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Influence of Computer Aided Assessment for Mathematics Assessment of Students with Hearing Impairment in Federal College of Education (Special) Oyo

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Abstract
The study examined the use of Computer Aided Assessment (CAA) in Mathematics assessment of students with hearing impairment at Federal College of Education (Special), Oyo. The study adopted a descriptive research design. The population consists of all the seven (7) Mathematics lecturers in the mathematics unit, Department of Science Education, School of General Studies Education and the nine (9) lecturers in Mathematics department, School of Science, Federal College of Education (Special), Oyo. This makes the population of sixteen (16) Mathematics lecturers. Total enumeration of the population was used as the sample. A Self-constructed and validated questionnaire tagged "CAAMASHI" was used with reliability coefficient 0.89 gotten from cronbach alpha. Two research questions guided the study. The finding reveals that the level at which Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo are used is slightly high and challenges faced based on the study are epileptic power supply, low availability of computers, Mathematics questions involving manipulations and simplifications are not easy to answer using CAA, Unstable internet services, sign language literacy, ICT facilities for mathematics assessment are obsolete. Based on the study, it was recommended among others that the college management should integrate CAA platforms into the mathematics assessment policy to ensure consistent use for students with hearing impairment.

Keywords: CAA, ICT, Mathematics, assessment, students with hearing impairment

Introduction

Mathematics remains a core subject in Nigeria's education system because it develops logical reasoning, problem-solving, and analytical skills. However, students with hearing impairment often face unique barriers in mathematics assessment. Traditional paper-and-pencil tests rely heavily on verbal instructions, teacher-student interaction, and timely feedback - areas where hearing-impaired learners are at a disadvantage.

Mathematics is a subject taught at all levels of education, including preschool, primary, secondary, technical, and postsecondary institutions. Mathematics can be defined as the "queen" of the sciences, without which individuals would find it difficult to study other sciences such as physics, chemistry, biology, computer science, and information technology (Alechenu, 2022). It

is hopeful that our administration would appropriately handle the subject of scientific transformation of our developed dynamics and processes as a nation, highlighting the significance of science and technology to national development (Lang & Pagliaro, 2007).

Only after an appropriate evaluation and assessment method has been implemented can the attainment of educational objectives in the classroom be ascertained. Furthermore, regardless of the format, it is widely accepted that assessment is essential to student learning. Because of this, the evaluation and assessment process is extremely important to the teaching and learning process. Assessment is more of a gauge of learning process success using quantifiable methods, whereas evaluation is a broader idea and more of a judgmental process. Teachers must therefore evaluate their students in order to ascertain whether their efforts were successful or not, the students' comprehension level, and the efficacy of the teaching method used, among other things. The foregoing is the reality as far as education of essential disciplines such as mathematics is concerned.

No matter how much you shied away from mathematics in school, it still follows you like a monster in everyday life. The value of mathematics transcends all definitions. It is unavoidable, no matter how hard you try. Therefore, the fact that mathematics is one of the core subjects taught in Nigerian primary and post-primary schools and that it is a prerequisite for admission to the nation's post-secondary institutions (i.e., obtaining a pass credit level) is a clear indication of the subject's importance in Nigerian education. Additionally, those who excel in mathematics have access to employment prospects and recruitment exercises into security agencies. Mathematics-based questions make up aptitude examinations for jobs, promotions, and placement (Qi & Mitchell, 2012). These are important arguments for why mathematics is important for each person's achievement and personal growth. There is widespread agreement at the national and international levels that, in the twenty-first century, economic development, viability, and stability are exclusively dependent on science and technology. This implies that a country's economic growth is mostly dependent on its scientific and technological advancements, which are impossible to achieve without a solid, efficient, and effective mathematics education (Fajemidagba, 2023).

Information and communication technology (ICT) is one invention that has persisted in having a direct impact on the evaluation of mathematics teaching and learning activities in specific as well as the process of teaching and learning mathematics in general. The use of ICT in both public

IJOGSE 2026

and private exams, such as the Unified Tertiary Matriculation Examinations (UTME), Post-UTME, and others, is proof of this. ICTs are also being used by both public and private higher education institutions to evaluate their students. Additionally, the development of Information and Communication Technology (ICT) has led to new advancements in the execution of the majority of our everyday mathematical tasks.

