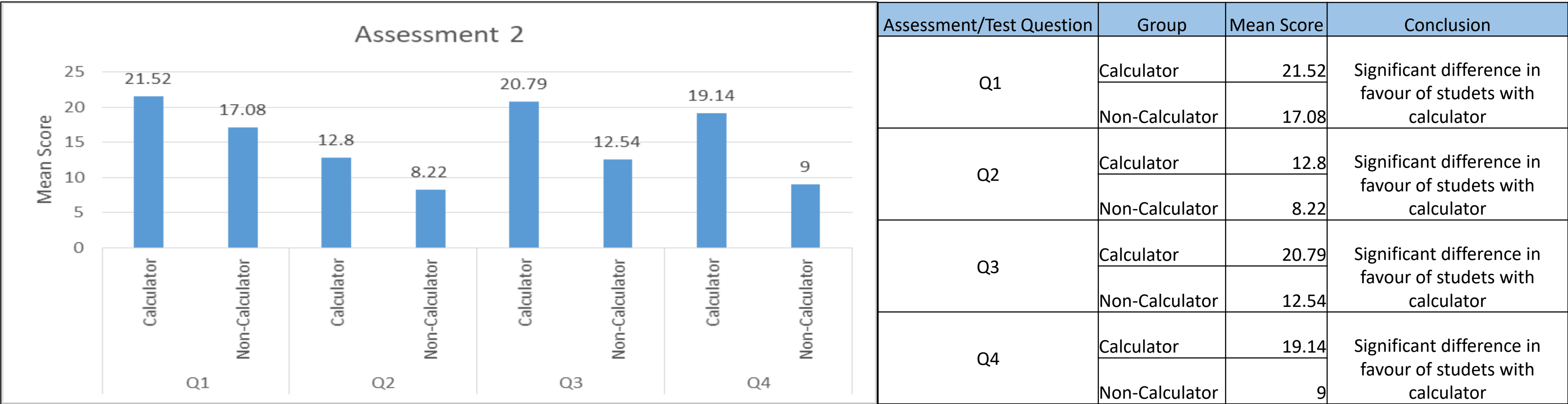
Number of Weeks	5	10	15	25
Height				

- b) In which week the plant height is between 1.1cm and 1.2cm?
- c) Knowing that the max height of the plant is 3.5 cm, if the plant height was measured on week 450 is there a potential for the height to increase? Follow the questions below to investigate

i. Calculate the height of the plant on week 450.
.....

ii. Compare the height of the plant on week 450 with the max height.
.....

iii. Will the plant height increase? Justify your answer.
.....
.....



Part 1 (direct answers) (2 marks)

- 1) Find the antilogarithm of each
- i. 2.1814

ii. 3.4485

iii. 0.5742

iv. 1.1091

2) Calculate the product and quotient of each using logarithmic method (2 marks)

- i. 53.78×27.39

ii. 89.13×13.19

iii. $12394 \div 125$

iv. $45223 \div 56$

Part 2 Case Study (16 marks)

In this case study you will investigate the rate growth change from year to year, And to predict the total number of population in the next 5 years.

You will use the following formula to calculate the rate growth of a certain population

