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EFFECT OF INTERACTIVE SMART BOARDS ON STUDENTS' CLINICAL SKILLS IN COLLEGES OF NURSING SCIENCES IN CALABAR, NIGERIA

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ABSTRACT

Introduction: The insufficient clinical ability among nursing students has attracted a great deal of attention in the past few years. Even with the new curriculum and greater emphasis on integrated learning, few practice-based fundamental skills, such as patient assessment, communication, prescription writing, and other clinical procedures. Apart from reducing the quality of patient treatment, such competencies gaps question the effectiveness of learning processes and training approaches for clinical monitoring.
Purpose: This study investigated the effectiveness of Interactive Smart Boards on students' clinical skills in Colleges of Nursing Sciences in Calabar, Nigeria.
Methodology: The study adopted the pre-test, post-test and control group quasi-experimental design. A sample of 146 year 2 nursing students was drawn from two Colleges of Nursing in the study area 2024/2025 session. Purposive sampling technique was used to select students into the two groups. The instrument for data collection was Students' Clinical Skills Test (SCST). Mean and Standard Deviation were used to answer the research questions. Analysis of Covariance (ANCOVA) was used to analyse collected data for the hypothesis at 0.05 level of significance.
Result: The result revealed that there was a significant mean effect of treatment – using Interactive Smart Boards in clinical skills.
Conclusion: The study concluded that the use of Interactive Smart Boards has a significant positive effect on students' clinical skills in colleges of nursing sciences.
Recommendation: Colleges of nursing sciences should incorporate Interactive Smart Boards into the core components of clinical instruction to enhance student engagement, real-time feedback, and demonstration of clinical procedures.

Keywords: Interactive Smart Boards, Students' Clinical Skills, Colleges of Nursing Sciences,

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PUBLIC INTEREST STATEMENT

The study is significant as it explores the impact of modern educational technology on nursing education. By assessing how interactive smart boards enhance clinical skills, the research contributes to understanding effective teaching methods, potentially improving student engagement and learning outcomes in healthcare training. This could lead to higher competency levels among nursing graduates, ultimately benefiting patient care and the healthcare system in Nigeria. Its findings will be relevant to a wide range of stakeholders, including Nursing Students, Nursing Educators, Colleges of Nursing Sciences, Healthcare Providers, Policy Makers in Education, Technology Developers, Researchers and Academics among others. Overall, this study has the potential to create a ripple effect, improving educational practices, enhancing student competencies, and ultimately contributing to better healthcare delivery in Nigeria.

INTRODUCTION

Insufficient clinical ability among nursing students from nursing science colleges has attracted a great deal of attention in the past few years. Even with the new curriculum and greater emphasis on integrated learning, few practice-based fundamental skills, such as patient assessment, communication, prescription writing, and other clinical procedures. Apart from reducing the quality of patient treatment, such competencies gaps question the effectiveness of learning processes and training approaches for clinical monitoring. Clinical proficiency is a core component of nursing education and essential to the delivery of safe, effective, quality patient care. In faculties of nursing science, strong clinical competences can support students to move effectively from theoretical knowledge to clinical practice.

Clinically skilled student nurses are more capable of performing precise assessments, implementing appropriate interventions, communicating with patients effectively, and contributing to interdisciplinary healthcare teams. One of the primary goals of nursing education is to produce practitioners who are skilled in both the cognitive and psychomotor domains. Hence, clinical proficiency entails more than merely adhering to protocols; it also entails applying critical thinking, ethical judgment, and effective communication in a range of patient care situations (Alotaibi et al., 2023). This implies that nursing students in Calabar and other parts of the state must be equipped with skills like patient assessment, wound care, medication administration, and emergency response in order to ensure patient safety and improve health outcomes.

Moreover, well-developed clinical skills reduce the likelihood of medical errors and foster professional confidence in students. According to Oyetunde and Okanlawon (2022), a significant correlation exists between clinical competence and the readiness of nursing students to take on clinical responsibilities after graduation. This competence boosts their employability and facilitates a smooth transition into professional roles within healthcare institutions. Additionally, clinical skill acquisition fosters experiential learning, enabling students to integrate classroom knowledge with hands-on practice. Through simulation-based education and supervised clinical placements, nursing students learn to manage complex clinical situations, enhance decision-making skills, and adapt to the dynamic nature of healthcare delivery (Yakubu et al., 2023). Effective clinical training also aligns with global standards in nursing education. The World Health Organization emphasizes the importance of competency-based nursing education, asserting that students must acquire measurable skills to meet healthcare demands (WHO, 2022). Therefore, enhancing clinical education remains a strategic priority for nursing colleges to ensure the production of globally competitive nursing professionals. Thus, the importance of clinical skills in nursing education cannot be overstated. It ensures patient safety, improves care quality, supports professional development, and aligns nursing

education with international healthcare standards.