Since ICTs are changing society and impacting every facet of existence, this has affected almost every part of our everyday lives and important economic sectors. Because ICTs give teachers and students additional chances to tailor instruction and learning to individual requirements, the effects are becoming more noticeable in the education sector. In developing nations like Nigeria, ICTs are thereby expanding access and enhancing the quality and relevance of education. ICT has the following potential: ICTs make it much easier to learn and absorb information, giving developing nations previously unheard-of chances to improve educational institutions, better formulate and implement policies, and expand prospects for business and the underprivileged.

As stated above, the application of ICT in mathematics teaching, learning and assessment is an innovation that is gradually gaining ground and which needs to be given more attention as ICT is speedily revolutionizing the world. This aspect of ICT adopted for assessment purpose is usually termed Computer Aided Assessment (CAA). Computer-Aided Assessment can be defined as 'any instance in which some aspect of computer technology is deployed as part of the assessment process' (Atkinson & Davies, 2020). thus, computer-aided assessment would employ the following use of computer technology:

i) the online completion of interactive exercises and tests
ii) online marking of assignments and exercises
iii) the use of revision software
iv) electronically mailed coursework
v) marks and feedback
vi) web pages to set tasks for students and to provide tutor support
vii) the use of spreadsheets or databases to keep records of students' marks
viii) software to detect plagiarism.

It can also be stated that CAA is one method that helps students to engage actively with their subject and further make mathematics teachers job easier as it allows marking, immediate feedback, the recording of student scores, and the analysis of student performance to be

IJOGSE 2026

processed by computer and thus alleviate the burden on educators (Billings, 2024; Okpala, Okoye & Anene, 2018; McKenna & Bull, 2020; Musham, 2024).

The need for CAA in mathematics is further supported by the fact that traditional assessment methods in higher education need to be reevaluated because they are not appropriate for the digital age, where using information is more crucial than retaining it. Paper-based evaluation is one type of traditional assessment method. Certain skills are difficult to evaluate on paper. Conversely, computer-based assessment technology offers students more rapid and insightful feedback on their progress, expands the scope of abilities that may be evaluated, and diversifies assessment activities.

The growing use of information and communication technology to improve learning in higher education worldwide naturally leads to the consideration of online and computer-based evaluation. Thus, it is also necessary to make mathematics assessment adaptable, which CAA makes possible. Additionally, academic unions in Nigeria, including the Academic Staff Union of Universities (ASUU), the Colleges of Education Academic Staff Union (COEASU), and the Academic Staff Union of Polytechnics (ASUP), among others, strike due to the growing academic workload in higher education.

The use of ICT through Computer Assisted Assessment (CAA) will continue to spark increasing interest because assessment is a crucial catalyst for student learning and higher education institutions are under significant pressure to measure mathematics learning outcomes more explicitly. Although promised productivity is not assured, it is commonly agreed that information and communications technology (ICT) has the ability to automate several parts of teaching and learning mathematics. Therefore, CAA has a great deal of promise to both reduce the burden of mathematics assessments and offer creative and effective methods of doing so (Kolawole, Oladosu & Ajetunmbis, 2023).

The population boom in higher education institutions, the rise in ICT use, the diversity of students, budgetary restrictions, and the transition from quality assurance to quality enhancement all contribute to the need for this discussion regarding CAA in mathematics assessment. According to research, increasing the number of tests, assignments, or exams given to pupils increases their pass percentage (Bull & Danson. 2004). Thus CAA not only serves as a mode of easing the pressure causes by overpopulation, it also improves the academic performance of students. However, indicated that it is not feasible to test the higher-level cognitive skills using

IJOGSE2026

CAA within mathematics (Tshibalo, 2007). This view was corroborated by another finding, which stated that CAA is just a *tool*, and it has some uses while not claiming to achieve everything (Paterson, 2022).

Increased enrollment in higher education institutions, particularly hybrid and inclusive settings like Federal College of Education (Special), Oyo, which accommodates all kinds of learners and hence causes a spike in the student population, is of particular importance to this research. Students with varied degrees of hearing impairment are among these students with special needs. The complete or partial incapacity to hear is known as hearing impairment. This suggests that both total and partial hearing impairment are possible. Although they are not the same, hearing impairment and deafness are related disability categories. The Individuals with disability education act (IDEA) defines hearing impairment as an impairment of the hearing, whether permanent or fluctuating, that adversely affects a child's educational performance but is not included under the definition of deafness (Sangwin, 2022). In most cases, a hearing loss of below 90 decibels is considered a hearing impairment. A student with hearing impairment may experience difficulty in: the subject of grammar, spelling and vocabulary, taking notes while listening to lectures, participating in classroom discussion, watching educational videos, presenting oral reports (Lasak, 2024).

