EFFECT OF INQUIRY-BASED TEACHING STRATEGY ON STUDENTS ACADEMIC ACHIEVEMENT AND RETENTION IN BASIC TECHNOLOGY

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EFFECT OF INQUIRY-BASED TEACHING STRATEGY ON STUDENTS ACADEMIC ACHIEVEMENT AND RETENTION IN BASIC TECHNOLOGY

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Abstract

This research sought to assess the effect of an inquiry-based teaching strategy on students' academic achievement and retention in basic technology. A quasi-experimental research design featuring a pre-test, post-test, and non-equivalent control group was utilized, comprising 122 subjects in total, with 63 individuals in the experimental group and 59 in the control group. The tool employed for gathering data was the Basic Technology Achievement Test (BTAT), which received validation from three specialists in the Department of Industrial and Technology Education at the Federal University of Technology Minna. A trial examination determined the reliability coefficient of the BTAT, resulting in a Pearson product-moment correlation coefficient of .78. Average scores were computed to address the research questions, and ANCOVA was utilized to evaluate the hypotheses. The findings showed that students educated through conventional lecture techniques. Furthermore, the average score of male students instructed through inquiry-based learning exceeded that of female students receiving the same instruction, though the differences lacked statistical significance. As a result, it is advised that teachers incorporate inquiry based instructional strategies in suitable curriculum fields to enhance student learning outcomes, and businesses should provide essential materials to facilitate teaching in Basic Technology
Keywords: inquiry-based, achievement, retention, Basic Technology

Introduction

Basic Technology is an all-encompassing subject provided at the junior secondary school level in Nigeria. As stated by Olaniyan and Ojo (2008), Basic Technology includes aspects of woodwork, metalwork, construction technology, automotive mechanics, electrical/electronics, and various fundamental technology concepts. The course seeks to introduce students to different fields of industrial technology, establishing a strong base for their career paths after finishing junior secondary education (Uwaifo & Edigin, 2011; Kennedy, 2011). This corresponds with the National Curriculum for Junior Secondary Schools (FRN, 2023), which stresses the significance of decreasing ignorance regarding technology.

Basic Technology was launched in Nigeria's 6-3-3-4 education system in 1982, originating from the National Policy on Education after the National Curriculum Conference held in September 1969. Yet, the approaches used to teach technical skills have frequently been overly

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theoretical and detached from modern technological practices, consequently compromising the core goals of the subject. School examination failures are frequently linked to outdated teaching methods that do not align with global best practices (Kennedy, 2011). This scenario poses challenges for educators and policymakers, as it can greatly impede students' opportunities in engineering and technical vocational education (TVE), which are essential for sustainable economic growth. Therefore, using teaching resources and inquiry-oriented learning approaches is essential.

Inquiry-based teaching is grounded in research on effective learning processes (Bransford et al., 2010). In inquiry-based science education, learners engage in activities and thought processes similar to those of scientists, promoting a deeper understanding of scientific principles. Educators are encouraged to move away from traditional teacher-centered practices—such as an overemphasis on textbooks and lectures—and instead embrace inquiry-oriented methods that captivate student interest and foster critical thinking (Secker, 2002). Such authentic inquiry-based activities empower students to actively construct knowledge, similar to the work conducted by scientists.

In sharp opposition, conventional classrooms frequently resemble solo performances where students are mostly uninvolved. In such environments, teaching often relies on direct, one-sided methods, assuming a set amount of information that students are required to absorb passively (Stofflett, 2008). This approach does not encourage independent thinking or productive discussions among learners (VAST, 2009). Even in activity-focused subjects, collaboration might not promote conversations or investigative learning, which can result in missing the essential critical thinking required for true scientific understanding and respect (Yore, 2001). Dori (2015) describes academic achievement as measurable by course grades or average scores in various subjects.

Additionally, students' learning methods and academic achievement may be influenced by gender. Gender refers to the socially constructed roles and behaviors society attributes to males and females (Myers, 2022). Disparities in performance between genders have been noted in various studies (Okoro, 2011). Therefore, this study seeks to investigate the impact of inquiry-based learning on students' achievement in Basic Technology in technical colleges across Niger State.

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attributes. Conducted in Niger State, the study's population consisted of 122 second-year students from junior secondary schools in Minna. Simple random sampling (balloting) assigned two schools to the experimental group and two schools to the control group. Each treatment group comprised two intact classes, including both male and female students. The instruments for data collection was the Basic Technology Achievement Test (BTAT), validated via content and face validation by three experts from the Department of Industrial and Technology Education at the Federal University of Technology, Minna. A trial test conducted on 40 JSSII students in a different school using test-retest reliability revealed a stability coefficient of .78. Researchers administered the instrument with the assistance of three research assistants. Pre-test and post-test data were analyzed using mean scores for research questions, while ANCOVA was employed to test the null hypotheses at a 0.05 level of significance.

Results

Research Question 1

What is the impact of the inquiry-based learning model on students' achievement in Basic Technology?

