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CLASSROOM DESIGN AS PREDICTOR OF ACADEMIC ACHIEVEMENT OF STUDENTS IN MATHEMATICS IN PUBLIC SECONDARY SCHOOLS IN IMO STATE

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ABSTRACT

Understanding the predictive value of classroom design on academic achievement of students will facilitate increase in learning outcomes especially in the core subjects. Thus, this study examined classroom design as a predictor of academic achievement of students in public secondary schools in Imo State. The study was guided by one research question and one hypothesis tested at 0.05 significance level. Correlation research design was adopted for the study. The population of the study consisted of 612 Mathematics teachers in the three education zones of Imo State. Proportionate stratified random sampling techniques was used to draw 40% samples from each of the three education zones, totaling a sample size of 245 mathematics teachers representing the entire population. Self-structured Classroom Design Questionnaire (CDQ) and Students Mathematics Achievement Test (SMAT) obtained from cumulative scores result broadsheets were used to collect data for the study. The instrument on Classroom Design Questionnaire (CDQ) was validated by three experts in the Faculty of Education, Nnamdi Azikiwe University Awka and the reliability to ascertain the consistency of the instrument was established using Chronbach alpha reliability index which yielded a coefficient of 0.85 and was considered fit for the study. Pearson Product Moment Correlation Coefficient and Regression Statistics were utilized for data analysis. The p-value was used to determine the predictive value at 0.05 level of significance for the hypothesis. The findings of the study showed that classroom design has a high predictive value and also significantly predicted academic achievement of students in Mathematics in public secondary schools in Imo State. Based on the findings, the study amongst others recommended that principals should encourage the teachers to practice a carefully planned layout of classroom design for physical organization of the learning materials to facilitate effective instructional delivery.

Keywords: Academic Achievement, Classroom, Design, Mathematics, Predictor.

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Introduction

At schools, teachers are bent on devising effective instructional measures in the process of teaching and learning to achieve the stated learning objectives especially in the core subjects. Considering the need for improvement in academic achievement of students in the core subjects especially mathematics, best performances can be enhanced through integration of quality teaching measures with effective classroom management practices in a standard classroom setting. Classroom is a formal room, often set up in a school to be used for teaching and learning and other academic indoor activities. Adeyemo (2012) defined a classroom as the space bounded by the wall and roof which a teacher houses his students for the purpose of giving instruction to the students. The classroom consists of the teacher, the learners, the learning materials, learning equipment and tools. In Akpomi, Okiridu and Chukwu (2022) a classroom is the powerhouse of formal education in which the success or failure of the curriculum is generated and sustained. They further pointed out in their study that the classroom is managed effectively under the guidance of a qualified teacher known as the classroom manager. The teacher coordinates and manages the classroom for the learners' activities to attain stated objectives aimed at acquisition of knowledge. According to Teachmint (2024) the classroom is a specially designed space to teach the students without any interruption. Thus, classroom is a place that is specifically designed for the students to be equipped with a learning environment that will improve their ability to create their own opinion and perception.

Classroom design is one of the vital classroom management practices in the hands of the classroom teacher. Classroom design can be seen as a carefully planned layout and physical organization of the learning environment to facilitate teaching and learning. It gives the entire classroom a spacious comfort. According to Cox (2024) classroom design includes everything from the placement of the desks, chairs, and tables to the color of the walls, choice of lighting and available resources as well as creating a learning environment where students feel safe, welcomed and motivated to learn. The sitting position of students could have an impressive impact on the attitude of the class. Ogungweru (2023) concurred that classroom design is about making the physical space of the classroom work for students' learning needs. Researchers at the University of Salford Manchester found that a well-designed classroom can boost students' learning. According to their study, the physical setup of the classroom can significantly impact the extent of successful academic achievements of the students. Classroom design should not limit collaboration and teamwork rather should encourage students' motivation and active participation to improve performance.

In addition, the important aspects of classroom design according to Hui, Postareff, Oosterheert, Panadero, Topping, Phye, Salas, Thijs, Angeli, and Haapasaari (2019) are the arrangement of furniture, equipment involving the layout of desks and chairs

which affect the ability of students to collaborate and interact with each other. In other words, proper classroom seating arrangements can relate to mutual interaction and understanding in the class. According to Lee and Olson (2017) studies have shown that various aspects of the classroom environment can influence learning outcomes, including physical layout, lighting, acoustics, and technology. This implies that the electrical arrangements of fixtures and fittings in the classroom, forms part of the classroom design. The color of the light bulbs, regulations of the fans, placement of charts, wall clock, free of ventilation and colour of the classroom wall paintings are part of classroom design. The arrangements of instructional materials in the classroom at strategic corners, especially hanging of mathematical tables, mathematical formulas, mathematical rigorous steps and signs, improvised nature corners, diorama, realia and other relevant instructional materials can also be part of classroom design. Moreso, implementing a well-designed, arranged seating plan in the classroom can enable a conducive learning environment where the students' learning needs are cared for and good behaviours encouraged to achieve the very best. Sometimes classroom design can be dependent on the teacher's teaching style and the layout of the classroom.

