Teaching, Learning, and Development, 4(1), 2026, 89-96

Effect of Computer Instructional Technique on Secondary School Students' Motivation in Chemistry in Anambra State

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Article History
Received: 14 November 2025
Revised: 3 December 2025
Accepted: 4 December 2025
Published: 5 December 2025

Keywords
Computer instructional technique
Conventional lecture method
Motivation

Abstract
The study investigated the effect of computer instructional technique on secondary school students' motivation in Chemistry in Anambra state. Two research questions were formulated to guide the study and two hypotheses were tested at 0.05 level of significance, guided the study. Quasi-experimental research design was adopted for the study. The population of the study was 241 senior secondary year two (SS2) students who offered Chemistry in Orumba South Local Government Area in Anambra state in the year 2024. A sample of 60 students obtained using simple random sampling (balloting with replacement) was involved in the study. The instruments for data collection were the Motivation Inventory Scale (MIS) and Periodic Table Achievement Test (PTAT), validated by three experts from the Departments of Science Education and Educational Foundations, at Nnamdi Azikiwe University, Awka. The reliability of the instruments was established using Cronbach Alpha for MIS and Kuder-Richardson 20 for PTAT and they yielded coefficient values of 0.86 and 0.82 respectively. Data were generated for the study through the administration of the instruments with the aid of two research assistants. The data obtained were analyzed using Mean and standard deviation, while ANCOVA was used to test the null hypotheses at 0.05 alpha level. The findings of the study revealed that students taught with computer instructional technique were more motivated in learning Chemistry concepts, than those in the control group. The study also revealed that gender had no significant influence on student's motivation in Chemistry. The study recommended among others that Chemistry teachers should adopt computer instructional technique in Chemistry classrooms, be encouraged through seminars and workshops, and be supported financially to do the same.

How to cite: Nnoli, J. N. & Onyekpudoro, C. E. (2026). Effect of Computer Instructional Technique on Secondary School Students' Motivation in Chemistry in Anambra State. *Teaching, Learning, and Development*, *4*(1). 89–96. doi: 10.62672/telad.v4i1.138

1. Introduction

Education is critical for the advancement of science and technology, which contributes to the advancement of humanity. Michael (2018) opined that education is the process by which societies reproduce or change the knowledge and skills that are necessary for their functioning and development. He emphasizes the role of education in transmitting both existing knowledge and the capacity to generate new knowledge. Education is the process of inviting truth and possibility, awakening the desire to know, expanding horizons and promoting the emergence as a responsible and responsive being (Biesta, 2019). Education is a fundamental pillar that nurtures scientific curiosity and innovation, fostering a robust understanding of the natural world. Through comprehensive educational frameworks, learners acquire the critical thinking skills and scientific knowledge necessary to explore and solve complex problems. This symbiotic relationship between education and science drives technological advancements, promotes sustainable development, and enhances the quality of life. By continuously investing in education, society empowers individuals to contribute to scientific progress and address global challenges with innovative solutions.

Science is a broad field that encompasses various disciplines or subjects some of the major branches or subjects within science include physics, chemistry, biology, earth science, astronomy, environmental science, geology, mathematics. These subject, among others collectively contribute to our understanding of the natural world and form the basis of scientific inquiry and exploration. Science is the systematic study of the structure andbehavior of the physical and natural world through observation and experiment (Richard, 2019).

Science is a vast field that encompasses various disciplines, each contributing to our understanding of the natural world. Among these, chemistry stands out as a crucial bridge between the physical and biological sciences. By studying the composition, properties, and reactions of matter, chemistry provides foundational knowledge that underpins advancements in physics, biology, environmental science, and medicine. Science is the human activity of seeking reliable knowledge about the environment (Neil, 2021). Its principles drive technological innovations and help address global challenges in healthcare, energy, and sustainability. As the

doi: 10.62672/telad.v4i1.138

ISSN: 2988-2834

central science, chemistry plays an integral role in connecting and enhancing the various branches of science, ultimately leading to a more comprehensive understanding of our universe.

