International Journal of Academic Pedagogical Research (IJAPR)
ISSN: 2643-9123
Vol. 9 Issue 4 April - 2025, Pages: 60-66

Workroom Practical: Implication for Students' Achievement and Attitude towards Science Curriculum in Delta South Senatorial Region

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Abstract: *The investigation investigated the practical ramifications for students' scholastic performance and disposition towards science curriculum within the Delta South Senatorial region. To guide the investigation, three investigation inquiries and three investigation suppositions were put together and developed accordingly. The quasi-experimental method, specifically employing the non-equivalent pretest, posttest managed group design, was utilized in this inquiry. Across all public mixed secondary schools, a total of 21,205 pupils were registered in senior secondary II (SS11) science classes. Two investigation tools, namely the Science Achievement Test (SAT) and the Science Attitude Questionnaire (SAQ), were employed for the investigation's objectives. The investigation sample comprised 380 students enrolled in the eleventh-grade science course. Utilizing the Kuder-Richardson formula 21 and Cronbach Alpha, yielding coefficient indices of 0.78 and 0.75 respectively, data were collected by administering the SAT and SAQ instruments as pre-tests and post-tests, respectively. Data analysis involved t-test analysis, mean, and standard deviation to scrutinize the acquired data. The analysis's findings indicated that science learners who were taught with workroom practical had significantly higher mean achievement and attitude scores than students who were not. The mean achievement score did not significantly differ across male and female participants taking science classes that included workroom practical. The findings imply that involvement in workroom and real-world experiences enhances students' scholastic achievement and attitude toward science curriculum. To mitigate potential obstacles, it is recommended that science educationalists incorporate workroom practical to supplement classroom instruction, while government and school administrators should ensure the provision of adequate workroom facilities.*

Keyword: Workroom Practical, Achievement, Attitude, Curriculum.

Introduction

The field of science has emerged among the most crucial and fundamental domains of human endeavor through its evolution. Science acts as the keystone upon which technology is rooted, and technology, in turn, acts as the base upon which modern advancement are established. Various scholars have characterized science from their unique perspectives. As Abimbola (2013) elucidates, science encompasses a reservoir of knowledge, a methodology of inquiry, and a mindset geared towards comprehending nature. Science has evolved into an indispensable aspect of human existence. Nations that disregard its significance jeopardize the future prospects of subsequent generations within their jurisdiction. Hence, it is imperative to recognize that the echelon of scientific education or literacy among a populace is a pivotal determinant of the attainable progress. Educational policies at the international echelon prioritize the cultivation of scientifically literate individuals.

The Nigerian government included scientific subjects including biology, chemistry, and physics in the secondary school curriculum by passing the National Policy on Education (NPE). The goal of this decision was to inspire students to pursue excellence in all facets of their lives, prepare them for success in the modern age of technology, and develop a pool of scholars who can contribute to the advancement of the country (Federal Republic of Nigeria, 2004, p. 29). This underscores the rationale behind the inclusion of science in secondary school curricula. To expand upon this, the NPE lucidly expressed its aims/objectives, highlighting the facilitation of chances for learners to gain crucial hands-on abilities directed towards attaining self-reliance and obtaining employment.

To achieve these laudable objectives, Science instruction in secondary schools must incorporate practical workroom activities as a vital element. This is essential to viaduct the gap between what students perceive, hear, and physically engage with. The schooling of any substantial scientific concept is unattainable without a corresponding practical activity complemented by relevant equipment and presentation methods. As per Gbamaja (2002), involving students in hands-on activities within the sphere of science ensures that instructional focus remains centered on the students, facilitating effective interaction between students and the subject being taught. According to James (2000), "practical knowledge" or "experience" pertains to knowledge acquired through the direct application of hands-on strategies during controlled investigation and instruction. Mankulik (2011) defines a "hands-on strategies" as any educational activity conducted in a school workroom that necessitates learners to watch and maneuver tangible objects and materials at various stages of the process.

As per Omiko (2007), a workroom acts as a designated space within a school premises where experiments (practical activities) are conducted to reinforce learned concepts, thereby enabling students to deepen their indulgent of ideas. This environment offers

students the occasion to actively participate in scientific endeavors rather than merely investigating theoretical concepts. Omiko further asserts that the workroom holds paramount importance in a robust scientific curriculum as it permit students to acquire experiential knowledge aligned with the overarching objectives of scientific literacy. This underscores the notion that comprehensive engagement in science instruction is unattainable without access to a well-equipped workroom. Ufonda (2009) echoes this sentiment, emphasizing the workroom's indispensable role within the educational framework in effectively delivering scientific content.

