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SCHOOL AND GENDER-BASED VARIATIONS IN PHYSICS TEACHERS' PERCEIVED COMPETENCE IN THE USE OF COMPUTER-ASSISTED INSTRUCTION IN SENIOR SECONDARY SCHOOLS IN ABUJA, NIGERIA

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Abstract

This study examined school and gender-based variations in physics teachers' perceived competence in the use of Computer-Assisted Instruction (CAI) in senior secondary schools in Abuja, Nigeria. Three research questions guided the study, and three null hypotheses were tested at the 0.05 level of significance. The study adopted a descriptive survey research design. The population comprised 570 physics teachers in public and private co-educational senior secondary schools in the Federal Capital Territory, Abuja, from which a sample of 201 physics teachers was selected using simple random sampling technique. Data were collected using the Computer-Assisted Instruction Competency Questionnaire (CAICQ), which was validated by experts and yielded a reliability coefficient of 0.82 using Cronbach's alpha. Mean and standard deviation were used to answer the research questions, while the independent samples t-test was used to test the hypotheses. The findings revealed that physics teachers in urban schools perceived themselves as competent in using CAI (grand mean = 2.94), whereas those in rural schools did not (grand mean = 1.86), and the difference was significant. Teachers in private schools rated their competence significantly higher than those in public schools, and male teachers rated their competence significantly higher than female teachers, although teachers in both types of school and of both genders perceived themselves as competent. The study concludes that school location, type of school and gender influence physics teachers' perceived competence in the use of CAI in Abuja. It recommends, among others, that the FCT Administration improve ICT infrastructure and electricity supply in rural schools, that public schools be equipped with computers and CAI software, and that male and female teachers be given equal access to ICT training.

Keywords: Computer-assisted instruction, Perceived competence, Physics teachers, School location, School type, Gender

Introduction

Physics is a physical science that studies matter in relation to energy, with branches including mechanics, optics, heat, electricity, magnetism, nuclear physics, solar energy and plasma physics. Physics is vital in transportation, aviation, medicine and many other areas of life, and it serves as the pivot around which the technological and economic growth of a nation revolves (Okafor, 2018). The technological progress of a nation therefore depends, in no small measure, on the quality of physics teaching and learning at the secondary level. In many Nigerian classrooms, however, the pattern of science teaching has changed little over the years. Science instruction has often lacked a clear focus and been delivered by inadequately prepared teachers, thereby dampening rather than encouraging learners' natural curiosity (Adamu, 2015). At the senior secondary level, the dominant pattern remains an authoritarian, didactic approach in which learners absorb facts by rote from teachers who exercise tight control over the learning process (Josiah et al., 2019).

The rapid spread of information and communication technology (ICT) has transformed the global educational landscape and necessitated a shift from traditional to computer-based instruction (Buabeng-Andoh, 2019). In Nigeria, computers are increasingly used not only to analyse school data but also to optimise students' learning (Gambari et al., 2015). This has placed greater emphasis on the quality of teachers and the training available to them (Uzoka & Giwa, 2025), since computers, unlike conventional classrooms, allow learners to be taught individually or in small groups (Laleye, 2019).

Physics holds a central place among the sciences. A credit pass in physics at the Senior School Certificate Examination is required for admission into university programmes in engineering, medicine, pharmacy, agriculture and the physical sciences (Okafor, 2018). Yet students and teachers perceive many senior secondary physics concepts as difficult or very difficult to learn and teach (Adebisi et al., 2020), largely because they are abstract and require more than mere definitions to be understood. Such concepts call for instructional approaches capable of making the invisible visible. Not surprisingly, students' achievement in physics in both internal and external examinations has remained below expectation over the years, and the persistent underperformance of Nigerian secondary school students in physics has been widely reported (Oladejo et al., 2023). Records of the West African Senior School Certificate Examination (WASSCE) presented in Table 1 illustrate this trend.