With the growth of Information and Communication Technology (ICT), Computer Aided Assessment (CAA) has emerged as an alternative that can provide visual, interactive, and self-paced evaluation. CAA tools can incorporate sign language videos, captions, diagrams, and immediate feedback, which may reduce communication barriers and test anxiety for students with hearing impairment (Bouck & Flanagan, 2009). In spite of this potential, little research has been done on the use of CAA specifically for mathematics assessment in Special Colleges of Education in Nigeria.

The theory is grounded in the Universal Design for Learning (UDL) theory by Rose and Meyer (2002). UDL posits that assessment should provide multiple means of representation, expression, and engagement to accommodate learner variability. In the context of this study, CAA serves as a UDL tool that makes mathematics assessment more accessible to students with hearing impairment by reducing linguistic and auditory barriers and providing flexible, visual, and interactive modes of assessment.

IJOGSE 2026

In addition, mathematics is a general course in the college in form of courses in general studies unit of the college. Also, CAA has been in use in the college for sometimes now. It is thus necessary to examine the use of ICT/CAA in assessing students with hearing impairment in mathematics within the scope of Federal College of Education (Special), Oyo.

Statement of the Problem

Students with hearing impairment in Federal Colleges of Education (Special), Oyo often underperform in mathematics not necessarily due to low ability, but due to assessment methods that do not accommodate their communication needs. If CAA can provide accessible, accurate, and engaging assessment, it may improve both performance and achievement in mathematics.

Assessing students with hearing impairment in mathematics teaching and learning is necessary at higher institutions level. However, due to population boom being experienced by these institutions, especially the Federal Colleges of Education (Special), Oyo which accommodates students with all categories of special needs, those with hearing impairment inclusive. It is thus necessary to adopt a technology-based time and energy saving approach so as to improve efficiency and quality. Computer Aided Assessment (CAA) can be adopted to achieve this as it reduces times, energy and also ease management of students. It is thus necessary to investigate the use of CAA in assessing students with hearing impairment in mathematics at Federal College of Education (Special), Oyo using CAA.

Research Questions

The following research questions guided the study

1. What is the level of usage of Computer Aided Assessment in Mathematics assessment for students with hearing impairment at Federal College of Education (Special, Oyo)?
2. What are the challenges of using Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special, Oyo)?

Methodology

Descriptive research design was adopted. The population consists of all the seven (7) Mathematics lecturers in the mathematics unit, Department of Science Education, School of General Studies Education, and the nine (9) lecturers in Mathematics department, School of Secondary Education (Science Programmes), Federal College of Education (Special), Oyo. This makes the population of sixteen (16) mathematics lecturers.

IJOGSE2026

Total enumeration of the population was used as the sample. A Self-constructed Questionnaire titled "Computer Aided Assessment in Mathematics Assessment of Students with Hearing Impairment" and tagged "CAAMASHI". The instrument is a 20-items instrument divided into two sections A and B with each section measuring each of the research questions. Each item is answered using likert scales of strongly agree, agree, disagree and strongly disagree with coded values of 4, 3, 2 and 1 respectively.

The instrument was validated by two chief lecturers in the Mathematics department and a chief lecturer in the department of education students with hearing impairment, Federal College of education (Special), Oyo. Cronbach alpha was used to test the reliability coefficient of 0.89 after administration of the instrument on ten (10) lecturers of the same school who are into mathematics related courses but not a sample in this study. The analysis of the instrument was done using descriptive statistics of frequency counts, simple percentage, Mean and Standard Deviation (S.D). 2.5 is considered as the standard mean. Weighted mean greater or equal to 2.5 is considered to be a factor or positive while below 2.5 is considered not to be a factor or negative.

Results

The results were analysed based on the stated research questions as follows;

Research Question One: What is the level of usage of Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo?

