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Equipped Science Laboratories Versus Students' Participation and Academic Achievement: The Case of Nigeria Niger Delta Secondary Schools and National Certificate Examinations

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Abstract
Niger Delta Region of Nigeria is an oil reach area that has served the economy of Nigeria very well but has not much in return for itself, and if anything at all, devastation of the ecosystem and impoverishment of the people, were the unfortunate outcomes. The creation of the Niger Delta Development Commission (NDDC) in year 2000 has proved to be a good response from the federal government to the region after many years of neglet. The commission is imprinting its relevance in many fronts in the region. Education and youth development has become a front burner for the commission in resent years. Science education received a boost in 2021 when NDDC decided to equip some secondary schools with laboratory resources as an intervention. This study is asking a vital question: What is the effect of this intervention on students participation and achievement in science education?. Data was gathered from schools that received laboratory equipment in all nine states of the region, using checklist for enrollment and achievement grades in school certificate examinations in chemistry, physics, biology and Agricultural Science as relevant data. The objective was to compare the status of the variables before and after the intervention by NDDC. Mean scores were used to answer the research questions while chi-square was used to test the hypothesis. Based on the findings of a significant positive effect in enrollment and achievement, recommendations to guide the Commission and other government agencies that have neglected populations, were proffered.
Keywords: Science equipment, School laboratory, Science enrolment, Niger Delta Region.
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1. Introduction

The roles and benefits of human ecosystems and her institutions can always be assessed for their impacts on sustainable developments. According to Onwukwe and Ofoegbu (2023:1) "Sustainable national development can be seen as a process of improving the range of opportunities that will enable people to achieve their aspirations and full potential over a period of time while maintaining the resilience of economic, social and environmental systems. Quality education, however, leads to acquisition of relevant skills and knowledge required for sustainable developments." Indices of sustainable development can therefore, be measured overtime. The Niger Delta Region of Nigeria with a teaming population of not less than forty million people in nine states of the Federal Republic of Nigeria, has been judged to have suffered neglect and devoid of meaningful and sustainable development plans by the Federal Government.

However, the neglect of the Niger Delta Region of Nigeria reversed with the creation of the Niger Delta Development Commission (NDDC) by the Federal Government under President Olusegun Obasanjo in the year 2000. Educational development, including increasing youth access to education, has since become a key focus of the Commission. According to Agommuoh, Onwukwe and Nwachukwu (2025), the educational programs of NDDC, among other things, aim at empowering the youths of the area with relevant skills, knowledge and attitudes that will make them both creators of employment and also becoming suitable for different employment opportunities that flood their region due to the activities of multinational companies and corporations operating in their region.

It is now nearly six years (2021-2026) since NDDC undertook a comprehensive overhaul of science laboratories in some secondary schools across the region by donating functional science laboratory equipment to secondary schools in the region. The researchers in this study are of the opinion that it is time to empirically assess the effect of the donated science equipment on the participation and academic achievements of secondary school students in the Niger Delta Region of Nigeria.

Consequently, the purpose of this study is to determine the effect of the Niger Delta Development Commission's science equipment intervention in secondary schools in the region on student enrollment and academic achievement in science subjects using the West African Senior School Certificate Examinations (WASSE) conducted by West African Examination Council (WAEC) and Senior School Certificate Examinations (SSCE) conducted by the National Examination Council (NECO) as indicators.

1.2 Research Questions

The questions raised that guided the study are as follows:

1. What is the effect of NDDC's intervention with science equipment in secondary schools on students enrollment in the science subjects of Physics, Chemistry, Biology and Agricultural Science using Senior School Certificate Examinations conducted by WAEC and NECO as indicators?.

2. What is the effect of NDDC's intervention with science equipment in secondary schools on students academic achievement in the science subjects of Physics, Chemistry, Biology and Agricultural Science, using Senior School Certificate Examinations conducted by WAEC and NECO as indicators?.

1.3 Hypothesis

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in students enrollments in Physics, Chemistry, Biology and Agricultural Science in senior school certificate examinations conducted by WAEC and NECO before and after NDDC's science equipment intervention.

2. There is no significant difference in students academic achievement in Physics, Chemistry, Biology and Agricultural Science in senior school certificate examinations before and after NDDC's science equipment intervention.