Table 1: Students' Achievement in WASSCE Physics, FCT Abuja (2018–2025)

Year	Total Entry	Credit (A1–C6)	%	Fail (D7–F9)	%
2018	416,580	174,432	41.87	242,148	58.13
2019	422,110	183,020	43.36	239,090	56.64
2020	429,523	184,092	42.86	245,431	57.14
2021	430,625	185,128	42.99	245,497	57.01
2022	430,721	185,725	43.12	244,996	56.88
2023	430,895	185,820	43.12	245,075	56.88
2024	431,825	186,920	43.29	244,905	56.71
2025	431,925	186,754	43.24	245,171	56.76

Source: West African Examinations Council (2025).

Table 1 shows that in every year from 2018 to 2025, fewer than half of the candidates obtained credit-level passes (A1–C6) in physics. The credit rate ranged only from 41.87% in 2018 to 43.36% in 2019, then remained between about 42% and 43%. Consistently, more than 56% of candidates failed to reach the credit benchmark required for progression into science-based programmes. The implication is that only a small proportion of candidates can go on to pursue physics-related careers in higher institutions.

Computer-Assisted Instruction (CAI) has therefore been advanced as a means of strengthening achievement. CAI is an interactive instructional technique in which the content to be taught is planned, programmed and presented through the computer, combining text, graphics, sound and video to guide and monitor learning (Ekundayo, 2022). CAI has been shown to improve students' achievement in science subjects (Ekundayo, 2022), while the extent to which it is applied in the classroom depends on factors such as teachers' experience and computer self-efficacy (Danladi, 2024; Yakubu, 2023). Through simulations and animations, it makes visible the abstract processes that are otherwise imperceptible, allowing learners to manipulate parameters and build an understanding of the connections among physical ideas (Finkelstein et al., 2005). CAI has also been found to improve students' achievement in physics (Onah et al., 2020; Ugwuanyi & Okeke, 2020), yet many teachers continue to rely on the lecture method.

The benefit of CAI, however, depends less on the technology itself than on the teacher's competence in applying it. Teacher competence in this context refers to the knowledge, skills and confidence required to select, operate and integrate computer-based tools within a lesson. Teachers' competence and self-efficacy are among the internal factors that determine whether ICT is used

meaningfully in teaching (Buabeng-Andoh, 2019). How competent teachers *perceive* themselves to be is equally important, because teachers who lack confidence in their ICT skills are unlikely to use them in the classroom. Teachers' self-efficacy for using ICT has been defined as their confidence in performing specific tasks that require the integration of ICT into teaching (Šabić et al., 2022). Studies have found secondary school teachers' perceived ICT competence to be low in some African contexts (Buabeng-Andoh, 2015). Such perceived competence is shaped by training, prior exposure to computers and access to professional development, and it tends to vary considerably among practising teachers.

The context in which teachers work may also influence their perceived competence, and school location is one such factor. Senior secondary schools in the Federal Capital Territory range from those in the urban city centre to others in rural and peri-urban area councils. Urban schools generally enjoy more reliable electricity, better-equipped computer facilities, internet access and more frequent in-service training. Many rural schools, by contrast, contend with irregular power supply, few or no functional computers and limited exposure to technology-based training (Owoeye & Yara, 2011). Poor ICT infrastructure in Nigerian secondary schools has been reported to restrict teachers' use of technology and to keep them tied to conventional instruction (Uzoka & Giwa, 2025), while teachers' location has been found to influence significantly the extent to which they integrate computer-based instruction into their teaching (Bariham et al., 2019). Competence in using technology grows largely through practice, so teachers who seldom have working computers or electricity in their schools have fewer opportunities to build and test their skills, and may therefore feel less confident about using CAI. On the other hand, Adeniyi and Yusuf (2016) found that the use of CAI in teaching Economics was not significantly affected by school location, which suggests that the urban–rural gap may not be uniform across subjects and settings. In the FCT, where rapid development in the city centre contrasts with the conditions of schools in the outlying area councils, it is therefore important to establish whether physics teachers' perceived competence in CAI differs between urban and rural schools.