Table 1: Mean and standard deviation of Pretest and Posttest Scores of Experimental and Control Groups

Group	N	Pretest scores		Posttest scores	Mean gain
		$\bar{X}$	SD	$\bar{X}$	$\bar{X}$
Experimental	63	17.66	10.08	65.87	48.21
Control	59	21.35	9.81	66.01	44.66

Table 1 shows that the experimental group had a Mean score of 17.66 with a Standard Deviation of 10.08 in the pre-test and a Mean score of 65.87 with a Standard Deviation of 13.51 in the post-test, resulting in a Mean gain of 48.21. The control group showed a pre-test Mean of 21.35 and Standard Deviation of 9.81, with a post-test Mean of 66.01 and Standard Deviation of 13.31, resulting in a Mean gain of 44.66. The results indicate that both the experimental and control groups effectively enhanced students' achievement in Basic Technology, with the inquiry-based learning model being more impactful.

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Research Question 2

What is the influence of gender (male and female) on students' achievement in Basic Technology?

Table 2: Mean and Standard Deviation of Pretest and Posttest Gender Achievement Scores

Group	Gender	N	Pretest		Posttest		Mean gain
			$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$
Experimental	Male	50	16.33	9.29	64.80	13.60	48.47
	Female	13	18.45	12.85	68.41	12.69	49.96
Control	Male	46	22.91	8.74	64.89	13.37	41.98
	Female	13	20.16	12.93	70.41	12.69	50.25

The data in Table 2 reveal that male students taught Basic Technology using inquiry-based learning had a Mean pre-test score of 16.33, and a post-test score of 64.80, translating to a Mean gain of 48.47. Female students taught via the same method achieved a higher post-test Mean score of 68.41, resulting in a Mean gain of 49.96. Furthermore, male students in the control group had a Mean pre-test score of 22.91 and a post-test mean of 64.89, indicating a Mean gain of 41.98. Female students in the control group achieved a post-test Mean of 70.41, with a Mean gain of 50.25. The findings suggest that females achieved higher mean scores than males in the achievement test when taught via inquiry-based methods.

Hypotheses testing

HO_1: There is no significant difference in the mean inquiry-based learning model on students' achievement in basic technology.

HO_2: There is no significant difference between the mean of gender on basic technology achievement of students (male and female).

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Table 3: Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Impact of Treatment (inquiry-based learning model and lecture method), their Gender and Interaction Effect with Respect to their Mean Scores in basic technology achievement Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8067.097[a]	17	474.535	17.619	.000
Intercept	195187.985	1	195187.985	7246.973	.000
METHOD	5593.886	9	621.543	23.077	.000
GENDER	13.708	1	13.708	.509	.017
GENDER * METHOD	337.642	7	48.235	1.791	.097
Error	2801.108	104	26.934		
Total	373893.000	122			
Corrected Total	10868.205	121			

a. R Squared = .742 (Adjusted R Squared = .700)
Significant at sig of F< .05

Table 3 shows the F-calculated values for three effects: treatment (inquiry-based learning versus lecture method), gender, and the interaction of treatment and gender on students' achievement in Basic Technology. The F-calculated value for treatment is 23.077 with a significance level of .000, indicating a significant mean difference between the inquiry-based learning model and the lecture method. The F-calculated value for gender is .509 with a significance level of .017, confirming a significant effect in favor of females. The interaction effect of treatment and gender yielded an F-calculated value of 1.791, with a significance level of .097, indicating no significant interaction effect.

Discussion

The information shown in Table 1 demonstrated that the inquiry-based learning model is notably more effective at enhancing students' performance in Basic Technology than conventional teaching methods. The ANCOVA results confirmed this observation, indicating a statistically significant difference between the two instructional methods. This result indicates that inquiry-driven approaches foster advanced thinking and involve students in more profound learning experiences.

The results from Table 2 show that gender influences achievement, benefiting females. This is consistent with current research, indicating that girls can succeed in technical fields with suitable teaching approaches. The lack of genetically determined cognitive variations between

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genders suggests that societal norms and educational approaches significantly influence student achievement (Udofia, 2008; Eze, 2009).

Conclusion

The results of this research clearly show that the inquiry-based learning approach significantly improves student performance in Basic Technology relative to conventional teaching methods. The findings indicate that both male and female students can excel with inquiry-based instruction, with females demonstrating notable enhancement attributed to the teaching method. This research highlights the importance for technical colleges in Nigeria to implement inquiry-based teaching methods to create a more interactive and efficient learning atmosphere.

Recommendations

1. Teachers should implement inquiry-based learning methods for relevant curriculum areas in Technical Colleges to maximize student engagement and learning outcomes.
2. School management should allocate funds for the acquisition of necessary materials to support the implementation of inquiry-based learning techniques.
3. Private enterprises should provide technical colleges in Niger State with spare parts and consumables essential for teaching Basic Technology effectively.

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