2. Literature Review

2.1 Concept Clarification: The Laboratory

The concept of laboratory has so expanded that it's definition can be too broad for specific treatment of a subject matter. The laboratory as a place that provides an opportunity to conduct an experiment, carry out an observation and analysis (Merriam-Webster Incorporated, 2025) may be one of such very broad definitions of the laboratory. Miller (2023) tries to court a more closer definition when he advanced the definition that the laboratory is a place where science research is conducted. Even in that definition the term "scientific research" may not necessarily be bounding "science" as a discipline but all enterprises that have adopted the scientific method in their research. There is therefore, an attempt to differentiate " Science laboratory" from the general concept of "The Laboratory".

For further clarification of the concept under discussion and as it relates to this study, it has become imperative to take a closer look at the concept of "The School Laboratory". When Kumari, Mwesigye and Balimuttajjo (2024:555) stated that "Science Education significantly benefits from the use of science laboratories …" they clearly highlighted "The School Laboratory" in connection with the teaching and learning of science in schools. It is in this concept that "school laboratory" which is sometimes used interchangeably with "science laboratory", comes to mean any instructional facility which science teachers employ to help students learn how to investigate the natural world just like scientists do (Gericke, Hogstrom & Willin, 2023, Miller, 2023, National Academies, 2006). It is in this perspective of the concept of secondary school science laboratory that can be equipped with resources, including personnel, that this study is carried out. In this study, therefore science laboratory or secondary school laboratory means that space or room in a building where gadgets and other pieces of equipment can be installed, where consumable materials like chemicals, vessels, chats and setups for specific experiments, and so on, can be installed or stored. It is from this concept of the laboratory that science teachers can harness resources to set up experiments or carry out specific observations in Chemistry, Physics, Biology, Agricultural

Science, and so on, within the laboratory space or even outside the four or so walls of the built up school laboratory space.

2.1. Role of Science Laboratory in Science Education.

First and foremost, the laboratory, taken in this study to mean adequately equipped, functional and properly manned school science laboratory, affords teachers and students opportunities to engage in science practical exercises: Be they of the confirmatory (set up to confirm a scientific laws) or inquiry based (set up as a guide to enable students arrive at conclusions on their own). Teachers also carry out practical demonstrations, either alone or together with students in school laboratories in order to help inculcate certain skills, attitudes or morals. These exercises are referred to interchangeably either as 'practical work' or 'laboratory work'(Bing and Chen 2024) Some authors and practitioners even prefer the term 'Hands-on exercises' (Hugo & Jeorge, 2023) for the same engagements of science teachers and their students in the school laboratory.

The school laboratory is believed to be at the heart of school science studies. To make laboratory facilities, like building, water supply, power, as well as adequate supply of equipment, materials and personnel available, is to critically define the level of optimal laboratory practices, level of learners learning of science and acquisition of science process skills that will follow (Samphina Academy, 2025)

The theories of learning advanced by Dewey; (learning by doing) Kolb (Experiential Learning) and Kuhn's (Paradigm Shift) upon which this study is based, all come to life in the school science laboratory learning of science (Kumari, Mwesigye and Balimuttajjo, 2024). The authors, therefore opine that science teaching and learning (a key component of the Quality Education advocated by the 17th goal of Social Development Goal of United Nation's Department of Economic and Social Affairs) and practical work are inseparable elements in science education. The authors further emphasized the all time shift from 'the way we do science' to 'what we do science' is hinged on the approach to science education from the laboratory practicals point of view, hence the conclution that there is " …enough empirical evidence that science laboratory education is an inseparable part of science education"(Odden et al, 2021 in Kumari, Mwesigye and Balimuttajjo, 2024: 559).

Many science teachers, through their own experiences with their students, affirm the very important role school laboratories play in science education and recommend that it not only be established but also equipped. It was in this wise that after their study on laboratory approach on interest and achievement that Amina and Salisu (2025) recommended that science teachers should adopt laboratory-based teaching methods, that school laboratories should be equipped with necessary resources. Effectiveness of laboratory based learning has been determined to play a role, not only in learners motivation and engagement but also in helping to drive teaching methodology, teaching resource availability, assessment and testing (Acheampong & Amaniampong, 2025). The logic is simple: With evidence to show that equipping the laboratory is increasing time on task and proficiency in science skill development of learners, request to replace used up materials will easily be attended to by the school authorities, equipped and functioning laboratories will task teachers' creativity to adopt teaching approaches that ordinary classroom experiences could not have made possible. In the same vein, assessment and testing in laboratory teaching though tedious in planning, are 'enjoyable' to execute as it calls for more hands on the deck.