The curriculum can be viewed as a conduit through which educational institutions strive to attain their scholastic aims or objectives. Following Oyovwi's (2012 & 2019) perspective, it constitutes a well-organized compilation of insight and encounters presented to learners to further their desired objectives. Mohammed (2001) defines the prospectus as the entirety of know-how provided by a school system to its students. Consequently, the science prospectus encompasses all experiences encountered by learners with the objective of attaining scientific knowledge. These encounters comprise the subsequent:

i. A syllabus fostering curiosity, wisdom, and rational reasoning to guide individuals towards a respectable existence within a democratic framework.
ii. To produce scholars to advance national progress.
iii. Studies in technology and the catalysts behind technical progress and innovations.
iv. Understanding the complex makeup of the wildlife, the institution of life, and its mechanisms is imperative.

The science domain has consistently underscored the necessity of enhancing students' aptitude for decisive thoughts and logical deduction to attain professional proficiency utilizing suitable resources and tools. In view of this, the merger of practical workroom exercises should be a standard rather than a choice, as advocated by Oyovwi (2020). This stems from the truth that learners augment their exposure, understanding, skills, and passion for science through engagement in appropriate practical endeavors. Practical work affords students the chance to apply scientific methodologies, instills scientific attitudes, problem-solving capabilities, and enriches their conceptual grasp. Oyovwi (2020) observed that students cannot derive meaningful scientific experiences without substantial practical exposure in the workroom. Despite the pivotal role workroom practical play in the instructive process, science educationalists often neglect the prescribed scientific practical activities outlined in the curriculum hindering students' ability to recognize and comprehend various concepts effectively.

Moreover, Oyovwi (2020) further noted an imbalance, with a predominant focus on theoretical instruction rather than practical engagement in Nigerian secondary schools. Could the omission of realistic work by science educationalists be a contributing factor to students' underperformance in science? The primary inquiry of this investigation revolves around the potential impact of workroom practical on enhancing the implementation of the scientific prospectus, thereby influencing both scholastic performance and attitudes toward science among students. Scholastic accomplishment connects to the tasks completed by students in the classroom, as delineated by Agora (2016), denoting the echelon of success or proficiency achieved in scholastic endeavors. Conversely, Othman, Sermarek, and Lend (2011) perceived scholastic attainment as the scale to which a learner benefits from educational instruction within a specific domain of learning.

Over time, the notion of attitude has evolved to encompass an individual's mental disposition or readiness. According to Naiho (2018), attitude can be conceptualized as a hypothetical construct reflecting one's emotional stance towards an exact subject, whether it be favorable, unfavorable, or neutral. Mnellerleile (2005) contends that while Early and Chaiken (2007) regard attitude as a mental predisposition manifested through the valuation of specific objects with varying degrees of favor or disfavor, Mnellerleile perceives attitude as a perceptual framework. Given this context, the intent of this investigation was to investigate the collision of workroom practical on students' environment and their attitude towards science.

1.1 Statement of the problem

An analysis of the principal examiner's reports from the West Africa Examination Council (WEAC) and the National Examination Council (NECO) has uncovered a consistent boost in the enrollment of students in science courses each year, despite their subpar performance. Reports explicitly indicate that science students lack proficiency in basic experiments and lack the necessary prerequisites to conduct scientific experiments effectively. Additionally, it is noted that science students often overlook practical activities attributable to insufficient exposure to workroom experiments facilitated by their teachers. Science educationalists, in their instructional approaches, tend to prioritize content coverage over the realization of prescribed workroom practical.

Workroom practical activities are instrumental in providing students with tangible experiences that facilitate comprehension of scientific concepts. Exposing students to an assortment of hands-on activities not only aids in the expansion of realistic skills but also contributes to enhancing their scholastic attainment and fostering a optimistic attitude towards science. Consequently, the central question posed by this investigation is whether the utilization of workroom practical can indeed enhance science students' scholastic performance and attitude towards the subject.

1.2 Theoretical Framework of the Investigation

This investigation is grounded in Piaget's theory of cognitive expansion, first presented in 1978. Piaget's investigation focused on children's development, particularly the part of maturation in their increasing ability to comprehend the world as they mature. In proportion to Piaget, children cannot engage in specific activities until they reach a certain echelon of physical maturity.

He underscored the implication of taking an all-encompassing approach to education, asserting that children obtain knowledge by actively exploring and experiencing their surroundings.