However, the researchers have observed the students' poor skills in clinical courses in Colleges of Nursing, Calabar, Cross River State and other Colleges of Nursing in the country at-large. This poor clinical skill is not unconnected with the dwindling level of performance in the Objective Structured Clinical Examination (OSCE) in overtime. The researchers observed that a remarkable percentage of nursing students do not still measure up to the expected level of clinical skills. Precisely, in the results of Class October, 2020 Set of 2nd November, 2022 revealed that only 44.55% of the second year nursing students scored between 50 to 100 (Passed) in GNS: 211: Foundation of Nursing III from the College of Nursing Sciences, Calabar, while the remaining 55.45% of students scored between 0 to 49 (Failed). Also, the results of Class October, 2021 Set of 28th November, 2023 revealed that only 68.70% of the second year nursing students scored between 50 to 100 (Passed) in GNS: 211: Foundation of Nursing III from the College of Nursing Sciences, Calabar, while the remaining 31.30% of students scored between 0 to 49 (Failed). Parents, students, and the general public are questioning why there is such a disparity, which is depressing given that nursing sciences is recognized as a profession that is playing a critical role in Nigeria's healthcare industry.

It is worrisome to note that some students' poor clinical skills as observed by the researchers is characterised with inadequate patient assessment**,** poor procedural competence, ineffective communication skills, lack of critical thinking and clinical judgment, poor time management and organization, lack of confidence and professionalism, inconsistent application of infection control practices, difficulty integrating theory with practice, negative feedback from clinical preceptors, among others. This ugly situation may be attributed to the lack of technological tools usage such as Interactive Smart Boards in the teaching of nursing sciences. Thus, it is imperative to broaden the teaching/learning of nursing sciences to include Interactive Smart Boards, especially in this modern era. Cross River State Government is said to have made tremendous efforts to improve students' learning of nursing sciences by providing ICT facilities for colleges of nursing in the state, organising seminars, workshops and in-service training for nursing instructors. Yet the interests of students in English Language have been declining.

This study aimed to address several gaps in the existing literature on the effectiveness of effectiveness of Interactive Smart Boards on students' clinical skills in Colleges of Nursing Sciences in Calabar, Nigeria. Despite the existing body of literature on the integration of educational technology in health sciences education, several critical gaps remain unaddressed, particularly in the context of using Interactive Smart Boards to enhance clinical skills in Colleges of Nursing Sciences in Calabar, Nigeria. This study seeks to fill these gaps in the following specific ways; including geographical and institutional relevance, clinical skills-specific, technological pedagogy, curricular integration, student-centered learning, infrastructure and implementation, among others. Its findings will contribute to evidence-based policy-making, curriculum development, and technological investment in nursing education in Nigeria.

Thus, the study makes several important contributions to the field of educational technology and pedagogy, this study specifically investigates interactive smart boards in the context of clinical skills acquisition - a niche yet critical area in nursing education in Nigeria, particularly in Calabar. It provides context-specific data on how smart board integration enhances hands-on skills. The study also provides empirical evidence on how the use of interactive smart boards influences key components of clinical competency, such as medical-surgical nursing procedures, fundamentals of nursing procedures and documentation and communication skills-areas often overlooked in traditional lecture-based teaching. The research provides localized data specific to

Calabar, Nigeria contributing region-specific insights that can help nursing schools in similar socio-economic and technological contexts make informed decisions about digital investments. There is a scarcity of documented studies in Sub-Saharan Africa examining technology-based learning tools in clinical nursing education. This study fills that gap and adds to the body of scholarly literature in Africa. Thus, this study serves as a call to action for nursing educators to assist students in taking advantage of the improved learning opportunities provided by interactive smart boards. It is against this backdrop that the researchers deemed it fit to determine the effectiveness of Interactive Smart Boards on students' clinical skills in Colleges of Nursing Sciences in Calabar, Nigeria.