Equipped and functional laboratories also build up the aura and sanctity of the laboratory among students and teachers, helping to build a culture of rules and regulations guiding laboratory engagements. The role of school laboratories in science education is easily perceivable, determinable and provable. If, for instance, the teacher lacks the full knowledge of equipment calibration or planning for practical exercises with students, this becomes obvious to stakeholders and administrators who will then institute in-service training, workshops and conferences as remediation (Agommuoh, Onwukwe & Nwachukwu, 2025)

2.3 The Link Between Science Laboratory and Students Performance.

Apart from the number scores like percentages or letter grades like the alphabets traditionally used to describe achievements in schools, which some times do not really portray authentic assessments of academic engagements, there are obvious indices that should predict the outcomes of the education enterprise, and in this case, science education. When adequate laboratory resources are made available and teachers are putting them to proper use, definitely, students' time on task increase. There is also the group interactions. These interactions with procedures, equipment and apparatus as well as with one another, surely will lead to deeper cognition, operational skills development and of course, the affective domain of learning will all be awakened. This assertion is clearly stated by Kumari, Mwesigye and Balimuttajjo, (2024:555) when they stated thus: "According to Instructional Theory of Learning, the science laboratory directly imparts students' attitudes and motivation,

leading to better academic performance". Mulinge (2017:48) came to a similar conclusion: " …there is a significant relationship between laboratory facilities and students academic performance in science subjects".

Achievement scores should not be the most important aspects of academic performance, as earlier stated. Lazaro and Paglinwan (2025) observed that available and functional laboratory resources do not only engage learners physically (more time on task) but also engage them emotionally and cognitively. So, academic performance includes physical presence, that is attendance as well as being emotionally attached, wanting to do more, bonding with the laboratory space in a positive way, looking out to see and get engaged with the personnel, peers, helping to set up apparatus, cleaning up, observing relevant rules and regulations and reminding others to do so, submitting assignments on time, doing corrections without coercion, asking questions and even repeating exercises if required to do so, are all part of performance in a hands-on laboratory set up. These and more are some salient issues in academic performance that can be determined. A learner who is so physically and emotionally attached to laboratory work because the equipment to practice and personnel to guide are adequately available, definitely will be proficient in science process skills (Samphina Academy, 2025).

Adequate laboratory resources enable teachers to assign pieces of equipment that can be used to set up specific apparatus to carry out some practical assignments either individually or in groups with minimal interference from the teacher. This is the type of engagement with the school laboratory that gives students greater autonomy with their own learning and mastery. Nicol, Gakuba and Habinshuti (2022) conducted a systematic review of literature on the opinion of students concerning their laboratory work. It is not surprising to the present researchers that some of the concerns of the students included concerns for greater independence, participatory and interactive learning engagements, learning science by fun and so on. There is therefore, no doubt that greater independence and a level of fun with laboratory work will answer the other concerns of the students unearthed in the study: Development of practical and science process skills, enhancing understanding of the theoretical concepts, permanent learning and application of learned concepts. On the students' opinion about what they gained from their practical exercises, their responses included improvement in their conceptual understanding, acquisition of attitudinal change towards science. Finne, Gammelgaard and Christinsen (2022) found out that students generally feel like missing out on something when they are not in the laboratory and doing the experiments themselves.

Some studies reveal that Nigerian students often exhibit poor performance in science subjects at the secondary school level due to such factors as; inadequate qualified science teachers, prevalent conventional teaching methods as well as low self-concept and lack of interest, (Mamah, 2022, Onah & Anamezie ,2022). These studies also noted less positive attitude toward science among female students when compared to their male counterparts.