Table 1: Mean scores of Level of usage of Computer Aided Assessment in Mathematics assessment for students with hearing impairment at Federal College of Education (Special, Oyo)

S/N	Item statement	Mean(x)	S.D	Remarks
1.	Mathematics continuous assessment tests are conducted for students with hearing impairment using CAA.	2.87	0.07	Accepted
2.	Mathematics classwork is usually given to students with hearing Impairment using CAA.	2.84	0.88	Accepted
3.	Traditional method of assessing mathematics is usually adopted in my classroom.	3.97	0.05	Accepted
4.	Students gets immediate feedback on their mathematics scores through the college portal or their personal email	2.79	0.09	Accepted

IJOGSE 2026

5.	Students with hearing impairment always use internet to solve mathematics assignments	2.78	0.86	Accepted
6.	I find it convenient using CAA to assess students with hearing impairment as markings is made easier.	3.86	0.94	Accepted
7.	Students with hearing impairment writes their semester examinations using CAA, so this has prepared them ahead.	3.85	0.88	Accepted
	Weighted Mean	**2.94**		

The above table further revealed a weighted mean of 2.94 out of the maximum obtainable score of 4.00 which is slightly higher than the standard mean of 2.5. This reveals that the level of usage of Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo is slightly high.

Research Question 2: What are the challenges of using Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo?

Table 2: Challenges of using Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special, Oyo)?

S/N	Item statement	Mean(x)	S.D	Remarks
1.	Epileptic power supply is a serious hindrance toward adoption of CAA in mathematics assessment of SHI	3.25	1.15	Accepted
2.	The available computers are not enough given the high population of students with hearing impairment	2.99	1.08	Accepted
3.	Mathematics questions involving manipulations and simplifications are not easy to answer using CAA	3.31	0.98	Accepted
4.	Unstable internet services can disrupts CAA mathematics assessment sessions for SHI	3.28	0.96	Accepted
5.	I am not versed in sign language and this prevent me from passing information across during CAA sessions.	3.05	1.18	Accepted
6.	Available ICT facilities for mathematics assessment are obsolete.	2.57	0.89	Rejected
7.	I am not skilled in ICT usage	2.18	1.08	Rejected
8.	Frequent changes in ICT policies is preventing use of	2.15	1.14	Rejected

IJOGSE 2026

CAA in mathematics assessment for SHI	
Weighted Mean	**2.85**

The above table further revealed a weighted mean of 2.85 out of the maximum obtainable score of 4.00 which is slightly higher than the standard mean of 2.5. This shows that the challenges of using Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo are epileptic power supply, low availability of computers, Mathematics questions involving manipulations and simplifications are not easy to answer using CAA, Unstable internet services, sign language literacy, ICT facilities for mathematics assessment are obsolete.

Discussion of Findings

The study revealed that the level of usage of Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo is slightly high. This level of the usage of Computer Aided Assessment for Mathematics Assessment of Students with hearing impairment in Federal College of Education (Special) Oyo is fair. This is in corroboration with the study of Lasak (2024).

Furthermore, the study revealed the challenges of using Computer Aided Assessment in Mathematics for students with hearing impairment at Federal College of Education (Special), Oyo which are

1. epileptic power supply,
2. low availability of computers,
3. Mathematics questions involving manipulations and simplifications are not easy to answer using CAA,
4. Unstable internet services,
5. sign language literacy and
6. ICT facilities for mathematics assessment are obsolete.

The finding is in line with the studies of Billings (2024), Okpala, Okoye & Anene (2018), McKenna & Bull (2020) and Musham (2024).

Conclusion

It can be deduces from the findings that Computer Aided Assessment is very crucial in tackling the challenge of population explosion in higher institutions like Federal College of Education

IJOGSE 2026

(Special), Oyo, especially to tackles the twins challenges of overpopulation as well as communication challenges of students with hearing impairment by incorporating instructions and other necessary information in the questions. This will not only resolve the menace of insufficient sign language interpreters but also accommodates the large population of these students. This will be made easier by the fact that majority of the lecturers are ICT proficient and thus, only needed to be prepped for the occasion. However, the idea of manual assessment using pen and paper cannot be totally discarded as there are aspects of mathematics that cannot be assessed using CAA. Thus, CAA has to go hand-in-hand with manual assessment method.

Recommendations

Based on the findings of the research work, the following recommendations are hereby made.

1. The College management should integrate CAA platforms into the mathematics assessment policy to ensure consistent use for students with hearing impairment.
2. Mathematics lecturers and special education teachers should be trained on designing and administering CAA items that use visuals, sign language, and captions.
3. Government and College authorities should provide adequate computers, stable internet, and accessible software to support CAA implementation.
4. Developers of CAA tools should work with special educators to ensure the platforms are disability-friendly and curriculum-aligned.

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IJOGSE2026

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IJOGSE2026