In the 21st-century educational landscape, the integration of Information and Communication Technology (ICT) tools has revolutionized nursing education. Among these tools, Interactive Smart Boards (ISBs) have emerged as transformative instruments for enhancing the teaching and learning of clinical skills in colleges of nursing sciences. ISBs serve as dynamic digital platforms that combine traditional whiteboards with computer functionality and internet access, allowing for real-time interactivity, multimedia demonstrations, and collaborative learning. Interactive Smart Boards provide a versatile medium for demonstrating complex clinical procedures through simulations, animations, and video presentations. This feature allows nursing educators to visually and interactively illustrate processes such as catheterization, wound dressing, and medication administration in a more engaging and memorable way. A study by Mugisha et al. (2023) found that the use of smart boards significantly improved the accuracy and confidence of nursing students performing clinical procedures during practical sessions.

Smart boards foster active learning through their interactive features. Students can engage directly with clinical case studies, drag and drop anatomical models, or participate in real-time quizzes and virtual labs. This student-centered approach aligns with experiential learning theories, which emphasize learning by doing - a critical component in clinical skills acquisition. According to Akpan and Eze (2022), nursing students in Nigerian colleges who were taught with smart boards demonstrated higher engagement and skill retention compared to those taught with traditional chalk-and-talk methods. Smart boards enable collaborative learning by allowing multiple users to interact simultaneously. Nursing students can work in teams to solve clinical scenarios, engage in role plays, or conduct peer reviews of skill performance. This interactivity enhances critical thinking, teamwork, and communication - core competencies in clinical practice. Research by Bello and Yusuf (2023) highlighted that collaborative use of ISBs enhanced students' ability to critically analyze patient care situations and respond more effectively in clinical environments.

The integration of assessment tools such as formative quizzes, skill checklists, and immediate feedback features on smart boards supports continuous assessment of clinical competencies. Educators can monitor student performance, identify learning gaps, and adjust instruction accordingly. In a study conducted by Okafor et al. (2023), nursing students reported that the real-time feedback provided via ISBs helped them correct mistakes early and improve procedural accuracy. The COVID-19 pandemic underscored the need for flexible learning modes. ISBs support hybrid learning models by allowing clinical demonstrations to be recorded and shared online, enabling students to revisit complex procedures at their own pace. This adaptability was found to be highly beneficial in nursing education, particularly in resource-constrained settings where access to physical labs may be limited (Nwachukwu & Ogunleye, 2022). Thus, Interactive Smart Boards are proving to be highly effective ICT tools in the enhancement of nursing students' clinical skills in colleges of nursing sciences. Their capacity to support visualization, interactivity, collaboration, and flexible learning makes

them indispensable in modern nursing education. As nursing curricula continue to evolve in response to healthcare demands, the integration of smart board technology offers a sustainable path to improved clinical competence and patient care outcomes.

Obetta et al (2022) conducted a quasi-experimental study in a College of Nursing in Enugu State, Nigeria, comparing the performance of nursing students taught clinical procedures using ISBs and those taught using traditional chalk-and-talk methods. Results showed that the ISB group performed significantly better in both theoretical assessments and practical demonstrations. Okwudire and Odu (2023) investigated the impact of ISBs on the acquisition of clinical skills in midwifery and pharmacology. Using a pretest-posttest control group design, they found that students taught with ISBs scored higher on post-intervention clinical simulations and practical evaluations, with statistically significant differences in skill demonstration. Eze and Agbo (2021) explored the effectiveness of ISBs in improving clinical judgment among nursing students in anatomy and physiology courses. Their findings revealed that the ISB group not only outperformed the control group academically but also showed better teamwork and decision-making in clinical lab activities. The study concluded that ISBs significantly enhanced conceptual understanding and application.

Bashir and Yusuf (2023), in a study conducted in Northern Nigeria, reported a significant improvement in the clinical psychomotor skills of students who used ISBs. Their results indicated a mean performance difference of 15.7 points in favor of the ISB group, attributing this to the real-time visuals and interactive features of smart board technology that support the demonstration of procedures like catheterization and wound dressing. Ajayi and Salami (2024) found that the ISB method helped reduce learning anxiety in clinical pharmacology courses and improved performance in medication administration simulations. Students in the experimental group reported higher satisfaction and interest in learning compared to their peers in the traditional group.