Chemistry is the scientific discipline that studies the properties, composition, structures, and behavior of matter. It seeks to understand the fundamental principles that govern the behavior of atoms and molecules. According to Nnoli (2021) chemistry is a discipline with high standard of conduct which must be amplified by teachers and researchers in ways that students cannot fail to observe and adopt. To her chemistry is one of the fundamental ingredients of science. The power of chemistry is what creates a whole and enabling infrastructure that delivers, food, medicine and materials that are the hall-mark of modern life. John and Fay (2018) sees chemistry as the study of matter and the changes it undergoes. They emphasize the role of matter in chemistry and the importance of understanding the transformation it undergoes through chemical reaction. Chemistry is the study of the composition, structure, properties and reactions of matter (Raymond and Kenneth, 2019). They highlight the interdisciplinary nature of chemistry which encompasses elements of physics, biology and environmental science among other fields. Olutayo (2019) also contributed that chemistry is the scientific study of the properties and behaviors of matter with a focus on the composition, structure and reaction of substances. He emphasizes the importance of chemistry in understanding the natural world and its application in various fields. Chemistry explores how substances interact, combine and change. By incorporating computer instructional technique, we can leverage digital tools to enhance the learning experience in Chemistry. This instructional technique provides students with a more engaging and interactive learning environment, allowing them to better understand complex chemical concepts through hands-on digital experiences.

Computer instructional technique refers to the use of computer technology and software applications to facilitate teaching and learning processes. It involves incorporating computers, multimedia resources and interactive platforms into educational activity to enhance engagement, comprehension and retention of information. Olajide (2018) sees computer instructional technique as the systematic use of computer base tools and resources to facilitate student's engagement, comprehension and retention of information. Computer instructional technique according to Bello, Kamar, Yushua and Abubaka (2022) is the use of moving images to teach the students. Computer instructional technique is a teaching aided package prepared by a computer-controlled machine and a response entry device that uses an amalgamation of text, graphics, sound and video to boost educational outcomes by enhancing the learning process true interaction. Computer instructional techniques leverage technology to enhance and transform the learning experience (Opesemowo and Omideyi, 2023). These techniques utilize digital tools and resources to create engaging, interactive, and personalized educational environments. Examples of this technique includes:

Animated Media- animated media brings concepts to life through visual storytelling and motion graphics. By using animations, educators can illustrate complex ideas, processes, and phenomena in a way that is easy to understand and memorable. This technique is particularly effective in subjects like science, where dynamic visualizations can demonstrate chemical reactions, biological processes, and physical principles.

Interactive Simulations-Interactive simulations provide learners with hands-on experience in a virtual environment. These simulations allow students to manipulate variables, observe outcomes, and experiment with different scenarios. This technique is valuable in fields such as physics, engineering, and medical training, where practical experience is essential but may be difficult to achieve in a traditional classroom setting.

Multimedia Presentations-Multimedia presentations combine text, images, audio, and video to create rich, multi-sensory learning experiences. This technique is versatile and can be used across various disciplines to reinforce key concepts, highlight important information, and maintain learner engagement. For example, a history lesson can be enriched with documentary clips, historical photographs, and narration to bring historical events to life.

Gamification integrates game-based elements such as points, badges, and leaderboards into learning activities to motivate students and enhance engagement. By fostering healthy competition and rewarding achievements, gamified learning environments improve participation and learning outcomes, especially in subjects requiring repetitive practice like mathematics and languages (Osegbue, Ohamobi, & Alordiah, 2025). Similarly, collaborative learning platforms promote teamwork, communication, and problem-solving through shared projects and peer interaction. These platforms cultivate collective responsibility and critical thinking by encouraging learners to co-create knowledge and provide feedback to one another (Osegbue, Manafa, & Ohamobi, 2022). In a broader educational context, integrating gamification and collaboration aligns with emerging innovations that strengthen instructional efficiency and resilience in schools (Osegbue et al., 2025). Moreover, effective supervision and structured digital collaboration support sustainable teaching and learning outcomes across educational settings (Ohamobi & Ezeaku, 2014). Together, these approaches reinforce engagement, inclusivity, and interactive learning in secondary education.