The type of school, whether public or private, is another factor of interest. Public and private senior secondary schools often differ in funding, staffing, facility provision and the priority they give to technology integration. Some private schools, particularly in urban areas, invest in computer laboratories and digital teaching tools to enhance their appeal to fee-paying parents, while many public schools lack the resources to procure digital tools (Uzoka & Giwa, 2025). External factors

such as training, access to computers and leadership support have been found to influence teachers' use of ICT in public and private secondary schools (Buabeng-Andoh, 2019), and inadequate ICT training has been reported as a major challenge for teachers in public secondary schools (Uzoka & Giwa, 2025). This is so even though CAI has been described as having powerful features that could improve the performance of both teachers and learners in Nigeria (Usman & Madudili, 2020). Administrative support also differs between the two types of school, since private school proprietors are often quicker to require and reward the use of technology in lessons. Such differences may affect the competence that teachers acquire and their confidence in applying CAI. Since public and private schools in Abuja serve the same curriculum and prepare students for the same WASSCE, any difference in teachers' perceived competence between them would point to inequality in the learning opportunities offered to their students.

Gender is a further variable that may account for differences in teachers' perceived competence. Studies of teachers' ICT self-efficacy have reported differences in favour of male teachers, with female teachers often rating their digital teaching competence lower than their male colleagues do (Gómez-Trigueros & Yáñez de Aldecoa, 2021). Other evidence, however, suggests that these differences are small and are largely confined to older teachers, being practically non-existent among younger teachers (Šabić et al., 2022). Bariham et al. (2019) similarly found that teachers' gender significantly influenced the extent to which they integrated computer-based instruction into their teaching. Such differences have been linked to unequal exposure to ICT, lower confidence, and fewer opportunities for female teachers to participate in technology-focused training. Because the present study relies on teachers' self-ratings of competence, gender differences in self-confidence may also shape the results, as men and women do not always rate their abilities in the same way. These mixed findings make it necessary to establish whether male and female physics teachers in Abuja differ in their perceived competence in using CAI.

Abuja, as the Federal Capital Territory, is often assumed to be comparatively well resourced. Yet achievement in physics remains low, and the readiness of physics teachers to use CAI is not well established. Although several studies have reported the effectiveness of CAI in teaching physics, few have directly assessed how competent physics teachers perceive themselves to be at using it or whether this perceived competence varies by school location, school type and gender. This gap matters because investment in computers and software yields little benefit when the teachers expected to use them lack competence in and confidence in the

technology. It is against this background that the present study examined school and gender-based variations in physics teachers' perceived competence in the use of Computer-Assisted Instruction in senior secondary schools in Abuja, Nigeria.

Objectives of the Study

This study assessed physics teachers' perception on their competencies in using computer-assisted instruction (CAI) in senior secondary schools in Abuja, Nigeria. Specifically, the objectives are to:

i. Determine the level of physics teachers' perception on competencies in using CAI based on school location.
ii. Determine the level of physics teachers' perception on competencies in using CAI based on the type of school.
iii. Determine the level of physics teachers' perception on competencies in using CAI based on gender.

Research Questions

The following questions guided the study:

i. To what extent are the mean levels of rural and urban physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI)?
(ii) To what extent are the mean levels of public and private school physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI)?
(iii) To what extent are the mean levels of male and female physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI)?

Research Hypotheses

The following hypotheses were formulated and tested at a significance level of 0.05:

H_{01}: There is no significant difference in the extent to which rural and urban schools' physics teachers' perception on their competencies in the use of CAI for teaching physics.

H_{02}: There is no significant difference between private and public schools' physics teachers' perception on their competencies in the use of CAI for teaching physics.