However, the disparity in skills acquisition, attitudes and performance between male and female students may be bridged through group laboratory work. Group laboratory work seem to help students perform better than when they work alone. This view is supported by experimental evidence too. Onyeukwu and Hope-Tariah (2023) employed quasi experimental design in studying the effects of laboratory teaching method on academic performance of Integrated Science students in Rivers state of Nigeria and came to the conclusion that students who worked in groups outperformed those who worked alone on the same exercises. The explanation is not far fetched. Interactions help correct mistakes while they are being made and shared ideas expand imaginations too. Another study of quasi experimental design conducted by Amina and Salisu (2025) on effect of laboratory approach on students interest and achievement, led the researchers to the observation that a significant effect was recorded in both variables. In another study, where the engagement levels of physical presence, emotional and cognitive attachments were related to laboratory work opinion survey, the respondents returned "Agreed" at all three levels of engagement while working in the laboratory. With such level of engagement in laboratory work, it is therefore, no wonder that literature is replete with evidence that students perform better in science education generally (Gericke, Hogstrom & Willin, 2023) and even in specific science subjects like chemistry(Bassey, & Ekara, 2025, Owusu, 2023, Afyusisye & Gakuba, 2022, James, Ugwu & Eze, 2019), physics(Unamma & Ebirim, 2024, Owusu, 2023, Oluwasegun & Ohwofosirai, 2012,), biology (Acheampong & Amaniampong, 2025, Ikah, G. G. & Ubodion, 2025, Zailani, M. T., 2024) and Agricultural science (Bala, 2024, Onah, Beatrice, Onu, & Ekenta, 2020).

3. Methodology

3.1 Design of the Study

This study used the Ex post facto design: Existing academic records of two groups of students who could not be subjected to experiments were collected and used to study how the variables related. In this case, the two groups are secondary school students in the Niger Delta Region of Nigeria who studied science in very poorly equipped school laboratories (2018 and 2019 sets), referred to in this study simply as 'Before The Intervention Group' and those who studied science in the same schools and in the same laboratories but now well equipped (2022 and 2023 sets) referred to in this study simply as 'After The Intervention Group'. The variables that were related to the state of the laboratories were the students participation, here measured as enrollment into the specific science subjects of Chemistry, Physics, Biology and Agricultural Science and staying on the programme till terminal national examinations and the proportion of the achievement grades in those examinations. The national examinations used to measure their achievement were those conducted by the West African Examination Council (WAEC) called the West African Senior School Certificate Examinations and those conducted by the National Examination Council (NECO) called the Senior School Certificate Examinations (SSCE) in the referenced years for the study.

The population for the study comprised all secondary school science students who sat for WAEC and NECO examinations in all fifty (50)secondary schools in the Niger Delta Region of Nigeria in the 2018 and 2019 and 2022 and 2023 examinations, whose schools benefited from NDDC's science equipment intervention. The researchers randomly sampled forty-two (42) secondary schools out the fifty (50) and all students who met the criteria for the study were selected, given a total of five thousand, eight hundred and twenty-three (**5,823:** 3,756 males and 2,067 females) as sample for the study. Of the sample size of **5,823**, 2,732 came from 2018-2019 school result records while 3,086 came from 2022-2023 school result records.

3.2 Instrument for Data Collection

Data was collected using WAEC/NECO results grade check list designed by the researchers from two years before (2018 and 2019) and two years after (2022 and 2023) the intervention. This instrument was judged valid for the purpose it was designed as it captured all the facts relevant for the study.

3.4. *Method of Data Collection*

The researchers visited the schools and with the permission of the school principals, who also supplied the relevant academic records of the students, the deans of studies or the vice principals, filled out the data required by the researchers using the instrument for data collection supplied to them. The instrument was then retrieved same day.

3.5 Method of Data Analysis

The collected data was analyzed and interpreted using percentages and arithmetic mean to address the research questions. To test the hypotheses, chi-square statistics was employed.

4. Data Analysis and Discussion of Findings

4.1. Data Analysis

Research Question1:

What is the effect of NDDC's science equipment intervention in secondary schools on students enrollment in the science subjects of Physics, Chemistry, Biology and Agricultural Science?

Table 1 : Contingency table on enrollment in science subjects before and after NDDC's science equipment intervention.