Adaptive Learning Systems-Adaptive learning systems use artificial intelligence to personalize the learning experience for each student. These systems analyze learners' progress and adjust the content, pace, and

difficulty level accordingly. Each technique offers unique benefits, and when combined, they can significantly enhance the overall quality of education and it tremendously increases student's level of Motivation to learn.

Motivation is the inner drive or external influence that compels an individual to take action towards achieving a goal or fulfilling a need. Nnoli (2021) opined that motivation is the process that initiates guides, and maintain goal-oriented behavior. She also sees motivation as a vital role in learning, energizing and directing behavior toward specific goals. It facilitates knowledge acquisition, social development and discipline. It represents the desire and willingness to take action towards a goal arising from internal or external forces that arouse enthusiasm and persistence. Motivation is intrinsic to individuals fueling the desire for change within oneself or the environment. Motivation according to Silva (2021) is the state that can maintain student's attention and behavior as well as provides them with some energy needed to lead tasks to completion. Motivation is the process of embracing challenging circumstances to face them with intention, persistence, direction, quality and intensity of behavior. Motivation is the driving force that propels individuals to take action, pursue goals, and overcome challenges (Caroll, 2021). It can be fueled by intrinsic factors like passion and curiosity, or extrinsic factors such as rewards and recognition. When students are motivated, they are more likely to engage actively in their learning, persist through difficulties, and strive for excellence. This sustained effort and dedication ultimately lead to higher levels of academic achievement, as motivated learners are better equipped to absorb, retain, and apply knowledge effectively. By fostering a motivating learning environment, educators can significantly enhance students' academic success and personal growth.

Achieving high academic standards is influenced by various factors, including motivation, access to resources, teaching quality, and family support. However, gender can also play a significant role in academic achievement. According to Siyi Liu in International Journal of STEM Education (2023) it shows that societal expectations, cultural norms, and gender stereotypes can impact the learning experiences and performance of students. For instance, girls are often encouraged to excel in language, arts, while boys may be steered towards science and mathematics. These biases according to Siyi Liu can affect students' self-perceptions and interests, ultimately influencing their academic outcomes. By addressing and challenging gender stereotypes, educators and policymakers can create a more equitable and inclusive educational environment that supports the academic achievement of all students, regardless of gender and teaching quality.

Lecture method according to Crawford and Parsel (2025) is a teacher-centered mode of instruction where the main aim is the provision of explanation by an educator to students. Kaur (2021) sees lecture method as a method of teaching by which the instructor gives an oral presentation of facts or principles to learner's, usually with minimal students interaction.

However, it does not emphasize the two fundamental tenets of teaching which according to Okoli (2023) are activity in the classroom and putting the learners in the center of the experience and it is not appropriate for modern multicultural classroom. Lecture method does not provide the learner opportunity to learn through tangible experiences. To eliminate these disadvantages, it is advisable to use other approaches such as computer instructional technique, guided inquiries and discussions to ensure participation of the students.

Gender refers to the social, cultural and psychological attributes, behaviors and roles that a society considers appropriate for men, women, and other gender identities. Gender according to Okeke (2018) refers to those characteristics of male and female which are biologically determined such as possession of penis by males and vagina by females. It is also a socially constructed characteristics and roles which are associated with males and females in a society. Christler and Lamar (2018) states that gender is individuals' social identity (woman/girl, man/boy) and personality or behavioral tendencies (e.g., masculine, feminine, androgynous, transgender). Gender as a social identity is usually (but not necessarily) related to an individual's biological sex. Feminists and most behavioral science researchers prefer to use gender, rather than sex (male, female), to describe humans in order not to imply that any differences between the groups are directly, essentially, or solely related to biological influences. In education there lies gender stereotype on what males should offer and that which is ideal for girls , this leads to limited opportunities, bias in teacher expectation, self-perception and confidence doubt, classroom dynamic and gender imbalance in various professions. And to this end the study sought to determine the impact of computer instructional techniques on student's motivation and academic achievement in chemistry.