$r = \log(\frac{p}{p_i}) \div 0.434$

Where *r* is the rate growth change in decimal

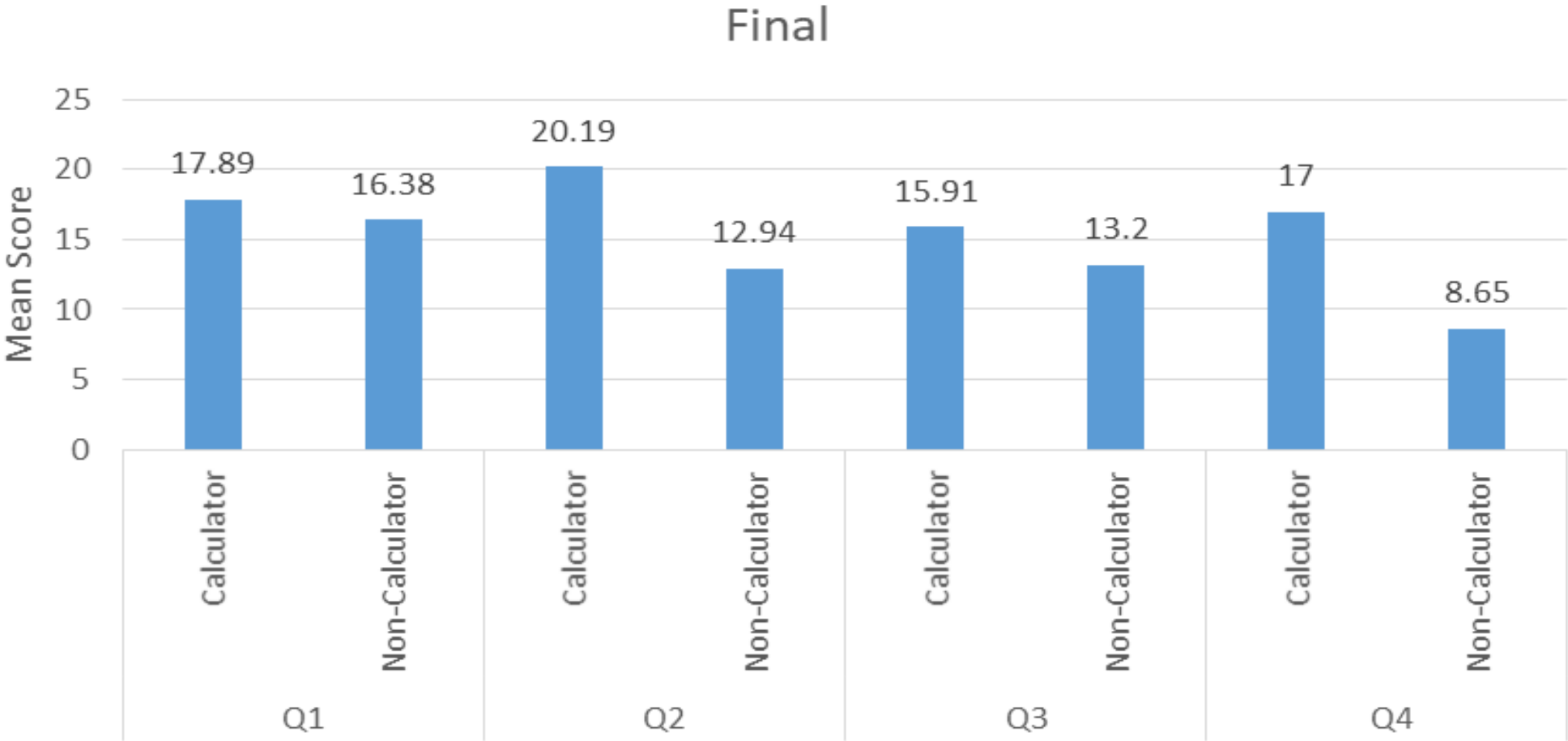
r is the rate growth change in decimal
P is the current count of population
P_i is the count of the population in previous year

Calculating the population growth rate over time

Fill the table below knowing that the total population in a certain country was 2,123,555 in 1940

Round your answer to nearest thousandths

Year	1950	1960	1970	1980	1990	2000
Population	2,345,567	2,567,789	2,785,456	3,456,341	3,785,433	4,000,456
r						



Assessment/Test Question	Group	Mean Score	Conclusion
Q1	Calculator	17.89	No significant difference
	Non-Calculator	16.38	
Q2	Calculator	20.19	Significant difference in favour of students with calculator
	Non-Calculator	12.94	
Q3	Calculator	15.91	No significant difference
	Non-Calculator	13.2	
Q4	Calculator	17	Significant difference in favour of students with calculator
	Non-Calculator	8.65	

Question 1: (2 marks)

What is the logarithm of each number? Round your answer to nearest thousandths

Direct question

- a) $\text{Log } 345.17 =$
- b) $\text{Log } 2912.194 =$
- c) $\log 1000^4 =$
- d) $\log 19.5 + \log 28.16 =$

Question 2: (2.5 marks)

Logic Questions

Answer by True or False

- a) $\text{Log } 23.8 = x$ then $x = 23.8$
- b) $\log 1000 = 3$ then $10^3 = 1000$
- c) Given $10^7 = 10000000$, and $\log x = 7$ then $x = 10$
- d) antilogarithm of 4 is 10000
- e) antilogarithm of 2.3 is 199.526 (answer is rounded to nearest thousandths)

Question 3: (4.5 marks)

Use logarithmic method to calculate the following (your answers should be rounded to the 9th decimal place)

Direct question

- a) $4578 \times 29.7 =$

No	Log

Part 2: Case Study (11 marks) Case Study

American Wire Gauge (AWG) is a system of numerical wire sizes, in this case study you will calculate the AWG size wire.