Enrollment Of Students In The Sciences						
NDDC Intervention	**Chemistry**	**Physics**	**Biology**	**Agric. Science**	**Total**	**%**
Before:(2018-2019)						
Male	1703	1554	1995	942	6194	61
Female	1075	596	1387	913	3971	39
Total	**2778**	**2150**	**3382**	**1855**	**10165**	**43.6**
After: (2022-2023)						
Male	2157	2276	2906	1383	8933	68
Female	1380	873	1246	884	4193	32
Total	**3537**	**3149**	**4152**	**2267**	**13105**	**56.4**
Grand Total	**6315**	**5299**	**7534**	**4122**	**23270**	**100**

Table 1 shows that students' enrolment in science subjects increased after the NDDC intervention. Before the intervention, 10,165 students (43.6%) enrolled for Physics, Chemistry, Biology and Agricultural Science in WAEC and NECO examinations, while after the intervention enrolment rose to 13,126 students (56.4%), indicating an increase of 2,961 students. Enrolment increased in all subjects in the years after the intervention as follows: Chemistry by 759, Physics, 999, Biology, 4, 152 and Agricultural Science by 433. A careful observation of Table 1, reveals some unexpected phenomena: That more female students offered Biology and Agricultural Science (1387 and 913 respectively) before the science equipment intervention compared to enrollment after the intervention (1246 and 884 respectively). Another equally surprising outcome is the unexpected higher increase in enrollment in Physics after the intervention than in Chemistry, 999 against 759 judging from the commonly held views that fewer students offer physics in secondary schools.

However, the general clear rise in total enrolment after the intervention indicates that NDDC's provision of science equipment intervention had a positive effect on students' enrolment in science subjects.

H_{01}: There is no significant difference in students' enrollments in Chemistry, Physics, Biology and Agricultural Science in senior school certificate examinations conducted by WAEC and NECO before and after NDDC's science equipment intervention.

Table 2: Chi-square result on the significant difference in students' enrollments in science subjects in senior school certificate examinations conducted by WAEC and NECO before and after NDDC's science equipment intervention.

	Enrollment in Science Subjects							
NDDC Intervention	**Physics**	**Chemistry**	**Biology**	**Agric**	χ^2_{cal}	df	χ^2_{tab}	**Dec.**
Before	2150	2778	3382	1855	28.445	3	7.81	Sig.
After	3149	3537	4152	2267				

Table 2 shows that the calculated chi-square value (χ^2_{cal} = 28.445) is greater than the critical chi-square value (χ^2_{tab} = 7.81) at 3 degrees of freedom. This indicates a statistically significant difference in students' enrollment in Physics, Chemistry, Biology and Agricultural Science in WAEC and NECO examinations before and after NDDC's science equipment intervention. Consequently, the null hypothesis (H_{01}) is rejected, implying that NDDC's intervention had a significant effect on students' enrolment in science subjects of physics, chemistry, Biology and Agric. Science.

Research Question 2: What is the impact of NDDC's intervention with science equipment in secondary schools on students' achievement in the science subject of Physics, Chemistry, Biology and Agricultural Science, using Senior School Certificate Examinations conducted by WAEC and NECO as indicators?

Table 3: Contingency table on achievement in science subjects (Physics, Chemistry, Biology and Agricultural Science) before and after NDDC's science equipment intervention.

	Academic Achievement				
NDDC Intervention	**A1-C6**	**D7-D8**	**F9**	**Total**	**%**
Before (2018-2019)	6573	2917	645	10135	43.6
After (2022-2023)	9075	3663	368	13106	56.4
Total	**15648**	**6580**	**1013**	**23241**	**100**

Table 3 shows that students' achievement in science subjects improved after the NDDC intervention. Before the intervention, 10,135 candidates (43.6%) were recorded, compared to 13,106 candidates (56.4%) after the intervention, indicating an increase of 2,971 candidates. Credit passes (A1–C6) increased from 6,573 to 9,075, while failures (F9) decreased from 645 to 368. This shift in percentages and achievement categories indicates that NDDC's provision of science equipment had a positive effect on students' achievement in Physics, Chemistry, Biology and Agricultural Science in WAEC and NECO examinations.

H_{02}**:** There is no significant difference in students' achievement in Physics, Chemistry, Biology and Agricultural Science in senior school certificate examinations conducted by WAEC and NECO before and after NDDC's science equipment intervention.

