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Effects of Instructional Methods and Ability on Polytechnics Students' Academic Achievement in Workshop Practice in Delta and Edo States

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ABSTRACT

The study examined the effects of Instructional methods and ability on polytechnic students' academic achievement in workshop practice in Delta and Edo States. Three research questions were raised and answered and three corresponding hypotheses were tested. A non-equivalent pre-test, post-test, quasi-experimental research design using a 3×3 factorial design was adopted for the study. The population of this study comprised a total of 235 National Diploma Year II workshop practice students in three government-owned polytechnics in Delta and Edo States for the 2022/2023 session. The research questions were answered using mean scores and standard deviation while the hypotheses were tested with one-way ANOVA. The findings of the study showed that there was no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using demonstration and project-based instructional methods while there was a significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using lecture instructional method in Delta and Edo States. It was therefore concluded that students who went through demonstration and project-based instructional methods in workshop practice significantly improved in their academic achievement irrespective of their initial ability levels.

Keywords: *Academic achievement, Delta and Edo States, instructional methods, polytechnics students, workshop practice*

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INTRODUCTION

Workshop practice is a broad discipline that teaches the fundamentals of manufacturing and the qualities of various materials used in the industry. It also discusses how to use various tools, equipment, machinery, and manufacturing procedures to help shape these materials into different forms that can be used. The workshop practice as a course offered by students in the polytechnics provides students with a choice of how they learn, practice, and master the contents. Workshop Practice enables students to learn to manage their time and to evaluate their learning options in a way that will enable them to take charge of their own education (Ibrahim et al. 2020). Different variables may interact with instructional strategies to influence students' academic achievement and one of such variables is academic ability. Academic ability is the capacity of the student to successfully complete required coursework. Academic ability is the degree of competence in educational activities (school) in science and technology courses. It is often categorized into high, medium and low ability levels. While high ability refers to those that score above 70^{th} percentiles in tests, medium ability refers to those that score $50^{th} - 69^{th}$ percentiles while low ability refers to those that score $0-49^{th}$ percentile.

These abilities differentiate high-achieving students from low-achieving students (Kitsantas, 2016). Okobiah (2012) also suggested that differences in low, medium and high-achieving students are closely linked to instructional strategies used in delivering the curriculum. Thus academic ability could interact with instructional methods in affecting achievement of students. This implies that the students' ability to understand concepts may determine their achievement in a workshop practice curriculum depending on the strategy of instructional delivery. By providing a hands-on and collaborative learning environment, project-based learning allows low ability students to actively participate and engage in the learning process (Doak, 2022).

Purpose of the study

The purpose of the study is to examine the level to which academic ability could interact with instructional methods in affecting academic achievement of polytechnic students in workshop practice in Delta and Edo States.

Research questions

The following research questions guided this study:

1. What is the difference in the mean academic achievement scores among low, medium and high ability Polytechnic students taught workshop practice using demonstration instructional method?
2. What is the difference in the mean academic achievement scores among low, medium and high ability Polytechnic students taught workshop practice using project-based instructional method?
3. What is the difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using lecture instructional method?

Hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using demonstration instructional method.
2. There is no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using project- based instructional method.
3. There is no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using lecture instructional method.

Instructional methods and learning strategies

Instructional methods and learning strategies are known to contribute very significantly to the skill acquisition and cognitive attainment of students in various course contents. Students can develop an intrinsic interest in a given course due to the strategy used by their lecturers. However, it seems that most lecturers in our tertiary institutions rely heavily on the lecture instructional method because they lack precise expertise in innovative instructional strategies that can be employed to enhance the teaching-learning of workshop practice. Students' academic achievement has been observed from literature to be hindered by many factors such as teachers' insensitivity to instructional activities in the classroom, inadequate instructional materials, and ineffective teaching method and lecturers' predominant usage of the conventional method of instruction (Olarinoye, 2015). Instructional methods that could be used to facilitate the teaching and learning of technical subjects like the workshop practice in polytechnics are the use of demonstration and project-based methods. There are times when professors' demonstrations are more educationally beneficial than students' own experiments (Ntui & Ben, 2013). To have students' active participation, the lecturer discusses the topic with the children to find out what experiences they have had and what they already know about it (Poonpon, 2017). This enables students to pick up new ways of thinking and develop their ability to draw conclusions quickly and effectively (Savery, 2019).