Spencer (2018) noted that some factors can be consistent across every classroom such as the need for students to see the board clearly, direct the whole class from the front of the room, creating enough space for the teacher to freely walk around the classroom and observe students whilst working. In the study, Spencer also pointed out the importance of taking into consideration the medical needs of the students, so as to create a plan that supports their needs. Obviously, visually or hearing-impaired students will need seats closer to the board at the front of the class. Foregoing, it can be affirmed that a well-arranged classroom sitting position makes the teacher and the learners feel comfortable and ready for teaching and learning. While the teacher teaches without distractions, the learners learn with concentration. According to research, Ogungweru (2023) concurred that the physical layout of the classroom can have a direct impact on student learning, stating that classrooms with open layouts, natural light, and a variety of furniture options can promote creativity and engagement while classrooms with a more traditional layout, limited natural light, and rows of desks can lead to reduced engagement and even feelings of confinement. In a clearer view there is a need to adjust to classroom design in adaptation of technological innovation tools. Thus, a well-designed classroom, places a learner in a comfortable position to learn for an improved academic achievement especially in Mathematics.

Overtime, overall outstanding performance in mathematics examinations has been of great concern to teachers, parents, governments, educators and other stakeholders. At university education, some courses cannot be offered for admission without a credit pass in Mathematics. Zalmon and Wonu (2017) asserted that Nigerians

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need nothing short of good academic achievement in Mathematics to attain the Nigeria National Development Aspiration by the year 2030. Sadly, some students still experience difficulties in learning the subject. Observations and reports from NECO Chief Examiners revealed that secondary school candidates still perform below standard in Mathematics examinations. Teachers devote their time in teaching mathematics, using various instructional materials to support teaching of mathematics. In some cases, school principals organize in-house training and seminars on Mathematics for their teachers on teaching methodology and Montessori techniques. Yet, there is still a decline in academic achievement of students in Mathematics in secondary school in Imo State, especially in public secondary schools. Recent research shows that these low achievements in mathematics have kept parents and other stakeholders worrisome. Some researchers have worked on factors such as students' background, students' attitude and lack of adequate learning materials as those that could affect students' academic achievement in mathematics in Imo State but the problem has not been fully resolved. Thus, this situation motivated researchers to examine classroom design as a predictor of academic achievement of students in mathematics in public secondary schools in Imo State.

Purpose of the Study

The study examined classroom design as a predictor of academic achievement of students in Mathematics in public secondary schools in Imo State.

Research Question

This research question guided the study:

1. What is the predictive value of classroom design on academic achievement of students in Mathematics in public secondary schools in Imo State?

Hypothesis

This null hypothesis was formulated for the study and was tested at 0.05 level of significance:

1. Classroom design is not a significant predictor of academic achievement of students in Mathematics in public secondary schools in Imo State.

Research Method

Correlation research design was adopted for the study. The population of the study consisted of 612 Mathematics teachers in the 306 Public Secondary Schools in Imo State, comprised of three Education Zones; Owerri zone, Orlu zone and Okigwe zone. Proportionate stratified random sampling technique was used to draw a sample size of 245 mathematics teachers for the study, being 40% of the entire population. The instrument for data collection was a structured questionnaire titled 'Classroom Design Questionnaire' (CDQ). The items were generated based on the information from the review of related literature. The questionnaire was structured with each item of classroom design assigned a four-point scale of: Strongly Agree (SA); Agree (A);

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Disagree (D), Strongly Disagree (SD), and corresponding values of 4, 3, 2 and 1 respectively. The instrument was subjected to content and face validation by three experts in the Faculty of Education Nnamdi Azikiwe University, Awka. The Students' Mathematics Achievement Tests (SMAT) were obtained using the Mathematics Achievement Test Results Broadsheet Scores. The internal consistency of the items was obtained using Cronbach alpha which yielded a reliability coefficient of 0.85. The researcher administered the copies of the instrument directly to the respondents involving two research assistants. All the 245 copies of the instrument were administered, subsequently retrieved and used for data analysis. Pearson's Product Moment Correlation coefficient was used to answer the research questions, the coefficient (r) between 0.0 - 0.40 yielded a low predictive value, between 0.41 - 0.60 yielded a moderate predictive value, between 0.61 - 0.80 yielded a high predictive value and between 0.81 - 1.00 yielded a very high substantial predictive value. Regression analysis for significance of (r) was used for hypothesis testing at 0.05 level of significance. The decision rules that the p-value greater than or equal to the significance value of 0.05 the null hypothesis was not rejected. On the other hand, the p-value less than the significance value of 0.05, the null hypothesis was rejected.