H_{03}: There is no significant difference between male and female physics teachers' perception on their competencies in the use of CAI for physics teaching

Methodology

The study used a survey research design. This design is suited to collecting data at a

particular point in time to describe the perceptions, opinions and attitudes held by a population too large to observe directly (Cohen et al., 2018). It allowed teachers' perceived competence in the use of Computer-Assisted Instruction (CAI) to be measured directly from the teachers and compared across school location, type of school and gender. The population comprised 570 physics teachers in public and private co-educational senior secondary schools in the Federal Capital Territory (FCT), Abuja, in the 2023/2024 academic session. These schools are spread across the six area councils of the FCT: Abaji, Abuja Municipal (AMAC), Bwari, Gwagwalada, Kuje and Kwali. A sample of 201 physics teachers was selected by simple random sampling from public and private schools in both urban and rural locations, which ensured that each subgroup compared in the study was represented.

Data were collected using the Computer-Assisted Instruction Competency Questionnaire (CAICQ), developed by the researcher. Section A obtained respondents' background information: school location, type of school and gender. Section B contained 20 statements on teachers' perceived competence in the use of CAI, rated on a four-point scale: Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). A mean of 2.50 and above was taken as competent, and a mean below 2.50 as not competent. The instrument was validated for face and content validity by three experts in the Department of Science, Technology and Mathematics Education, Nasarawa State University, Keffi. Their suggestions, including the removal of double-barrelled items, were incorporated into the final draft, and the instrument yielded a validity index of 0.79. To establish reliability, the CAICQ was administered to 30 physics teachers in Abuja who were not part of the sample but had the same characteristics. This yielded a reliability coefficient of 0.82, estimated with Cronbach's alpha. Mean and standard deviation were used to answer the research questions, and the independent samples t-test was used to test the null hypotheses at the 0.05 level of significance.

Results

Research Question One

To what extent are the mean levels of rural and urban physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI)?

Table 1: Mean and Standard Deviation on the Level of Urban and Rural Physics Teachers' Perception on their Competencies in using Computer–Assisted Instruction (CAI)

		Urban			Rural		
S/N	**Statement**	**Mean**	**SD**	**Decision**	**Mean**	**SD**	**Decision**
1	I switch on the computer.	2.96	1.00	Competent	1.91	0.92	Not-Competent
2	I can shut down the computer.	2.93	1.02	Competent	1.89	0.96	Not-Competent
3	I can use MS Word to type learning instructions, e.g., lesson notes.	2.97	1.02	Competent	1.88	0.95	Not-Competent
4	I can use MS Excel to compute student marks.	2.93	1.01	Competent	1.88	0.91	Not-Competent
5	I can download resources from the internet, including YouTube, etc.	2.97	1.03	Competent	1.88	0.93	Not-Competent
6	I can type students' assessments on the computer.	2.98	1.00	Competent	1.88	0.95	Not-Competent
7	I have practical experience in using CorelDRAW	2.84	1.05	Competent	1.80	0.87	Not-Competent
8	I can use Google Spreadsheets for teaching	2.90	1.03	Competent	1.80	0.91	Not-Competent
9	I can use PowerPoint to create learning lessons	2.97	1.05	Competent	1.86	0.94	Not-Competent
1	I can type student exams	2.98	1.01	Competent	1.86	0.92	Not-Competent
1	I do graphical design on the system for my science topics	2.84	1.04	Competent	1.82	0.87	Not-Competent
1	I can operate the projector	2.94	1.02	Competent	1.85	0.91	Not-Competent
1	I can teach using PowerPoint	2.97	1.03	Competent	1.86	0.94	Not-Competent
1	I can use Zoom to run online classes	2.87	1.04	Competent	1.83	0.88	Not-Competent
1	I use computer tools to type set documents	2.97	1.05	Competent	1.86	0.94	Not-Competent
1	I can set CA questions for computer students' exams	2.93	1.01	Competent	1.86	0.92	Not-Competent
1	I can download documents using PDF	2.97	1.02	Competent	1.88	0.95	Not-Competent