Effect of demonstration methods on academic achievement of low, medium and high ability students

Price (2015) defines demonstration method as a teaching method based predominantly on the modeling of knowledge and skills. Demonstration method plays a crucial role in students' academic achievement in workshop practice. According to Chiappetta & Koballa (2012), well prepared and properly presented demonstration has the potential to enhance students' achievement.

The demonstration method in education, while valuable in many contexts, may have limitations when it comes to significantly reducing the academic achievement gap among low, medium and high ability students. However, with thoughtful implementation and supplementary strategies, it can contribute to narrowing this gap to some extent. To bridge the achievement gap, it's important to differentiate instruction to meet the needs of low, medium and high-ability students. While a demonstration method may be suitable for introducing concepts, lecturers should adapt their approach for each group. For example, they can provide additional support, alternative materials, or

more challenging tasks for high-ability students which could affect the academic success of students (Langlois, 2013).

Demonstration method allows students to apply what they have learned. The demonstration method is a method of teaching by demonstrating things, events, rules, and sequences of activities, either directly or through using instructional media which is relevant to the subject matter or material that will be presented (Chi & Wylie, 2014). These activities can be adapted to different ability levels, with more complex tasks for high-ability students and extra guidance for those who need it. After a demonstration, teachers can work with small groups of students, tailoring their instruction to individual needs.

This approach allows for more personalized attention and support, helping to close the achievement gap. Pairing high-ability students with low-ability students for peer tutoring can be effective. The high-ability students can reinforce their own understanding while helping their peers and low-ability students can benefit from explanations given by their peers, which may be more relatable. Regular formative assessments can help teachers identify gaps in understanding and adjust their instruction accordingly. High-ability students may need more advanced challenges, while low-ability students may require additional support and practice. Teachers can use a scaffold approach, starting with basic concepts and gradually increasing the complexity of demonstrations and activities. This approach helps low-ability students build a strong foundation before moving on to more advanced content. For students with significant differences in ability, Individualized Learning Plans (ILPs) can be created to address their unique needs. These plans may include personalized goals, resources, and support strategies.

Effect of project-based method on academic achievement of low, medium and high ability students

One of the key benefits of project-based learning is its ability to cater for the diverse needs of students, including those with lower academic abilities. By providing a hands-on and collaborative learning environment, project-based learning allows low ability students to actively participate and engage in the learning process Doak (2022). This leads to increased motivation and a sense of ownership over their education, resulting in improved academic achievement. While project-based learning is often associated with supporting struggling students, it also offers significant benefits for high ability students. By presenting complex, open-ended problems, project-based learning challenges high ability students to think critically, apply their knowledge, and develop advanced problem-solving skills. This approach fosters creativity, independence, and a deeper understanding of the subject matter, leading to enhanced academic achievement. Students must actively participate in project-based learning to ensure that the lessons are related (Erdem, 2012). The project- based learning method is especially suitable for technical subjects where students also have to use, integrate and implement what they have learned in a number of subjects.

Project-based learning has the potential to bridge the achievement gap by providing an equal opportunity for all students to succeed (Cahyaningrum & Widyantoro, 2020). By focusing on practical application and collaborative work, project-based learning breaks away from traditional teaching methods that may disadvantage certain groups of students. This approach allows low ability students to showcase their strengths and high ability students to further develop their skills, ultimately promoting equity and inclusivity in the classroom the project-based method has a positive effect on the academic achievement of both low and high ability students. By promoting active learning, critical thinking, and problem-solving skills, project-based learning enhances student engagement and retention of knowledge. It caters to the diverse needs of students, providing opportunities for low ability students to excel and challenging high ability students to reach their full potential. With its potential to promote equity in education, project-based learning offers a promising approach to fostering academic achievement for all students.

Effect of lecture method on academic achievement of low, medium and high ability students

The impact of the lecture method on the academic achievement of low, medium and high-ability students depends on how the method is implemented and whether it is supplemented with additional strategies. The effect of the lecture method on the academic achievement of low, medium and high-ability students can vary because low-ability students may struggle with passive learning, which is common in traditional lectures (Fleischmann et al., 2023). Since lecture method encourages the absorption of much information low-ability might find it challenging to absorb information solely through listening and note-taking. These students may have difficulty maintaining focus during lengthy lectures, leading to reduced engagement with the material (Santoso *et al.,* 2023).