The formula to calculate the AWG size wire is given by $n = 36 - 19.7 \times \log\left(\frac{d}{0.127}\right)$

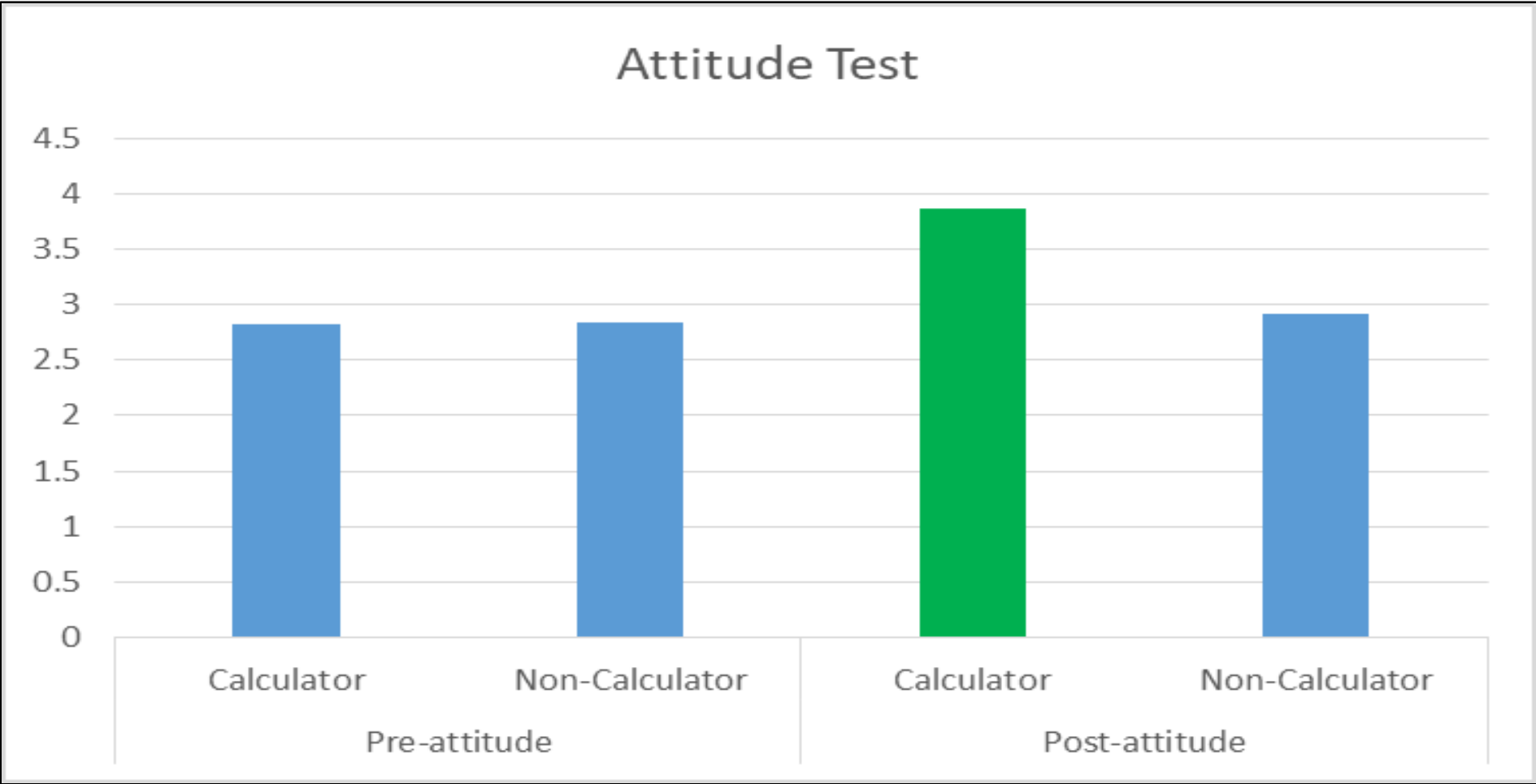
Where ' n ' is the AWG size wire
and ' d ' is the diamtere in of the wire

Note: round your answers to nearest ones

- a) Fill the table below

	Wire 1	Wire 2	Wire 3
d	1.15	0.511	0.08
n			

- b) Wire 1 diameter is multiplied by 5, use the logarithmic method to calculate the answer of the new diameter.