Table 4: Chi-square result on the significant difference in students' achievement in science subjects in senior school certificate examinations conducted by WAEC and NECO before and after NDDC's science equipment intervention.

	Academic Achievement						
NDDC Intervention	**A1-C6**	**D7-D8**	**F9**	χ^2_{cal}	df	χ^2_{tab}	**Dec.**
Before	6573	2917	645	183.574	2	5.99	Sig.
After	9075	3663	368				

Table 4 shows that the calculated chi-square value (χ^2_{cal} = 183.574) is greater than the critical chi-square value (χ^2_{tab} = 5.99) at 2 degrees of freedom. This indicates a statistically significant difference in students' achievement in Physics, Chemistry, Biology and Agricultural Science in WAEC and NECO examinations before and after NDDC's science equipment intervention. Consequently, the null hypothesis (H_{02}) is rejected, implying that NDDC's intervention had a significant effect on students' achievement in science subject of Physics, Chemistry, Biology and Agricultural Science

4.2. Summary of Findings

1**.** Students enrollments increased significantly in the science subjects of Chemistry, Physics, Biology and Agricultural Science in the years after the science laboratory equipment intervention by NDDC in the Niger Delta Region of Nigeria.

It was however, observed that less female students registered for Biology and Agricultural Science in the years after the science equipment intervention. A higher enrollment in physics than chemistry was also noted.

2.Achievement of science students in the subjects of Physics, Chemistry, Biology and Agricultural Science increased significantly in the years after the science laboratory equipment intervention by NDDC in the Niger Delta Region of Nigeria, with more students achieving the university admission grades of A1-C6 than in the years before the intervention.

4.3. Discussion of Findings

The higher participation in science, measured in this study as enrollment in the science subjects of Chemistry, Physics, Biology and Agricultural and carrying through till terminal certificate examinations, is consistent with

literature (Nicol, Gakuba and Habinshuti ,2022). Many studies reveal that equipped science laboratories accord students greater independence, participatory and interactive learning engagements and can even accord them the opportunity to learn science with fun. It is therefore, not a wonder that they could enroll in the science subjects, studied them with increased participation from senior secondary class one to class three and still enrolled them for their national certificate examinations with confidence. Even the less enrollment of female students in Biology and Agricultural Science after NDDC intervention with laboratory equipment could be explained as well as the unusually higher enrollment in Physics than Chemistry. It is conceivable that with more equipment, more time on task, higher confidence and better understanding, more girls moved over and enrolled in physics, a subject often considered easier for boys than girls, especially in societies with gender stereotypes like the Niger Delta Region of Nigeria.

Similarly, the increase recorded in achievement in all the science subjects of Chemistry, Physics, Biology and Agricultural Science after the laboratories equipment intervention by NDDC that enhanced the teaching and learning of these subjects is also consistent with literature (Gericke, Hogstrom & Willin, 2023). Amina and Salisu (2025) and other similar studies came to the same conclusions: The effect of laboratory approach on students interest and achievement, is significantly positive on achievement and participation.

5. Conclusion

This study concludes that Nigeria's Niger Delta Development Commission's intervention of supplying secondary schools in the region with science laboratory equipment significantly enhanced secondary school students participation and achievement in science. The significant difference in enrollment and achievement found by comparing these parameters in the years before and after the intervention, using the national certificate examinations conducted by The West African Examination Council ,WAEC and National Examination Council, NECO in Chemistry, Physics, Physics, Biology and Agricultural Science are verifiable evidence.

6. Recommendations and Further Research

1. Nigeria's Niger Delta Development Commission, NDDC should go ahead and donate science laboratory equipment in all secondary schools offering science in the region and should establish a monitoring and feedback mechanism to enable it give individual attention to schools when needed, especially in the areas of renovations and re-equipping of secondary school science laboratories.

2. Federal and state governments as well as other funding agencies around the world should emulate NDDC and use equipment of secondary school science laboratories to bridge the educational and human capacity gap between rural, neglected and underdeveloped populations and the privileged populations of the urban areas.

3. Science education funding agencies should include retaining of science teachers as an integral part their secondary school intervention programs.

Further researches should be conducted in the following areas:

1. Impact of laboratory learning on male and female students participation and achievements in science.

2. Effect of community collaboration with NDDC on the participation and achievement of science students in NDDC states in Nigeria.

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