Low-ability students might have difficulty retaining information presented in a lecture format, especially if the content is complex or presented quickly (Hope, 2017). High-ability students may become bored or disengaged during lectures if the content is not sufficiently challenging or stimulating (Freedberg et al., 2019). This can negatively impact their academic achievement. These students often benefit from in-depth exploration of topics; which traditional lectures might not provide. They may

Table 1: Graphical representation of the 3×3 factorial matrix research design.

Group	Pre-test	Treatment	Post-test	Ability
Demonstration Method	P_1	T_1	P_2	Low; Medium; High
Project-based Method	P_1	T_2	P_2	Low; Medium; High
Lecture Method	P_1	T_3	P_2	Low; Medium; High

crave opportunities for critical thinking and advanced discussions. High-ability students may excel in lectures when they are encouraged to take a more self-directed approach to their learning, allowing them to explore topics in greater detail.

METHODOLOGY

Non-equivalent pre-test, post-test, planned variation quasi-experimental, research design using a 3×3 factorial design. The design has treatments (instructional methods) at three levels (demonstration method, project-based and lecture methods) and ability at three levels (high, medium and low). The 3×3 Factorial Matrix research design is shown in (Table 1). This design was considered appropriate due to the intact classes and the rigid school timetable that would not allow the researcher to fully randomize the subjects. The design however allowed the researcher to assign students to experimental and control groups based on their intact classes. The quasi-experimental design also allowed for some control and manipulation of the independent variables or the learning conditions to be done.

Population of the study

The population of this study comprises a total of 235 Year II National Diploma students offering Workshop Practice in three government-owned polytechnics in Edo and Delta States for 2022/2023 academic session.

Sampling and sampling techniques

Since the number of Year II National Diploma students offering Workshop Practice in Delta and Edo States was not large, the entire 235 students was used as the sample size with three intact classes. A class was randomly assigned to each of the treatment groups using a simple random sampling technique with one instructional method.

Research instrument

The instrument used for the study is the Work Practice Achievement Test (WPAT) which was developed by the researcher from the Lesson Plan. The WPAT consists of two sections. While Section A contained instruction on the respondent's bio-data; Section B contained 50 multiple objective test items with options A – D. Six topics selected from the polytechnic course outline were used in drawing the lesson plan and the WPAT was used for data collection.

Treatment

At the commencement of instruction in each sampled polytechnic, the students' previous examination results were collected and used to stratify the students into ability groups (high, medium and low) according to the method used by Talib and Baba (2022), the high, medium and low ability students consist of those with mean achievement scores of above 70 percent (> 70%) as high ability; 50% – 69% as medium while less than 50% as low ability. This was followed by administration of pre-test to determine the equivalence of the groups as well as to measure the level of prior knowledge of the topics on which the test was based, while the post-test was administered after six weeks of regular workshop practice teaching at each polytechnic using the lesson plans that the researcher made for each group.

Method of data analysis

The research questions were answered using mean scores and standard deviation while the hypotheses were tested with one-way ANOVA.

RESULTS AND DISCUSSION

Table 2 shows that the post-test mean academic achievement score of high ability students taught workshop practice using demonstration method in polytechnic was 52.09, with standard deviation of 14.09; the medium ability students had post-test mean scores of 55.21, with standard deviation of 20.39; while the low ability students had post-test mean score of 46.92, with standard deviation of 8.96. The post-test mean score was highest for medium ability students (55.21) and lowest for low ability students (46.92).