Assessment/Test Question	Group	Mean Score	Conclusion
Pre-attitude	Calculator	2.82	No significant difference
	Non-Calculator	2.84	
Post-attitude	Calculator	3.86	Significant difference in favor of students who used calculator
	Non-Calculator	2.91	

Pre Attitude test

The 92 students who used calculators in the experimental group (M=2.82, SD=0.561) compared to the 89 students in the control group that did not use calculators (M=2.84, SD=0.54) did not demonstrate significantly better pre-attitude towards mathematics, $t(179)=0.24$, $p=.64$. Thus, there was no significant difference in the pre-attitude towards mathematics between students that used calculators and those that did not use calculators.

Post Attitude test

The 92 students who used calculators in the experimental group (M=3.86, SD=0.23) compared to the 89 students in the control group that did not use calculators (M=2.91, SD=1.14) demonstrated significantly better post-attitudes towards mathematics, $t(179)=7.71$, $p<.01$. Thus, there was a significant difference in the post-attitudes towards mathematics between students that used calculators and those that did not use calculators in favour of those that used calculators.

After Test					
Attitude test of students towards Scientific Calculator					
School.....Grade.....		Date.....			
Major.....					
Instruction To what extent do you agree or disagree following questions? Mark X to identify the level of your impression.					
	Statement	Level of Impression			
		Most	very	less	least
1	I like learning Mathematics.				
2	When I learn mathematical formulas, I try to prove it and to understand the meaning.				
3	I am good at getting important information from graphs.				
4	I can make a persistent effort to solve Mathematics problems.				
5	I try to use concept or/and knowledge that I already have when solving Mathematics problems.				
6	I reflect my answering process after solving problems.				
7	I want to research in-depth about what I learn in Mathematics class.				
8	I find something in common or different when I listen what my friends say.				
9	I am interested in calculation with Scientific Calculator.				
10	I enjoyed the lesson with Scientific Calculator more than usual.				
11	I could try solving difficult problems by using Scientific Calculator more than usual.				
12	I could pay more attention to Mathematics class if teacher allow to use Scientific Calculator.				
13	I could save time to learn Mathematics by using Scientific Calculator.				
14	I could find a formula through enough calculation practice with confirmation.				
15	I think Scientific Calculator is suitable for learning Mathematics.				
16	How much did you enjoy this type of lesson, which rather values your thoughts and idea with more discussions.				
17	I want to take this type of lesson in other units, too.				
18	I think that my understanding in this lesson is better than usual.				
19	I think that using the Scientific Calculator is easy.				

This study highlights the benefits of integrating scientific calculators into mathematics teaching and learning. The use of scientific calculators, such as CASIO, can enhance students' motivation, achievement, and attitudes towards mathematics, particularly in activity-based instruction.

Key Findings

- CASIO Scientific calculators help increase student engagement and achievement in mathematics.
- Activity-based instruction based in Inquiry based learning with calculators can improve students' attitudes towards mathematics.
- CASIO calculators assist all students, including struggling learners, by reducing computational errors and increasing conceptual understanding, leading to procedural fluency in mathematics.

Benefits of CASIO Scientific Calculators

Efficiency: As mentioned earlier, calculators can help students solve complex problems more quickly and accurately than they would be able to do by hand. This can be especially useful in time-limited exams or when solving problems with large numbers or decimals.

Accessibility: Calculators can help make mathematics more accessible to students with disabilities or those who struggle with arithmetic calculations. For example, students with dyscalculia may find it difficult to perform basic arithmetic operations, but can still use calculators to complete math problems.

Real-world applications: In many fields, including science, engineering, finance, and accounting, the use of calculators is essential for solving complex problems quickly and accurately. Therefore, it is important for students to become proficient in using calculators to prepare them for future careers.

Advanced concepts: Calculators can help students explore more advanced mathematical concepts, such as graphing functions and solving equations. This can help students gain a deeper understanding of mathematical principles and prepare them for more advanced coursework in the future.

Aspect	Fake Calculators	Genuine CASIO Calculators
Accuracy	Display incorrect or misleading results	Provide accurate and reliable results
Impact on Learning	Cause confusion, frustration, and misconceptions	Enhance understanding of mathematical principles and problem-solving
Development of Math Skills	Hinder development of necessary mathematical skills	Support development of mathematical skills when used appropriately
Trust and Authenticity	Erode trust between teachers and students	Foster trust between teachers and students
Assessments and Grading	Undermine the integrity of assessments and grading	Support fair assessments and grading
Use during Exams and Workforce	Problematic when calculators are not allowed	Useful when calculators are permitted
Support for Students with Needs	No specific support	Beneficial for students with disabilities or those struggling
Role in Pedagogical Discourse	Can negatively impact educational technology integration	Can be a sustainable alternative for educational technology
Usage Recommendations	Teachers and students should avoid using fake calculators	Teachers and students should use genuine calculators responsibly





DIGITISED CURRICULUM, TABLETS FOR TEACHERS AND INTRODUCTION OF CASIO CALCULATORS: LAGOS STATE EDUCATION IS AT THE FORE OF TECHNOLOGY.