1.1. Statement of the Problem

Anambra state, like many regions globally has witnessed an increased integration of computer instructional techniques in Secondary school education. However, there remains a gap in understanding the specific impact of these techniques on student's motivation levels and academic achievement in the subject of Chemistry. Some researchers opined that low achievement in science is attributed to lack of student's motivation, interest and retention in science subject's concept. Teachers should therefore stimulate and sustain their student's motivation and interest through the use of varieties of teaching techniques like computer instructional technique, this would go a long way in promoting students Motivation in science which would in

turn stimulate high academic achievement in the area. Despite the potential benefits of using computer-based instruction, such as increased engagement and interactive learning experiences. It is unclear how these methods effect student's motivation to learn Chemistry and their subsequent academic achievement in Anambra state.

According to WAEC Chief Examiners Report 2018 to 2023 highlights poor academic achievements in chemistry paper 2 (theory) over the years. This arises from students having difficulties and tackling questions that required explanation and plotting of graphs. Few researchers also noted that the conventional method can no longer meet the needs of our instructional delivery method in this era of computer age and hence they are gradually being replaced by computer instructional strategies which has the ability of motivating students and making information and objects available in learning environment with speed and practical approach.

Therefore, this study aims to investigate the effect of computer instructional technique on Secondary School student's motivation in Chemistry in Anambra State. By addressing this gap in research, the study seeks to provide valuable insights into effective teaching methods that can enhance students learning outcomes in chemistry Education in the state.

1.2. Purpose of the Study

The purpose of the study is to investigate the effect of computer instructional technique on Secondary school student's level of motivation and academic achievement in chemistry in Anambra State. Specifically, the study sought to determine the:

a. Mean motivation scores of Chemistry students taught with Computer instructional technique and those taught with lecture method among senior secondary school students.

b. Mean motivation scores of male and female students taught Chemistry using Computer instructional technique and those taught with lecture method among senior secondary school students

1.3. Research Questions

The study sought answers to the following research questions:

a. What are the difference in motivation mean scores of students taught using computer instructional technique and those taught using lecture method in chemistry among senior secondary school students?

b. What are the gender differences in the mean Motivation scores of students taught with Computer instructional technique and those taught with lecture method in chemistry?

1.4. Hypotheses

The following null hypotheses (H_o) were tested at 0.05 level of significance:

a. There is no significant difference in the mean motivation scores of students taught with Computer instructional technique and those taught with lecture method of teaching Chemistry.

b. There is no significant difference in the mean motivation scores of male and female students taught using computer instructional technique and those taught with lecture method in Chemistry due to gender.

2. Method

The study adopted a pretest-posttest non-equivalent control group quasi-experimental design. According to Nworgu (2018) the design is where a random assignment of research subjects into experimental and control groups is not possible. Therefore, in this study, the already existing classroom arrangements in the schools that were sampled as experimental and control groups were not disrupted by the researcher but rather used the way they were. The area of the study was Orumba South Local Government Area. The population and sample of the study are comprised of 241 and 60 (30 males and 30 females)public secondary school students respectively. The participants were selected from two out of 15 public secondary schools in the area using simple random sampling (balloting with replacement). The instrument for data collection was the Motivation Inventory Scale (MIS). The instrument was structured into two parts A was to elicit information on students demographic data while part B contained the main questions. The MIS is a 25-item questionnaire scaled for 4 for very high level, 3 for high level, 2 for low level, and 1 for very low level.

The face validation of the instrument was done by three experts and was subjected to reliability. The reliability coefficient of the instrument was found to be 0.86 which confirmed the reliability of the instrument. Mean was used to answer the research questions while analysis of covariance (ANCOVA) was used in testing the hypotheses at an alpha level of 0.05.