Piaget postulated that a youngster's cognitive faculties experience ongoing reorganization as they develop and engage with their surroundings, a metamorphosis that progresses as the child matures. Young individuals build their personal comprehension of the cosmos by actively engaging with their environment, a procedure in which they create mental structures known as schemas. These schemas develop and refine as children advance through various stages of education. Crucial to Piaget's framework, and pertinent to this inquiry, is the concept that children gain knowledge through active participation in activities, highlighting the import of tactile exploration.

Attributable to the essential requirement for tactile interaction with apparatus, materials, and specimens to comprehend scientific principles, this theory of cognitive advancement was the foundational basis for the investigation . While the educationalist is responsible for guiding, it is imperative for the child and their peers to methodically build their own comprehension by manipulating apparatus, materials, and specimens during scientific experiments. Consistent with Piaget's cognitive development theory, education underscores the active participation and engagement of the child with provided information. Students are encouraged to actively partake with educational materials and amid them within the workroom environment of practical sessions.

1.3 Objectives of the Investigation

The primary objective of the study is to investigate the position of workroom practicals in the delivery of the science prospectus and its impact on students' scholastic performance and attitudes toward science curriculum. More specifically, the investigation seek to scrutinize:

i. Whether there exists a variance in the average scholastic performance of students exposed to science curriculum with workroom practical compared to those without such practical components.
ii. Whether there exists a variance in the average attitude scores of students exposed to science curriculum with workroom practical compared to those without such practical components.
iii. Whether there exists a discrepancy in the average scholastic performance between male and female students exposed to science curriculum with workroom practical.

Research questions

The investigation was guided by the following research inquiries:

i. Does a variance exist in the average achievement score of students instructed in science curriculum with workroom practical?
ii. Is there a discrepancy in mean attitude scores between students instructed in science curriculum with workroom practical and those without?
iii. Do disparities emerge in average achievement scores between male and female students instructed in science curriculum with workroom practical?

Research hypotheses

The following null hypotheses were devised and examined at a significance echelon of 0.05, utilizing data from three (3) public mixed schools:

i. There is no statistically substantial disparity in the average achievement scores of students instructed in science curriculum with workroom practical compared to those without.
ii. There is no statistically substantial disparity in the average attitude scores of students instructed in science curriculum with workroom practical compared to those without.
iii. There is no statistically substantial disparity in the average achievement scores between male and female students instructed in science curriculum with workroom practical.

Materials and methods

1.4 Design/ Instruments of the Investigation

A quasi-experimental design was employed for this investigation, specifically utilizing the pretest non-equivalent control group design attributable to the prearranged intact classrooms. This approach aimed to ensure consistency and maintain the integrity of the learning environment without disrupting ongoing teachings. Throughout the instructional period on the chosen scientific topic, students allocated to experimental groups were exposed to workroom practical, while the control group abstained from any practical involvement.

The investigation population consists of all students attending science classes in public mixed secondary schools at grade two (SS II) within the Delta South Senatorial District. The estimated population for the entire Local Government Area falling under the jurisdiction of the Delta South Senatorial District is anticipated to be twenty-one thousand, two hundred and five (21,205) students. Data collection involved the utilization of two instruments: the Science Achievement Test (SAT) and the Science Attitude Questionnaire (SAQ).

The sample selection, comprising three hundred and eighty (380) students from six (6) public mixed schools, was achieved through the simple random sampling method using a ballot approach. The SAT, rooted in scientific principles, consisted of fifty multiple-choice questions with four answer options (A, B, C, and D). On the other hand, the SAQ comprised twenty (20) questions aimed at gauging students' perspectives on the influence of workroom practical on their attitudes. Responses to the Science Attitude Questionnaire (SAQ) were structured using a Likert scale with four points, ranging from strongly disagreeing to strongly agreeing (SD, 1).

A panel comprising three experts in the fields of Science instruction and Measurements and Evaluation conducted face validation on both the Science Achievement Test (SAT) and the Science Attitude Questionnaire (SAQ). Conversely, the content validity of the SAT was established through the utilization of a table of specifications encompassing all scientific content pertinent to the investigation.

The dependability of the Science Achievement Test (SAT) was ascertained using the Kuder-Richardson 21 formula. The instrument was administered to forty scientific students not enrolled in the sampled schools, yielding a dependability coefficient of 0.75 upon completion of the investigation.