Mrs Akinlade Omolayo
Director, Lagos State Education Resource Centre
Lagos State Ministry of Education

The Lagos State Ministry of Education is looking forward to replicating this model school project across other Educational Districts- from 1 to 5. We started with District 6 but we want to give all students across the state access to the CASIO calculator. I welcome CASIO to Lagos State, there are a lot of things we need to do together to take Lagos State Education to a higher level and I believe this is just the start. We are looking forward to collaborating with CASIO to drive student performance and improve appetite for learning- not just for mathematics but other subjects like Economics that require calculations and problem solving.





WE ARE PROUD TO HAVE HOSTED THE TEACHER TRAINING AND SUPPORTED THIS GREAT INITIATIVE

Mr. S.O Olamoyegan
Principal, Western College, Yaba.

Western College is proud to have been chosen to host the teacher and facilitator training for this great and very important project. Technology is the gateway to success in this new world and we are thrilled to be introducing it as a fixture in our educational practice here in Nigeria. We saw instantly, the impact of genuine CASIO calculators in the performance of our students.



WE WITNESSED A PARADIGM SHIFT FROM THE OLD WAYS TO TECHNOLOGY BASED LEARNING

Mrs Bose Kuwanta
Principal, Mate Comprehensive College.

It was exhilarating to watch the students thirst for knowledge and apply what they learned to produce their solutions quicker. I have to laud CASIO and the government for this great initiative. The Calculators made the students happy and we appreciate this as a school. We are adding the CASIO calculators to our textbook package so every student can have access to it and benefit.



THE ONLY WAY TO ENHANCE STUDENT PERFORMANCE IS WITH TECHNOLOGY.

Mr. Akinsola Akinwoye
Principal, Prudence City College, Yaba.

We saw during the CASIO model school project how the introduction of authentic calculators improved the standard of learning and encouraged student participation in mathematics. It is clear that continued use of technology in the classroom will help develop new skills, make learning easier, more fun and encourage students to be creative and confident.



EDUCATIONAL MATERIALS NEED TO BE UP TO PAR FOR NIGERIAN STUDENTS TO COMPETE WITH THEIR PEERS AROUND THE WORLD.

Mr. Abiodun Ezekiel
Principal, St. Timothy, Iwaya.

I am greatly satisfied with the project and applaud CASIO for selecting our school and being intentional about boosting education and helping students learn STEM subjects with particular attention to mathematics. The world has gone global; educational materials and resources need to be up to par so that Nigerian students can compete favourably with their peers around the world.



THE GOVERNMENT SHOULD SUPPORT MORE INITIATIVES LIKE THE CASIO MODEL SCHOOL PROJECT.

Mrs. Osurinde A. O
Babs Fafunwa Millennium School.

I am very impressed with the initiative, particularly the level of enthusiasm and willingness on the student's part to learn mathematics. I want the government to do more in encouraging initiatives like the CASIO Model School Project- the CASIO scientific calculators has really helped in simplifying and ensuring that students are able to understand basic maths problems like logarithm and so on



Dr. Adeneye O. A. Awofala is a highly qualified researcher in Nigeria who has made significant contributions to the field of mathematics education. He holds a PhD, M.Sc., M.Ed., B.Ed., N.C.E., CCA, and DIM from various institutions, which demonstrates his extensive academic background and expertise.

Dr. Awofala has been involved in data analysis for over two decades using different software, and he has analyzed datasets leading to the publication of numerous journal articles. He has over 90 publications in mathematics education that are visible on Google Scholar, Loop, ORCID, Research Gate, and Academia.

<https://scholar.google.com/citations?user=5gA7tz4AAAAJ&hl=en>

Dr. Awofala's research interests include mathematics education, educational technology, curriculum development, and teacher education. He has served as a consultant to several organizations on issues related to mathematics education and has received several awards for his contributions to the field.

Overall, Dr. Awofala is a highly respected researcher with extensive experience in data analysis and a strong track record of publications in mathematics education.