1	I can use MS Excel to calculate students' scores	2.95	1.01	Competent	1.88	0.91	Not-Competent
1	I can download videos on physics lessons via the downloader	2.92	1.02	Competent	1.85	0.91	Not-Competent
2	I operate the internet efficiently	2.99	1.03	Competent	1.86	0.94	Not-Competent
	Grand Mean	**2.94**			**1.86**		

Table 1 shows the level of teachers' competency in the use of Computer-Assisted Instruction (CAI) for Physics teaching by school location. The mean scores for teachers in urban schools range from 2.84 to 2.99, with a grand mean of 2.94, while those in rural schools range from 1.80 to 1.91, with a grand mean of 1.86. Since the benchmark for acceptance is 2.50, this indicates that teachers in urban schools possess a high level of competency in using CAI for Physics teaching, whereas teachers in rural schools possess a low level of competency.

Hypothesis One

H_{01}: There is no significant difference in the extent to which rural and urban schools' physics teachers' perception on their competencies in using CAI.

Table 2: t-test Result on Urban and Rural Physics Teachers' Perception on their Competencies in using Computer–Assisted Instruction (CAI)

	LocationC	**N**	**Mean**	**Std. Deviation**	**t-test for Equality of Means**		
					T	Df	Sig. (2-tailed)
Meanscores	Urban	20	2.9390	.04518	90.160	38	0.000
	Rural	20	1.8595	.02874			

Table 2 shows the t-test result on urban and rural Physics teachers' perception on their competencies in using Computer-Assisted Instruction (CAI). The mean score for urban school teachers (2.9390) is higher than that for rural school teachers (1.8595), indicating that urban school teachers' level of competency in using CAI for teaching Physics is more than that of their rural counterparts. The obtained t-value of 90.160,

with a significance level of 0.000, indicates that the difference in the mean scores is statistically significant. This positive t-value further indicates that the competency level of urban school teachers is significantly higher than that of rural school teachers. Therefore, the null hypothesis, which states that there is no significant difference in the competency of rural and urban Physics teachers in the use of CAI in Physics teaching, is rejected.

Research Question Two

To what extent are the mean levels of public and private school physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI)?

Table 3: Mean and Standard Deviation on the Level of Public and Private Physics Teachers' Perception on their Competencies in using Computer–Assisted Instruction (CAI)

		Public			Private		
S/N	**STATEMENT**	**Mean**	**SD**	**Decision**	**Mean**	**SD**	**Decision**
1.	I switch on the computer.	2.77	1.06	Competent	2.91	1.03	Competent
2.	I can shut down the computer.	2.76	1.05	Competent	2.90	1.03	Competent
3.	I can use MS Word to type learning instructions, e.g., lesson notes.	2.78	1.07	Competent	2.92	1.04	Competent
4.	I can use MS Excel to compute student marks.	2.74	1.05	Competent	2.88	1.03	Competent
5.	I can download resources from the internet, including YouTube, etc.	2.79	1.08	Competent	2.92	1.04	Competent
6.	I can type students' assessments on the computer.	2.77	1.06	Competent	2.91	1.03	Competent
7.	I have practical experience in using CorelDRAW	2.69	1.04	Competent	2.84	1.02	Competent
8.	I can use Google Spreadsheets for teaching	2.73	1.05	Competent	2.87	1.03	Competent
9.	I can use PowerPoint to create learning lessons	2.79	1.08	Competent	2.92	1.04	Competent
10.	I can type student exams	2.77	1.06	Competent	2.91	1.03	Competent
11.	I do graphical design on the system for my science topics	2.72	1.04	Competent	2.86	1.02	Competent
12.	I can operate the projector	2.76	1.05	Competent	2.90	1.03	Competent
13.	I can teach using PowerPoint	2.78	1.07	Competent	2.92	1.04	Competent
14.	I can use Zoom to run online classes	2.71	1.05	Competent	2.85	1.03	Competent