Presentation of Results

Research Question: What is the predictive value of classroom design on academic achievement of students in Mathematics in public secondary schools in Imo State?

Table 1. Pearson correlation analysis of the predictive value of classroom design on academic achievement of students in Mathematics in public secondary schools in Imo State

Variables	N	Classroom Design	Students' Achievement in Mathematics	Remarks
Classroom Design	245	1.00	0.784	
				High Predictive Value
Students' Achievement in Mathematics	245	0.784	1.00	

Results in Table 1 showed that Pearson's correlation coefficient (r) of 0.784 was obtained. With reference to the interpretation guide by Okoye (2015) as indicated in the method of data analysis, (r) 0.784 is between 0.61 and 0.80 showing a high predictive value. This means that there is a high positive predictive value of classroom design on students' academic achievement in Mathematics in public secondary schools in Imo State.

Hypothesis Testing: Classroom Design is not a significant predictor of Academic Achievement of students in Mathematics in Public Secondary Schools in Imo State.

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Table 2: Test of Significance of Regression Analysis of the predictive value of classroom design on academic achievement of students in Mathematics.

Variables	R	R^2	Adjusted R^2	P-value	Remark
Predictor: Classroom Design	0.784	0.6146	0.601	0.02	Significant
Dependent: Students' Achievement in Mathematics					

In table 2, test of hypothesis one indicates that the p-value 0.02 was less than 0.05 level of significance (0.02 < 0.05). Therefore, the null hypothesis which states that classroom design is not a significant predictor of students' academic achievement in Mathematics in public secondary schools in Imo State was rejected. This indicates that classroom design significantly predicts students' academic achievement in Mathematics. More so, the simple regression coefficient R = 0.784 with R^2 value of 0.6146 shows that classroom design has 61.5% validity to significantly predict students' academic achievement in Mathematics in public secondary schools in Imo State.

Discussion of Findings

The findings of the study showed that classroom design has a high positive predictive value on academic achievement of students in Mathematics. The testing of the related hypothesis revealed that classroom design significantly predicted academic achievement of students in Mathematics in public secondary schools in Imo State.

This shows that an increase in teachers' use of a well-designed classroom will strongly improve academic achievement of students in Mathematics. Thus, a unit increase in the extent of classroom design is associated with a unit increase in academic achievement of students in Mathematics in Imo State. This shows that the use of classroom design by the teachers highly improves academic achievement of students in Mathematics in Imo State when effectively applied in classroom teaching and learning. In other words, an enhanced level of increase in the classroom design predicts an improved academic achievement of students in Mathematics.

Thoughtfully, it becomes important for teachers to be more concerned about the arrangement of classroom materials, desk layouts, display charts, learning notes and other instructional materials. More so, classroom design can help create a safe and welcoming learning environment for a classroom that is properly organized and well ventilated to promote teaching and learning activities. This is in line with Ogungweru (2023) who observed that the overall physical design of the classroom such as lighting, layout and technology has an impact on student learning and progress and recommended that school administrators and teachers should show concern on the aspects

of the physical environment which can impact on student learning and progress.

Further findings of the study also showed that classroom design predicted academic achievement of students in Mathematics. Therefore, a carefully planned layout and physical organization of the learning environment facilitate teaching and also motivate students' interests, triggering their urge and desire to learn. This concurred with Cox (2024), who noted that classroom design; from the placement of the desks, chairs, and tables to the color of the walls, choice of lighting and available learning materials and resources promote students' academic achievement.

Conclusion

It was observed that classroom design has a high predictive value on academic achievement of students in Mathematics in public secondary schools in Imo State.

The study concluded that the effective and efficient application of classroom design in the process of teaching and learning improves students' academic achievement in Mathematics.

Implications of the Findings

The findings of this study revealed that classroom design has positive predictive value on academic achievement of students in Mathematics in public secondary schools in Imo State. The implication is that classrooms with display of relevant instructional materials at strategic corners, hanging of mathematical tables and formulas, carefully layout desks and well-ventilated atmosphere promotes learning for increased academic achievement of students especially in mathematics in public secondary schools in Imo State. Thus, a well-designed classroom, places a learner in a comfortable position to learn for an improved academic achievement.

Recommendation

Based on the findings, the study recommends that principals should encourage the teachers to practice a carefully planned layout of classroom design for physical organization of the learning materials, the environment and students to facilitate effective instructional delivery.

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