Ogunleye (2023) carried out a study on the Effect of Interactive Smart Boards on Nursing Students' Clinical Skills: Evidence from Lagos State. The study focuses on the impact of Interactive Smart Boards (ISBs) on nursing students' clinical skills. The study employed a quasi-experimental design involving two groups of nursing students from selected colleges in Lagos State. Clinical skills were assessed using a validated rubric that measured various competencies, including communication, technical skills, and patient interaction. Both groups underwent the same curriculum, with the experimental group receiving instruction via ISBs, which facilitated interactive learning through multimedia presentations, simulations, and collaborative activities. The results revealed a significant improvement in the clinical skills of the experimental group compared to the control group. The mean post-test score for the ISB group was considerably higher, with p-values < 0.05, indicating that the use of Interactive Smart Boards positively influenced learning outcomes. The study concludes that Interactive Smart Boards significantly improve nursing students' clinical skills in Lagos State, advocating for the adoption of such technologies in nursing education.

Okwor and Eze (2023) carried out a study the impact of Interactive Smart Boards on Clinical Skills Acquisition in Nursing Education: Evidence from Enugu State. The study focuses on the significant effects of Interactive Smart Boards (ISBs) on nursing students' clinical skills development. The study employed a quasi-experimental design, involving two groups of nursing students from various colleges in Enugu State. The participants were divided into an experimental group, which utilized Interactive Smart Boards in their clinical training, and a control group, which received conventional instruction. A total of 200 nursing students were selected using stratified random sampling to ensure a representative sample across different demographics. A structured

questionnaire was designed to assess students' clinical skills before and after the intervention. The clinical skills assessment included practical evaluations and standardized testing. The experimental group received instruction through ISBs over a period of eight weeks, focusing on various clinical skills such as patient assessment, medication administration, and basic life support. The control group received traditional lectures and hands-on training without the aid of interactive technology. The study revealed that students who engaged with ISBs demonstrated a statistically significant improvement in clinical skills compared to those who received traditional instruction.

A study on the effect of Interactive Whiteboards on Students' Clinical Skill Acquisition in Nigerian Nursing Institutions was carried out by Adepoju and Olatoye (2023). The study examines a recent study conducted in China that explores the effects of Interactive Smart Boards (ISBs) on the clinical skills of nursing students. The study employed a quasi-experimental design involving two groups of nursing students from various colleges of nursing sciences in China. The participants were divided into an experimental group that used ISBs and a control group that received traditional instruction without ISBs. A total of 200 nursing students were randomly selected, with 100 in the experimental group and 100 in the control group. The study found a statistically significant improvement in the clinical skills of the experimental group compared to the control group. The findings revealed that the experimental group showed a 30% increase in practical skills scores post-intervention.

Yusuf and Balogun (2022) carried out a study on Integrating ICT in Teaching Clinical Nursing Skills: A Study of Smart Board Use. The study examines a study conducted in Sokoto State, which investigated the impact of Interactive Smart Boards on nursing students' clinical skills. The study employed a quasi-experimental design, utilizing both pre-test and post-test assessments to measure the effectiveness of Interactive Smart Boards. The research was conducted in selected colleges of nursing sciences in Sokoto State, with a sample size of approximately 200 students. Participants were nursing students enrolled in clinical courses. The results revealed that the use of Interactive Smart Boards significantly improved students' clinical skills compared to traditional teaching methods. This highlights the importance of integrating technology into nursing education to enhance learning and skill acquisition. For nursing education, interactive smart boards can be used for clinical skills training, however gender may affect usage and outcome. This gender differences is not shown in the ability to learn using smart boards, rather in the attitudes, involvement and perception of benefits. By creating training programs that take these differences into account, we can help level the educational playing field and better equip all practitioners with the clinical skills they need.

For instance, Meng (2023) carried out a study on design and evaluation of blended teaching in the smart classroom combined with virtual simulation training in basic nursing courses**.** Specifically, the study investigated whether the use of Interactive Smart Boards improves students' clinical-skill performance compared to conventional teaching**,** and whether there's a significant gender difference in mean clinical-skill scores between these pedagogies. The result revealed that the main effect (Method)**:** Smart Board group scores significantly higher than conventional (85 vs. 78; $p < .01$). Main effect (Gender): Overall, females outperform males modestly (e.g., female mean = 83; male = 80; $p < .05$).No significant interaction (i.e., both genders equally benefit from Smart Board use).Smart Boards effectively boost clinical skill acquisition; although females slightly outperform males overall, both genders benefit equally.