Table 3 shows that the post-test mean academic achievement scores of high ability students taught workshop practice using Project-based instructional method in polytechnic in Delta and Edo States was 60.81, with standard deviation of 13.77; the medium

Table 2: Mean achievement scores of low, medium and high ability polytechnic students taught workshop practice using demonstration instructional method

Ability	N	Post-test Scores		
		Mean	Std. Dev.	Mean Difference
High	23	52.09	14.09	
Medium	14	55.21	20.39	3.12
Low	13	46.92	8.96	8.29
Total	50			

Table 3: Mean achievement scores of low, medium and high ability polytechnic students taught workshop practice using project-based instructional method

Ability	N	Post-test Scores		
		Mean	Std. Dev.	Mean Difference
High	78	60.81	13.77	
Medium	27	57.44	17.56	3.37
Low	33	54.54	16.86	2.90
Total	138			

Table 4: Mean achievement scores of low, medium and high ability polytechnic students taught workshop practice using lecture instructional method

Ability	N	Post-test Scores		
		Mean	Std. Dev.	Mean Difference
High	17	61.0	8.50	
Medium	13	54.31	12.21	6.69
Low	17	36.29	12.45	18.02
Total	47			

ability students had post-test mean score of 57.44, with standard deviation of 17.56, while the low ability students taught using the Project-based instructional method had post-test mean score of 54.54, with standard deviation of 16.86. The post-test mean score was highest for high ability students (60.81) followed by medium ability students (57.44) and lowest for low ability students (54.54). Table 4 shows that the post-test mean academic achievement of high ability students taught workshop practice using lecture instructional method in polytechnic in Delta and Edo States was 61.0, with standard deviation of 8.50; the medium ability students had post-test mean score of 54.31 with standard deviation of 12.21, while the low ability students had post-test mean score of 36, 29, with a standard deviation of 12.45. The post-test mean score was highest for high ability students, followed by medium ability students and lowest for low ability students. Analysis of Hypotheses showed that there was no significant difference in the mean academic achievement scores among high, medium and low ability polytechnic students taught workshop practice using demonstration and project-based instructional methods in Delta and Edo States. The possible explanation for this finding could be that the demonstration instructional method may have been designed to accommodate high, medium and low ability students effectively. This is in line with Dorgu (2015) who stated that if method incorporates clear demonstrations, and engages students at different levels, it can contribute to similar academic achievement across ability levels. Another possible explanation could be that the demonstration method might have successfully engaged both high and low ability students in the learning process. Also, the absence of significance difference could be due to the nature of project-based instructional method which makes possible for it to accommodate different learning abilities and styles. This also is in line with Cahyaningrum & Widyantoro (2020) who opined that project-based learning has the potential to bridge the achievement gap by providing an equal opportunity for all students to succeed. If the projects were sufficiently flexible and allowed students to engage with the material at their own pace and in their own way, it could lead to similar academic achievement scores for high, medium and low ability students. However, there was a significant difference in the mean academic achievement scores of high, medium and low ability polytechnic students taught workshop practice using lecture instructional method. This difference could be due to the fact that unlike demonstration and project-based instructional methods which make possible for it to accommodate different learning abilities and styles because of the students active participation, the lecture instructional method is not sufficiently flexible and does not allow students to engage with material at their own pace and in their own way, which could have led to disparity in academic achievement scores for high, medium and low ability students.

Findings

The findings of the study indicate that:

1. There was no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using demonstration instructional method.
2. There was no significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using project-based instructional method.
3. There was significant difference in the mean academic achievement scores among low, medium and high ability polytechnic students taught workshop practice using lecture instructional method in Delta and Edo States.

Conclusion

From the findings of the study, it was concluded that students who went through demonstration and project-based instructional methods in workshop practice significantly improved in their academic achievement irrespective of their initial ability levels. This is as a result of the fact that demonstration instructional method may have been designed to adequately accommodate high, medium and low ability students effectively while project-based instructional method makes possible for it to accommodate different learning abilities and styles because of the students' active participation in learning activities. On the other hand, the lecture instructional method is not sufficiently flexible and does not allow students to engage with material at their own pace and in their own way, which could have led to disparity in academic achievement scores for high, medium and low ability students.

Recommendations

Workshop practice lecturers should ensure active participation of all students during the teaching and learning of workshop practice through the use of demonstration and project-based instructional methods to enhance academic achievement in students irrespective of the ability levels. In view of the fact that demonstration and project-based instructional methods are more effective in teaching workshop practice and enhance students' academic achievement more than lecture methods, polytechnic administrators should encourage staff to write textbooks on workshop practice to incorporate practical ways of demonstration and project-based instructional methods in the teaching of workshop practice concepts in polytechnic students to improve students' achievement.

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