To assess the reliability of the Science Attitude Questionnaire, the Cronbach Alpha Method was employed. Forty scientific students from schools not included in the sample were tested using the instrument, resulting in a discovered dependability coefficient of 0.75 during the investigation.

2.2 Treatment Procedure

Permission was obtained from the school principals to enlist the cooperation of both instructors and students from the sampled schools. The six teachers selected from these schools were enlisted as investigation assistants and trained in the techniques required to introduce scientific concepts to students through workroom practical, utilizing training manuals prepared by the investigation er.

Experimental groups comprised three complete SS 11 classes from each of the six schools, which did not engage in workroom practical. Conversely, control groups comprised the remaining intact SS 11 courses, also excluding workroom practical involvement. Both experimental and control groups were presented with identical scientific concepts during the experiment.

While the experimental group actively participated in workroom practical to reinforce their understanding of the scientific principles taught and gain a more tangible grasp of the material following instructor explanations, the control group refrained from any workroom practical activities. Instead, they solely received explanations from the instructor within the classroom setting regarding the selected scientific concepts.

A timeframe of six weeks was designated for the implementation of the intervention. Prior to the commencement of the therapy, a pretest utilizing the Investments Science Achievement Test (SAT) was administered to both the experimental and control groups to assess their comparability. Following the therapy, the SAT was administered again to both groups as a posttest to evaluate the effectiveness of the intervention.

Method of data analysis

To address the investigation inquiries, the mean and standard deviation were employed, and the hypotheses were scrutinized through t-test analysis at a significance threshold of 0.05.

2. Results and discussion

Table1: Mean and Standard Deviation of pre-test and post-test achievement scores of students taught science prospectus with workroom practical and those taught without workroom practical

Group	N	Pretest		Post test		Mean gain
		Mean	SD	Mean	SD	
Exposed to lab. Pract.	199	21.92	5.72	29.55	5.76	8.60
Not exposed to lab. Pract.	171	21.19	4.70	26.67	5.41	6.50

Students enrolled in science classes involving workroom work achieved an average pretest score of 21.91, with a standard deviation of 5.72, as depicted in Table 1. Conversely, students who did not engage in lab practical achieved an average pretest score

of 21.19, with a standard deviation of 4.70. The pretest results suggest that both groups exhibited nearly identical echelons of comprehension regarding the covered scientific concepts prior to any intervention.

In contrast, the experimental group achieved an average post-test accomplishment score of 29.55, with a standard deviation of 5.76. On the other hand, the control group attained an average score of 26.67, with a standard deviation of 5.41. This reflects an 8.60-point disparity between the experimental and control groups, indicating a statistically substantial increase compared to the control group's 6.50-point increment.

Table 2: Mean and Standard Deviation of pre-test and post-test attitude scores of students taught science with workroom practical and those taught without workroom practical

Group	N	Pretest		Post test		Mean gain
		Mean	SD	Mean	SD	
Exposed to lab. Pract.	199	22.06	9.53	56.87	7.60	33.76
Not exposed to lab. Pract.	171	25.20	9.06	56.24	9.18	30.11

According to the information provided in Table 2, the average pretest attitude score is recorded at 22.06, with a standard deviation of 9.53. The investigation encompassed all students enrolled in scientific classes incorporating workroom practical. Conversely, students whose science classes lacked workroom components exhibited an attitude score of 25.20, with a standard deviation of 9.06 points. The pretest findings suggest distinct disparities in the perspectives on science between the two nearly opposing groups.

In contrast, the control group's average posttest attitude score was 56.24 (standard deviation= 9.18), while the experimental group's score was slightly higher at 56.57 (standard deviation= 7.60). In comparison to the control group's mean disparity of 30.11, the experimental group exhibited a higher mean disparity of 33.76.

Table 3: Mean and standard deviation of pretest and posttest achievement scores of male and female students taught science with workroom practical.

Sex	N	Pretest		Post test		Mean gain
		Mean	SD	Mean	SD	
Male	110	20.76	4.31	29.65	6.29	8.78
Female	89	20.15	5.07	29.30	5.21	8.25

In Table 3, it is evident that male students enrolled in science classes with workroom practical attained an average pretest score of 20.76, with a standard deviation of 4.31. Conversely, female students engaged in lab work achieved an average pretest score of 20.15, with a standard deviation of 5.07. Both male and female students exhibited comparable echelons of understanding of scientific fundamentals.