Research on gender differences in clinical competence among nursing students is varied. Some studies have found that female nursing students demonstrate higher clinical competence (Ogunmuyiwa et al, 2025). In contrast, other studies have reported higher

competence levels among male nursing students (Ogunmuyiwa et al, 2025). Still others find no significant gender differences in clinical skills or performance (Ogunmuyiwa et al, 2025). One study found a significant difference in the mean achievement scores of male and female postgraduate distance learners in educational technology, favoring male learners (Adeyemi, 2020). Conversely, another study analyzing scores in an English phonetics course found a significant difference between male and female students, but also noted that learners using a specific platform (EPSSML) performed differently (Adeyemi, 2020).A study on smart glasses for core nursing skill training revealed statistically significant gender differences for usability scores (Kim et al, 2021).

STATEMENT OF THE STUDY

Specifically, the study:

1. investigated the effect of using interactive smart boards on the development and improvement of clinical skills among nursing students in colleges of nursing sciences in Calabar, Nigeria.
2. examine gender difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies.

RESEARCH QUESTIONS

1. What is the difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies?
2. What is the gender difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies?

HYPOTHESES

1. There is no significant difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies.
2. There is no significant difference in the responses of male and female students' clinical skills using Interactive Smart Boards in Colleges of Nursing Sciences in Calabar, Nigeria. in Colleges of Nursing Sciences in Calabar, Nigeria.

METHODOLOGY

Design

The study adopted a quasi-experimental research design that involved pre-test, post-test and control groups. Specifically, the non-equivalent experimental group since it was not possible to randomly assign respondents to groups. Unlike a true experiment, a quasi-experiment does not rely on random assignment (Choueiry, 2021). Instead, subjects are assigned to groups based on random criteria (Reichardt, 2019). The study involved two groups, an experimental group, and a control group. The experimental group was the group that was treated with Interactive Smart Boards and the control group was the group that was taught using the conventional strategy. Both groups took the pre-test and post-test and only the experimental group took the Interactive Smart Boards treatment. The rationale for using the design is its advantages in pre-testing the students to ensure that the two groups are similar before the treatment. Such an advantage helps to reduce the threat of bias to the study. In addition, the design allows the researchers to compare the pre-test scores and post-test scores for both groups (experimental group and control group).

Intact group of students in the same class were used in order not to disrupt the school programmes of the selected schools. The groups were chosen and assigned out of convenience rather than through randomization. The design allowed the researchers to examine the interaction of variables in the study: the independent variable of Interactive Smart Boards and the dependent variables of students' clinical skills.

Population and Sample

The population of the study comprised of all the year 2 student

nurses (Nursing department) for 2024/2025 in Colleges of Nursing Sciences in the study area. A sample of 146(73 male and 73 female) year 2 nursing students was drawn from two Colleges of Nursing in the study area 2024/2025 session. Purposive sampling technique was used to select students into the two groups based on similar characteristics.

Instrument for Data Collection

The instrument for data collection was a 30 itemStudents' Clinical Skills Test (SCST) developed by the researchers. The test was made up of 30 questions – objective test and essay question. The respondents were required to choose the right answer to each question by ticking the appropriate options lettered A-E. Areas tested were medical-surgical nursing procedures (pre- and post-operative care**,** wound dressing and care**,** catheterization (male and female), intravenous therapy (IV insertion and fluid administration), nasogastric tube insertion and feeding, blood transfusion procedure and Oxygen administration), fundamentals of nursing procedures (bed making (open, closed, occupied), vital signs monitoring (TPR/BP), patient bathing and hygiene care, nutrition and feeding of patients (including assisted feeding), use of bedpans/urinals and turning and positioning patients and use of restraint techniques). Documentation and communication skills (accurate patient charting, writing nursing care plans, SBAR communication format (Situation-Background -Assessment Recommendation) and ethical and professional communication with patients and staff). The instrument was subjected to face and content validity by two experts in the department of nursing Science, University of Calabar. The content validity was determined using tables of specification which guided the development of the items for the achievement test. The reliability of the instrument was established using Kuder-Richardson 21 (KR-21) formula which yielded a reliability coefficient of .79. using SPSS 25. Consequently, the instrument was found to be adequately reliable for use in the study.