15.	I use computer tools to type set documents	2.79	1.08	Competent	2.92	1.04	Competent
16.	I can set CA questions for computer students' exams	2.74	1.05	Competent	2.88	1.03	Competent
17.	I can download documents using PDF	2.77	1.06	Competent	2.91	1.03	Competent
18.	I can use MS Excel to calculate students' scores	2.76	1.05	Competent	2.90	1.03	Competent
19.	I can download videos on physics lessons via the downloader	2.75	1.05	Competent	2.89	1.02	Competent
20.	I operate the internet efficiently	2.79	1.08	Competent	2.92	1.04	Competent
	Grand Mean	**2.76**			**2.89**		

Table 3 shows the level of physics teachers' perception on their competencies in using Computer-Assisted Instruction (CAI) based school type. The mean scores for teachers in public schools range from 2.69 to 2.79, with a grand mean of 2.76, while those in private schools range from 2.84 to 2.92, with a grand mean of 2.89. Since the benchmark for acceptance is 2.50, this indicates that teachers in both public and private schools possess a high level of competency in using CAI in Physics instruction.

Hypothesis Two

H_{02}: There is no significant difference between private and public schools' physics teachers' perceptions of their competencies in using CAI for teaching physics.

Table 4: t-test Result on Public and Private Physics Teachers' Perception On their Competencies in Using Computer–Assisted Instruction (CAI)

	Sch Ownership	**N**	**Mean**	**Std. Deviation**	**t-test for Equality of Means**		
					T	df	Sig. (2-tailed)
Mean	Public	20	2.7580	0.02858	-16.259	38	0.000
scores	Private	20	2.8965	0.02519			

Table 4 shows the t-test result on public and private Physics teachers' perceptions of their competencies in using Computer-Assisted Instruction (CAI). The mean score for private school teachers is 2.8965, while that of public-school teachers is 2.7580, indicating that private school teachers have a higher level of competency in using CAI for teaching Physics than public school teachers. The obtained t-value of -16.259, with a significance level of 0.000, indicates that the difference in the mean scores is statistically

significant. This negative t-value further indicates that public school teachers' competency levels are significantly lower than those of private school teachers. Therefore, the null hypothesis, that there is no significant difference between public and private school Physics teachers in their competency in the use of CAI in Physics teaching, is rejected.

Research Question Three

To what extent are the mean levels of Physics teachers' perception of their competencies in the use of CAI based on gender?

Table 5: Mean and Standard Deviation on the Level of Male and Female Physics Teachers' Perception on their Competencies Using Computer–Assisted Instruction (CAI)

		Male			Female		
S/N	**STATEMENT**	**Mean**	**SD**	**Decision**	**Mean**	**SD**	**Decision**
1.	I switch on the computer.	2.88	1.02	Competent	2.59	1.15	Competent
2.	I can shut down the computer.	2.87	1.02	Competent	2.59	1.19	Competent
3.	I can use MS Word to type learning instructions, e.g., lesson notes.	2.88	1.03	Competent	2.59	1.17	Competent
4.	I can use MS Excel to compute student marks.	2.86	1.02	Competent	2.61	1.10	Competent
5.	I can download resources from the internet, including YouTube, etc.	2.89	1.03	Competent	2.63	1.16	Competent
6.	I can type students' assessments on the computer.	2.88	1.02	Competent	2.63	1.12	Competent
7.	I have practical experience in using CorelDRAW	2.79	1.03	Competent	2.49	1.17	Not-Competent
8.	I can use Google Spreadsheets for teaching	2.84	1.02	Competent	2.61	1.12	Competent
9.	I can use PowerPoint to create learning lessons	2.89	1.03	Competent	2.56	1.21	Competent
10.	I can type student exams	2.88	1.02	Competent	2.56	1.17	Competent
11.	I do graphical design on the system for my science topics	2.81	1.03	Competent	2.54	1.15	Competent
12.	I can operate the projector	2.87	1.02	Competent	2.56	1.15	Competent