Following the conclusion of the post-test, the average score for male students was 29.65, with a standard deviation of 6.29, while female students achieved an average score of 29.65 with the same standard deviation. Moreover, the female students attained an average score of 29.30, with a standard deviation of 5.21. On average, there is minimal disparity in their performance gains. Notably, female students outperformed male students, who achieved a score of 8.25.

Table 4: t-test comparison of posttest achievement score between students taught science with and without workroom practical

Group	N	$\bar{X}$	SD	Df	t-cal	Sig.	Decision
Exposed to lab. Pract.	199	29.55	5.76				
Not exposed to lab. Pract.	171	26.67	5.41	360	4.832	0.000	Rejected

According to Table 4, there exists a notable contrast in the average posttest achievement scores among students instructed in science with workroom practical compared to those without. Consequently, it appears that the null hypothesis has been refuted.

Table 5: t-test comparison of posttest attitude scores of students taught science with and without workroom practical.

Group	N	$\bar{X}$	SD	Df	t-cal	Sig.	Decision
Exposed to lab. Pract.	199	56.87	7.60				
Not exposed to lab. Pract.	171	56.24	9.18	360	3.109	0.002	Rejected

Table 5 demonstrates a noteworthy distinction in the average attitude ratings of students exposed to science lessons with workroom practical compared to those without. Specifically, students engaged in workroom practical exhibited markedly higher mean attitude scores.

Table 6: t-test comparison of posttest mean achievement scores of male and female students taught science with workroom practical

Sex	**N**	$\bar{X}$	**SD**	**Df**	**t-cal**	Sig.	Decision
Male	110	29.65	6.29				
Female	89	29.30	5.21	193	0.303	0.751	Accepted

Table 6 illustrates the performance of male and female students who underwent workroom practical as part of their scientific education on the posttest. However, no statistically notable variances were observed in the outcomes of this evaluation. These findings indicate that the alternative hypothesis is not supported.

Discussion of results

The results of this investigation reveal a statistically substantial disparity in the average attainment echelons among students whose science courses integrated workroom work compared to those whose courses did not. Students exposed to workroom practical achieved substantially elevated scores. This can be credited to the abundant chances for experiential learning provided during workroom sessions. Through these engagements, learners can gain a more profound comprehension of scientific principles by employing diverse instruments, apparatus, samples, and living organisms. For further elucidation on similar findings, consult Cengiz (2010), and Yadav and Mishra (2013).

Additionally, the findings indicate that students enrolled in science classes incorporating workroom practical displayed markedly higher mean attitude ratings compared to those in classes without such practical. The outcomes reveal that students undergoing workroom work achieved notably superior mean attitude scores. This inference aligns with the anticipated expectations, as workroom practical actively engage students in scientific education from the outset, fostering sustained enthusiasm throughout their scholastic journey. Drawing from their findings, Katcha and Wushishi (2015) concluded that there were substantial disparities in both performance and attitude change among biology students when exposed to adequately equipped laboratories versus inadequately equipped ones. This data supports their assertion, illustrating that students' attitudes witnessed positive transformations within well-equipped workroom environments. Furthermore, this outcome resonates with Ayoubu's (2018) findings, which demonstrated a noteworthy contrast in the mean attitude scores of students exposed to virtual labs, favoring the students. These favorable results for the students are also in accordance with those observed in another investigation.

The third aspect to consider is that regarding scientific courses incorporating workroom work, the outcomes unveiled no statistically noteworthy variance in the mean achievement assessments between male and female students. These findings suggest that the workroom environment is inclusive of all genders, implying that students of both sexes can derive benefits from their participation. Both male and female students derived considerable advantages from the hands-on workroom practical, as they promoted active learning, encouraging students to employ critical thinking and procedural skills. Uzezi and Zainab (2017) and Oyovwi (2021) similarly found no substantial disparities in the mean achievement ratings of males and females exposed to workroom practical. This investigation offers further corroboration for their conclusions.

Conclusion

The findings of the investigation indicated that workroom practical substantially enhance students' achievement and their disposition towards the scientific curriculum. Moreover, it enhances scholastic performance in science for both male and female students. Based on the implication, workroom practical are inclusive of individuals of all genders.

Recommendations

The investigation proposes the subsequent recommendations:

i. Science educationalists should consistently integrate sufficient workroom practical to supplement classroom instruction, thereby minimizing abstraction.
ii. Government and educational authorities ought to furnish schools with ample workroom amenities to support student learning.
iii. Science instructors should develop the skill of improvising workroom resources and materials to efficiently engage students in practical exercises.
iv. Science teachers should instill the concept of improvisation among students on a regular basis.

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