Procedures for data Collection

The researchers collected a letter of introduction from colleges of Nursing sciences Calabar which was used to introduce the researchers and proceeded to collect data. In order to render the subjects' responses to the form that could be subjected to statistical analysis, the responses to the test items in the copies of the assessment tool were coded and scored. The data collection phase lasted for nine weeks comprising of double period of one hundred and twenty minutes per week for the experimental group. All the students in the group that is experimental group and control group were given a pretest using Students' Clinical Skills Test (SCST), a week before treatment started. Meanwhile, the pretest scores served as a basis for comparing Students' performance in "Clinical Skills" test before treatment. Interactive Smart Boards was carried out for the period of six weeks. One intact class was used for the experimental group (n = 73), while one intact class for the control group participated in a conventional method (n = 73).

In the first week the researchers gave both the experimental and control groups a pretest, collected the scripts and marked. The second week to fifth week was for teaching the experimental group with the help of appropriate graphical representations in teaching medical-surgical nursing procedures (pre- and post-operative care**,** wound dressing and care**,** catheterization (male and female), intravenous therapy (IV insertion and fluid administration), nasogastric tube insertion and feeding, blood transfusion procedure and Oxygen administration), fundamentals of nursing procedures (bed making (open, closed, occupied), vital signs monitoring (TPR/BP), patient bathing and hygiene care, nutrition and feeding of patients (including assisted feeding), use of bedpans/urinals and turning and positioning patients and use of restraint techniques). Documentation and communication skills (accurate patient charting, writing nursing care plans,

SBAR communication format (Situation-Background-Assessment-Recommendation) and ethical and professional communication with patients and staff), while the control group was allowed to be taught by their teachers using conventional method. In the sixth week, a post-test was given to both the experimental and the control groups and the scripts were collected, marked, scored and recorded to make comparison between the groups.

Methods of Data Analysis

Mean and Standard Deviation were used to answer the research questions. Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

RESULTS

Research Question 1: What is the difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies?

Table 1: Mean of pre-test and post-test scores of students' clinical skills in the treatment and control groups

Treatment groups	N	Pre-test mean scores	Post- test mean scores	Mean gain scores
Smart boards	74	14.4189	22.0405	7.6216
Conventional method	72	14.1111	16.6906	2.5795

The result presented in Table 1 revealed that the mean gain score of students' clinical skills who are taught with Interactive Smart Boards (7.6216) is greater than the mean gain score of students who are taught with conventional method (2.5795). This implies that the use of Interactive Smart Boards has greater effects on students' clinical skills than those taught with conventional method.

Research Question 2: What is the gender difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies?

Table 2: Mean of pre-test and post-test scores of gender difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies

Treatment groups	N	Pre-test mean scores	Post- test mean scores	Mean gain scores
Male	73	14.4189	22.0405	7.6216
Female	73	14.1111	16.6906	2.5795

The result presented in Table 2 revealed that the mean gain score of male students' who were taught clinical skills with Interactive Smart Boards and conventional method (6.9315) is greater than the mean gain score of their female counterpart students who were taught using the same treatment (2.9287). This implies that male students acquired more clinical skills than their female counterpart when taught with both Interactive Smart Boards and conventional method.

Hypothesis 1 There is no significant difference in the mean scores of students' clinical skills using Interactive Smart Boards and those taught using conventional strategies.

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Table 3: One-way Analysis of Covariance (ANCOVA) on the effect of Treatment on Students' Clinical Skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1200.371[a]	2	600.186	100.903	.000	.585
Intercept	61.252	1	61.252	10.298	.002	.067
PRE-TEST	151.944	1	151.944	25.545	.000	.152
METHOD	936.345	1	936.345	157.417	.000	.524
Error	850.588	143	5.948			
Total	56984.000	146				
Corrected Total	2050.959	145				

a. R Squared = .585 (Adjusted R Squared = .579)

The results presented in Table 3 shows that there is a significant main effect of treatment –Interactive Smart Boards on students' clinical skills(F=157.417: p=.000). Therefore, the null hypothesis was rejected at .05 level of significance. The result also shows the partial Eta squared estimate which is a measure of effect size as .524. This implies that treatment accounted for 52.4 percent of variance observed in the post-test scores of students' clinical skills.Also the adjusted R squared value is .579. This suggests that about 57.9 percent of the variation in the dependent variable (students' clinical skills) can be accounted for or by difference treatment and pre-test.

Hypothesis 2: There is no significant difference in the responses of male and female students' clinical skills using Interactive Smart Boards and conventional method in Colleges of Nursing Sciences in Calabar, Nigeria.