3. Results and Discussion

3.1. Research Question One: What are the Differences in the Mean Motivation Scores of Students Taught Using Computer Instructional Technique and Those Taught Using Lecture Method in Chemistry Among Senior Secondary School Students?

Data collected in respect of this research question are presented in Table 1.

Table 1. Mean Motivation Scores of Students taught Chemistry using Computer Instructional Technique (CIT) and Lecture Method (LM)

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain
CIT	30	58.27	8.21	75.63	8.73	17.36
LM	30	57.93	8.43	60.47	11.82	2.54
Total	60	58.10	8.27	68.05	9.18	9.95

Table 1 shows that students taught Chemistry using Computer Instructional Technique had a pretest mean motivation score of 58.27 and SD of 8.21 and a posttest mean of 75.63 and SD of 8.73 with a gain in mean motivation score of 17.36, and while those taught with lecture method (LM) had a pretest mean motivation score of 57.93 and SD of 8.43 and a posttest mean motivation of 60.47 and SD of 11.82 with a gain in mean motivation of 2.54. Students' scores in LM were more spread in posttest (11.82) than those in CIT group (8.73)

3.2. Research Question Two: What Are the Gender Differences in the Mean Motivation Scores of Students Taught With Computer Instructional Technique and Those Taught With Lecture Method in Chemistry?

Data collected in respect of this research question are presented in Table 2

Table 2. Mean Motivation Scores of Male and Female Students taught Chemistry using CIT and LM

Group	Gender	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain
CIT	Male	12	57.58	8.42	74.25	8.85	16.67
	Female	18	58.72	8.29	76.86	8.67	17.84
LM	Male	18	58.11	8.39	59.83	9.53	1.72
	Female	12	57.67	8.33	61.42	9.01	3.75

Table 2 shows that with a higher mean gain of 17.84, computer instructional technique increased the motivation of female students in Chemistry. Computer instructional technique increased the spread of motivation scores (8.85) among the male students than among the female students (8.67). The difference in the mean motivation scores is 1.17, in favor of the females.

3.3. Hypothesis

Hypothesis 1 There is no significant difference in the mean motivation scores of students taught with Computer instructional technique and those taught with lecture method of teaching Chemistry.

Table 3. ANCOVA Test of Significance of Difference in Mean Motivation Score of Students taught Chemistry using CIT and LM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig. (P)
Corrected model	3852.174	4	963.044	31.279	.001
Intercept	1327.581	1	1327.581	43.133	.000
Pre-test Motivation	1087.963	1	1087.963	35.342	.003
Teaching Method (TM)	2643.291	1	2643.291	85.862	.000
Gender	64.732	1	64.732	2.103	.153
TM* Gender	12.673	1	12.673	0.412	.524
Error	1692.976	55	30.781		
Total	283758.000	60			
Corrected Total	5545.150	59			

R Squared=.695 (Adjusted R Squared =.674)

From Table 3, the ANCOVA results show a significant main effect of teaching method on post-test motivation scores ($F = 85.862$, $p < .001$). Since the p-value (.000) is less than the alpha level of 0.05, the null hypothesis is rejected. This means that there is a statistically significant difference in the mean motivation scores of students taught with Computer Instructional Technique and those taught with the Lecture Method in chemistry.

From Table 3, the ANCOVA results show that the effect of gender on post-test motivation scores was not statistically significant ($F = 2.103$, $p = .153$). Also, the interaction effect between teaching method and gender was not statistically significant ($F = 0.412$, $p = .524$). Since both p-values are greater than the alpha level of 0.05, the null hypothesis is not rejected. This means that there is no statistically significant difference in the mean motivation scores of male and female students taught using the Computer Instructional Technique and those taught with the Lecture Method in chemistry due to gender.