S/N	STATEMENT	Male			Female		
		Mean	SD	Decision	Mean	SD	Decision
13.	I can teach using PowerPoint	2.89	1.03	Competent	2.66	1.14	Competent
14.	I can use Zoom to run online classes	2.82	1.04	Competent	2.54	1.13	Competent
15.	I use computer tools to type set documents	2.89	1.03	Competent	2.59	1.17	Competent
16.	I can set CA questions for computer students' exams	2.86	1.02	Competent	2.59	1.15	Competent
17.	I can download documents using PDF	2.88	1.02	Competent	2.61	1.15	Competent
18.	I can use MS Excel to calculate students' scores	2.87	1.02	Competent	2.61	1.19	Competent
19.	I can download videos on physics lessons via the downloader	2.86	1.01	Competent	2.61	1.15	Competent
20.	I operate the internet efficiently	2.89	1.03	Competent	2.61	1.19	Competent
	Grand Mean	**2.86**			**2.59**		

Table 5 shows the levels of male and female physics teachers' perception on their competencies in using Computer-Assisted Instruction (CAI). The mean scores for male teachers range between 2.79 and 2.89, with a grand mean of 2.86, while the mean scores for female teachers range between 2.49 and 2.66, with a grand mean of 2.59. Since the benchmark is 2.50, both male and female teachers perceived themselves as competent in using CAI overall, although female teachers rated themselves not competent on item 7 (practical experience in using CorelDRAW), with a mean of 2.49.

Hypothesis Three

H_{03}: There is no significant difference between male and female physics teachers' perception on their competencies in using CAI

Table 6: t-test Result on Male and Female Physics Teachers' Perception on their Competencies in using CAI

	Gender C	N	Mean	Std. Deviation	t-test for Equality of Means		
					t	df	Sig. (2-tailed)
Mean scores	Male	20	2.8650	.02875	25.684	38	0.000
	Female	20	2.5890	.03851			

Table 6 shows the t-test result on male and female Physics teachers' perception on their competencies in the use of Computer-Assisted Instruction (CAI). The mean score for male teachers (2.8650) is higher than that for female teachers (2.5890), indicating that male teachers have a higher level of competency in using CAI for teaching Physics than their female counterparts. The obtained t-value of 25.684 with a significance level of 0.000 shows that the difference in the mean scores is statistically significant. This positive t-value further indicates that male teachers' competency levels are significantly higher than those of female teachers. Therefore, the null hypothesis, which states that there is no significant difference between male and female Physics teachers in their competency in the use of CAI in Physics teaching, is rejected.

Discussion of Findings

The study found a significant difference in physics teachers' perceived competence in the use of Computer-Assisted Instruction (CAI) based on school location, with teachers in urban schools in Abuja rating their competence higher than their counterparts in rural schools. This suggests that the environment in which teachers work influences how confident they feel in acquiring and using the technological skills required for effective instructional delivery. Access to technological resources and opportunities for professional development may therefore shape how competent teachers perceive themselves to be in CAI. This finding is consistent with Bariham et al. (2019), who found that teachers' location significantly influenced the extent to which they integrated computer-based instruction into their teaching. Similarly, Uzoka and Giwa (2025) reported that poor ICT infrastructure in Nigerian secondary schools restricts teachers' use of technology. The finding also agrees with Buabeng-Andoh (2019), who found that external factors such as training and access to computers influence teachers' pedagogical use of ICT. However, it contrasts with Adeniyi and Yusuf (2016), who reported that the use of CAI in teaching Economics was not significantly affected by school location. The higher perceived competence of urban teachers may be attributed to the greater availability of ICT facilities, stable electricity supply, internet connectivity and technology-related training programmes in the urban areas of Abuja. Teachers in these schools are more likely to interact regularly with digital tools, which builds their confidence in using CAI. Teachers in rural schools within Abuja's area councils, on the other hand, may face infrastructural challenges that limit their practical engagement with technology and, in

turn, lower their perceived competence in computer-assisted instruction.