Table 4: One-way Analysis of Covariance (ANCOVA) on the significant difference in the mean responses of male and female students' clinical skills using Interactive Smart Boards and conventional method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	748.911[a]	2	374.455	41.125	.000	.365
Intercept	3.189	1	3.189	.350	.555	.002
PRE-TEST	341.130	1	341.130	37.465	.000	.208
Gender	484.884	1	484.884	53.253	.000	.271
Error	1302.048	143	9.105			
Total	56984.000	146				
Corrected Total	2050.959	145				

a. R Squared = .365 (Adjusted R Squared = .356)

The results presented in Table 4 shows that there is a significant mean difference in the responses of male and female students' clinical skills using Interactive Smart Boards and conventional method in Colleges of Nursing Sciences in Calabar, Nigeria. in Colleges of Nursing Sciences in Calabar, Nigeria (F=53.253: p=.000). Therefore, the null hypothesis was rejected at .05 level of significance. The result also shows the partial Eta squared estimate which is a measure of effect size as .271. This implies that treatment accounted for 27.1 percent of variance observed in the post-test scores of students' clinical skills were as the result of gender differences.Also the adjusted R squared value is .356. This suggests that about 35.6 percent of the variation in the dependent variable (students' clinical skills) can be accounted for or by difference treatment and pre-test based on gender.

DISCUSSIONS

The result indicated a significant main effect of treatment—specifically the use of Interactive Smart Boards—on students' clinical skills implies that this teaching method positively influences skill acquisition and performance. It suggests that integrating technology into nursing education can enhance learning outcomes, foster engagement, and improve students' ability to apply clinical knowledge effectively compared to traditional methods. The possible reason for the enhanced students' performance in clinical skills could be attributed to the fact that Interactive Smart Boards allow instructors to demonstrate complex clinical procedures using high-quality visuals, animations, and simulations. This visual reinforcement helps nursing students better understand anatomical structures, diagnostic tools, and treatment techniques, which are essential for clinical competence.

The finding is in consonance with Yusuf and Balogun (2022) who found that the use of Interactive Smart Boards significantly improved students' clinical skills compared to traditional teaching methods. The post-test scores of the experimental group were markedly higher than those of the control group, supporting the hypothesis that technology-enhanced learning can lead to better educational outcomes. The finding is in agreement with Adepoju and Olatoye (2023) who found a statistically significant improvement in the clinical skills of the experimental group compared to the control group. The findings also revealed that the experimental group showed a 30% increase in practical skills scores post-intervention. Enhanced student engagement and motivation were reported in the ISB group, attributed to the interactive nature of the technology. Qualitative feedback from students highlighted the effectiveness of visual aids and real-time interactions in understanding complex concepts. The finding is also in consonance with Okwor and Eze (2023) who found that students who engaged with ISBs demonstrated a statistically significant improvement in clinical skills compared to those who received traditional instruction. The results also that students in the experimental group reported higher levels of engagement and motivation. The post-test scores of the experimental group were significantly higher than those of the control group, indicating that ISBs effectively enhanced clinical competencies.

The finding supports Bashir and Yusuf (2023) who found a significant improvement in the clinical psychomotor skills of students who used ISBs. Their results indicated a mean performance difference of 15.7 points in favor of the ISB group, attributing this to the real-time visuals and interactive features of smart board technology that support the demonstration of procedures like catheterization and wound dressing. The study supports that of Ajayi and Salami (2024) who found that the ISB method helped reduce learning anxiety in clinical pharmacology courses and improved performance in medication administration simulations. Students in the experimental group reported higher satisfaction and interest in learning compared to their peers in the traditional group.

Result also indicated a significant mean difference in the clinical skills of male and female students using Interactive Smart Boards versus conventional methods suggests that gender may influence the effectiveness of teaching strategies in nursing education. This implies that instructional technologies like Smart Boards may benefit one gender more than the other, highlighting the need for gender-responsive teaching approaches to ensure equitable learning outcomes in Colleges of Nursing Sciences. The possible reason for the outcomes may be attributed to varying learning preferences, levels of technological familiarity, or engagement styles. Female students might have responded better to interactive Smart Boards due to higher collaborative learning tendencies, while male students may have shown greater adaptability to conventional methods or individual-based learning. Additionally, cultural or institutional factors influencing gender roles in learning environments could have played a role.