3.4. Discussion

The findings from Table 1 revealed a substantial difference in the mean motivation scores between students taught using Computer Instructional Technique (CIT) and those taught using the conventional Lecture Method (LM). The experimental group exposed to CIT achieved a significantly higher mean motivation score compared to the control group taught using LM. The mean gain for the experimental group was notably larger than that of the control group. The ANCOVA results in Table 3 confirmed this observation by showing a statistically significant main effect of teaching method on post-test motivation scores ($F = 85.862$, $p < .001$), leading to the rejection of the null hypothesis.

These findings suggest that Computer Instructional Technique significantly enhances students' motivation in chemistry compared to the traditional lecture approach. This aligns with the findings of Oyekola, Ishola and Odedokun (2020), who reported a positive correlation between motivation and student achievement in chemistry. The present study extends this understanding by demonstrating that CIT can be an effective tool for boosting motivation levels.

Similarly, the results support the work of Agiande and Nnaji (2024), who found that motivation significantly influences students' academic achievements in chemistry. The substantial improvement in motivation scores observed in the present study suggests that CIT creates a more engaging learning environment that stimulates students' interest in chemistry. This enhanced motivation could be attributed to the interactive and visually stimulating nature of computer-based instruction, which makes learning more appealing compared to traditional lecture methods.

The data in Table 2 showed that both male and female students in the experimental group demonstrated substantial improvements in motivation scores (mean gains of 16.67 and 17.84 respectively), with females showing a slightly higher improvement. Similarly, in the control group, both genders showed minimal improvements (mean gains of 1.72 for males and 3.75 for females), with females again showing a slightly higher gain. However, the ANCOVA results in Table 3 revealed that neither the main effect of gender ($F = 2.103$, $p = .153$) nor the interaction effect between teaching method and gender ($F = 0.412$, $p = .524$) was statistically significant. Therefore, the null hypothesis was not rejected.

These findings indicate that while CIT significantly enhances motivation for all students, the effectiveness is not significantly differentiated by gender. This is consistent with the results of Agiande and Nnaji (2024), who found no significant influence of motivation on students' academic achievement by gender. The present study extends this understanding by specifically examining the interaction between teaching method (CIT vs. LM) and gender on motivation, confirming that the benefits of CIT for motivation are experienced similarly by both male and female students.

This gender-neutral effect of CIT on motivation contradicts some traditional expectations that might assume differential impacts of technology-based teaching methods on male and female students. Instead, it suggests that well-designed computer instructional techniques can be equally motivating for all students, regardless of gender. This finding has important implications for educational equity and the universal applicability of CIT in chemistry education.

3.5. Recommendations

The following recommendations are made in the light of the findings of the study:

a. The Post Primary Schools Service Commission should expose teachers to annual training and retraining programmes on the use of Computer Instructional Technique to enable them to upgrade their skills in using the techniques in presenting lessons to bring about improvement in students motivation.

b. Orientation exercises should be organized for students by school authorities on how to effectively operate computers and computer related gadgets in other not to be passive during teaching and learning process thereby improving the effectiveness of the teaching.

c. The government should provide Chemistry teachers with facilities such as computers, storage devices and projectors which they need for preparing and teaching their lessons using CIT effectively.

d. Teachers should incorporate interactive and student-centered CIT strategies such as digital storytelling, virtual experiments, and game-based assessments that spark curiosity and make learning feel adventurous rather than routine.

e. Curriculum planners should collaborate with subject experts and educational technologists to embed engaging computer instructional techniques into the Chemistry curriculum, ensuring that lesson objectives align with digital learning tools that foster student motivation.

f. Parents should actively collaborate with schools and curriculum planners to enrich learning at home, ensuring students receive consistent support and real-word connections to classroom content.

4. Conclusion

The findings of this study showed that Computer Instructional Technique significantly improved the motivation of students in Chemistry. Based on the findings, the researcher concluded that Computer Instructional Technique is more effective for enhancing students' motivation in Anambra State. Also, gender has no significant influence on students' motivation in Chemistry.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

Funding

No funding support was received.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript. AI were used only to improve readability and language under strict human oversight; no content, ideas, analyses, or conclusions were generated by AI.

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