The study also revealed a significant difference in physics teachers' perceived competence in the use of CAI based on the type of school, with teachers in private schools rating their competence higher than those in public schools. This suggests that institutional factors such as resource availability, administrative support and access to technological facilities influence how competent teachers feel in using technology for instruction. The finding supports Uzoka and Giwa (2025), who reported inadequate ICT training and a lack of digital tools in public secondary schools in Lagos State. Similarly, Buabeng-Andoh (2015) found that secondary school teachers' perceived access to ICT, ICT training and ICT competence were low. The finding also has implications for the view of Usman and Madudili (2020) that CAI could transform teaching and learning in Nigeria, since that potential cannot be realised where teachers lack the competence to use it. The higher perceived competence of private school teachers may be associated with better access to computers, internet facilities, stable electricity and regular ICT training. Private schools often invest more in educational technologies to improve instructional quality and remain competitive, which gives their teachers more opportunities to acquire and refine technological skills. Public schools, in contrast, may face funding constraints and infrastructural deficiencies that limit teachers' exposure to technological resources and their confidence in using them.

Furthermore, the study found a significant difference in physics teachers' perceived competence in the use of CAI based on gender, with male teachers rating their competence higher than female teachers. This suggests that differences in technological exposure, confidence and engagement with ICT-related activities may influence how competent teachers perceive themselves to be in CAI. The finding is in agreement with Gómez-Trigueros and Yáñez de Aldecoa (2021), who found that female teachers had a poorer self-perception of their digital teaching competence than male teachers. Similarly, Bariham et al. (2019) found that teachers' gender significantly influenced the extent to which they integrated computer-based instruction into their teaching. However, the finding contradicts Kimaiyo (2019), who reported that trainee teachers' gender had no significant influence on their integration of ICT in teaching, suggesting that the influence of gender may vary across contexts and educational environments. The higher perceived competence of male teachers may be attributed to greater participation in ICT-related activities, more exposure to technological tools and greater confidence in handling computer-based

applications. Since the measure used in this study was teachers' own perception, the difference may also reflect a tendency for male teachers to rate their technological abilities more highly than female teachers do. Female teachers, on the other hand, may encounter factors that limit their participation in ICT-related activities and technology-focused training, thereby affecting both their actual and perceived competence.

Conclusions

The findings of this study show that school location, type of school and gender influence physics teachers' perceived competence in the use of Computer-Assisted Instruction (CAI) in senior secondary schools in Abuja. Teachers in urban schools rated their competence higher than those in rural schools. Teachers in private schools rated their competence higher than their public school counterparts, and male teachers rated their competence higher than female teachers. These differences suggest that access to ICT resources, institutional support and exposure to digital tools play important roles in shaping how competent teachers feel in using CAI. Since physics teachers do not perceive themselves as equally competent across these contexts, the integration of CAI in physics instruction in Abuja is likely to remain uneven unless the gaps between rural and urban schools, public and private schools, and male and female teachers are addressed.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. The Federal Capital Territory Administration, through the Secondary Education Board, should improve ICT infrastructure, electricity supply and internet connectivity in rural secondary schools in Abuja, and should give rural physics teachers priority in CAI training, to close the gap between rural and urban teachers' perceived competence.
2. Government and school administrators should provide public secondary schools with adequate computers, projectors and CAI software. They should also organise regular, hands-on CAI workshops for physics teachers in public schools, so that these teachers attain a level of competence comparable to that of their counterparts in private schools.
3. School administrators and professional bodies should ensure that male and female physics teachers have equal access to ICT training and digital teaching resources. They should also encourage female teachers to take part in technology-focused professional development to

build their confidence and competence in using CAI.

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