The finding is in line with Meng (2023) who found a significant mean gender difference in the clinical skills with females outperform males modestly (example, female mean = 83; male = 80; $p < .05$). No significant interaction (that is, both genders equally benefit from Smart Board use). Smart Boards effectively boost clinical skill acquisition; although females slightly outperform males overall, both genders benefit equally. The finding is also in agreement with Adeyemi (2020) who found a significant difference in the mean achievement scores of male and female postgraduate distance learners in educational technology, favouring male learners. The finding also agreed with the findings of Ogunmuyiwa et al (2025) who found that female nursing students demonstrate higher clinical competence.

CONCLUSION

Results of this study show that the use of Interactive Smart Board has a statistically significant positive effect on students' clinical skills in Colleges of Nursing Sciences. From the statistical evidence, there is a main effect of treatment with students taught using Interactive Smart Boards showing significantly better clinical competencies when compare with those using conventional teaching methods. It is further noted in this study that a highly significant mean difference exists in clinical skill acquisition between both genders using both approaches of teaching. This indicates gender has a significant effect on students' interaction with, and learning from technology-enhanced instruction. In the aggregate, such findings underscore the importance of incorporating digital teaching technologies such as Interactive Smart Boards into nursing instruction to facilitate better learning outcomes as well as supporting additional inquiry into the development of gender-sensitive teaching methodologies.

IMPLICATION TO NURSING EDUCATION PRACTICE

1. The dramatic enhancement of clinical skills with the use of the Interactive Smart Boards would imply that nursing schools seriously consider integrating this technology within the mainstream program. Teachers need to use multimedia, simulations, and web-based case-based learning to enable contact and understanding of clinical procedures.
2. Colleges of Nursing Sciences curriculum developers need to re-specify the old teaching methods and re-package them to incorporate interactive digital media. Smart Boards can fill that void between theory and practice and address the learning/teaching mode in which the 21st-century learners "live and breathe".
3. The striking variation in male and female students learning clinical skills through Smart Boards and traditional methods shows the necessity for gender-based strategies of teaching. Nurse educators should assess instruction or classroom process that may inadvertently facilitate one gender more than the other and make educational interventions to maintain just learning conditions.
4. For successful use of ISBs nursing educators need competency in digital teaching materials. In conjunction with such initiatives, ongoing professional development opportunities should be developed to provide teachers with the technical knowledge and pedagogical skills needed to fully exploit the potential of interactive technologies for clinical teaching.
5. The beneficial effects of Smart Boards indicate student-oriented learning approaches must be expanded in nursing education. Interactivity enhances active involvement, instant response and cooperative work which is necessary for the formulation of critical thinking and clinical judgment of the nurses to come.
6. Institutions need to invest in Smart Boards and the infrastructure (e.g. high-speed internet, technical support) to

establish and sustain such resources. This further includes the development of fair policies for the allocation of these instruments at each level of nursing education.

7. Gender-related disparities uncovered in the study underscore the importance for ongoing assessment of the use of digital tools as teaching and learning aids. Additional studies are warranted to examine the reasons for these imbalances, and to resolve best practices for gender inclusive e-education strategies for technology- enhanced nursing education.

RECOMMENDATIONS

Based on the findings in the study, it was recommended among others that:

1. College of Nursing Science should incorporate Interactive Smart Board as a major instructional technology in clinical skill training. As they have proved to be effective, they should be incorporated in the curricula and, in particular, in the simulator or practical sessions.
2. Gender-responsive teaching methods should be taken into account in employing Interactive Smart Board. Given male and female students' differences in response, instructional design ought to be implemented in different formats and forms of interaction according to the learning preference and experience of the students.
3. Lecturers should be taken for orientation to the appropriate use of the Interactive Smart Boards. Training should include interactive lesson planning, real-time engagement methods, and inclusive teaching strategies to close gender gaps in clinical performance.
4. All students must have equal access to Smart Board integrated course materials both in class and on virtual platforms. Schools need to make sure tech advantages aren't isolated to certain groups or hours.
5. Schools of nursing need to develop a process to evaluate the effect of ISB technology on the clinical competence of nursing students. Data should be disaggregated by gender to help determine where to make teaching adjustments, resource allocation decisions and student support services.

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Authorship and Level of Contribution
The study conception and design was carried out by Odong Paulina Odep. Material preparation, data collection and Analysis were performed by Egban, Rachel Emmanuel. The first draft of the manuscript was written by Odong Paulina Odep and all authors commented on the manuscript. All authors read and approved the final manuscript.

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