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PHYSICS EDUCATION: TRANSFORMING THE NIGERIAN ECONOMY THROUGH PEDAGOGICAL SHIFT

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Abstract
Education is the best process to achieving any form of transformation. The economy of any nation primarily depends on the level of scientific and technological development of such nation through the process of education. Physics has being identified as a core subject for scientific and technological advancement. Nigerian students run away from this subject as a result of poor performance due to poor method of instruction which is predominantly on teacher's activities at the expense of students' interactions in the classroom. This of course hinders Nigerian students from constructing their own knowledge that will lead to the discovery of new technologies to solve problems of energy and power and boost the economy rather than depending on foreign technologies. The study compares student achievement in four different classroom interaction patterns in the teaching and learning of Physics in secondary schools in Lagos State. A pretest, posttest non randomized control group quasi-experimental design was adopted. Purposive sampling was used to obtain a sample of 211 SSII students of intact classes from four co-educational secondary schools. A validated Physics Achievement Test (PAT) of reliability coefficient r= 0.73 was used. Three hypotheses were formulated and tested at 0.05 level of significance. Data were analyzed using ANCOVA. Results showed a significant main effect of treatment and gender on achievement of students in physics. Also, students exposed to teacher-student interaction obtained the highest mean score of 44.00, followed by those exposed to group work/projects and supervised by the teacher (Mean=37.60), the entire classroom interaction group has a mean of 35.92 while the student taught by a fellow student scored the lowest (Mean=32.92).Researchers recommended that varied forms of classroom interaction patterns should be adopted for teaching physics for a transformative economy in Nigeria.

Keywords: *Nigerian Economy, Physics Education, Transforming.*

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Background to the Study

The economy of any nation primarily depends on the level of scientific and technological development of such nation. Nigeria as a nation is currently having serious problem with her economy as a result of her low level of scientific and technological development leading to absence of constant power supply, inadequate energy to power home and industries, folding up of industries ,unemployment, diseases, poverty, high rate of criminal act ,kidnapping, insecurity of life and properties, untimely death etc .All these are the consequences of lack of scientific knowledge of physics and its application needed for technological development and innovations for improved economy.

It is high time for the education sector to wake up from slumber to revitalize the pedagogical mode of instruction right from the very grassroots- the secondary school level, the very level where physics is introduced to students At this crucial and sensitive stage the mode of instruction is very germane, since the success of any program depends majorly on the mode of presentations/ / communication of such program (Busari,2006) .A good number of people today would have been good scientists and physicists but due to the abstract way in which the nature and content of physics was presented to them ,they found themselves in another field. Few students that determine to offer physics does not have excellent grade in it at the school certificate level WAEC results 2005 to date). This prevented them from reading related professional courses in science and technology (such as engineering, medicine, computer science geology and its applications etc) needed for technological development that would in turn transform the Nigeria economy (Ogunleye & Babajide2011).

The paradigm pedagogical shift within the context of this study refers to sets of active forms of learning, involving diverse classroom interactions of the students and teacher, which endowed the students with the power to construct their own knowledge needed for technological advancement and for economy transformation., . In practice, classroom interaction patterns may to a large extent be determined by the cognitive classroom scripts since mental representations have been found to be rather similar among the actors in a given instructional situation, and the constraints and affordances in western classrooms are impressively homogeneous and constant over time (Schratzenstaller, 2010).

Classroom scripts in this context refers to the cognitive representations of typical lesson sequences which guide both teachers and learners in their understanding and help them to act in specific classroom situations (Seidel, Rimmele, & Prenzel, 2005).Classroom interaction encompasses all types of interaction that goes on in a classroom. There are several different ways to categorize classroom interactions, but all of the types are important to engage learning and to create sound and competent young people inside and outside the classroom. Interaction types includes: student-teacher interaction, student-student interaction, small-group interactions, and entire classroom interactions.

Student-Teacher Interactions
This type of interaction that is student teacher relationships such as the relationship between a boss or superior and subordinate. Students must learn to interact respectfully, but must also learn how to be assertive without being rude, so that their points and opinions are heard without disruption.

Student-Student Interactions
This is the type of interaction that is one-on-one student relationships. Students must learn to rely on one other person and must be able to evaluate what their own strengths and weaknesses are as they try to complete a task.

Small-Group Interactions
This is the type of interaction hereby students work in group of three to six people, students have equal time to talk and learn to perform a role that they are assigned. They also learn that a small group must have a leader and how to incorporate different learning and working styles into a group in harmony.

Entire Classroom Interactions
Entire classroom interaction allows all students to interact with all other students in the classroom. Students learn how it feels to be only a small part of a very large group. Other forms of classroom interactions are: Classroom conversation, Question-and-answer and Role-playing

Statement of the Problem
Physics teachers' traditional method of instruction has not yielded excellent performance of students in school certificate examination and has not encourage students to offer physics at the secondary schools that will qualify them to offer professional physics related courses at the University and other tertiary institutions which will further empower them to make significant contributions to technological sector that will transform Nigerian economy.

Purpose of the Study
The purpose of the study is to:
1. To show the efficacy of classroom interaction patters (Pedagogical shift in classroom instruction) on achievement of students in physics.
2. To show if of gender will influence the achievement of students in physics
3. To make submission on how the influence of classroom interaction pattern will lead to the development of the Nigerian Economy.

Research Questions
1. What is the effect of classroom interaction patterns on achievement of students in physics?
2. Is there any influence of gender on achievement of students in physics?
3. Is there any interaction effect of gender and treatment on students' achievement in physics?
4. How would classroom interaction pattern develop Nigerian Economy?

Hypotheses

H_o 1: There is no significant main effect of treatment on students' achievement in physics

H_o2: There is no significant main effect of gender on students' achievement in physics

HO3: There is no interaction effect of gender and treatment on students' achievement in physics

Theoretical Framework

This study adopted the theory of Teaching through Interactions (TTI) framework invented by Hamre and Pianta (2007). It is a theoretically driven and empirically supported system for conceptualizing, organizing, and measuring classroom interactions between teachers and students in three major domains: Emotional Interaction domain, Classroom Organization domain and Instructional Interaction domain. Hamre & Pianta, (2007) proposed a model that organizes teacher-student interactions at four levels, from broad to micro in nature. The broad domain of emotional interaction domain is de?ned in terms of three dimensions as: Classroom climate, Teacher sensitivity and Student perspectives. Each dimension is operationalized at more granular levels of analysis in terms of a set of speci?c behavioral indicators that are then de?ned in terms of observable behavioral interactions. Classroom climate includes observable behavioral indicators such as the frequency and quality of teachers' affective communications with students (further specify in terms of smiles, positive verbal feedback) as well as the degree to which students appear to enjoy spending time with one another. The classroom Instructional Interaction domain is adopted in this study. In this case different classroom interactions are under different instruction. For example, what is happening in student-teacher classroom interaction is quite different from what is happening in student-student and different from what is happening in small group and this is also different from what is happening at the entire classroom interaction.

Methodology

This study adopted a pre-test, post-test quasi-experimental research design A sample of 211 Senior Secondary Two (SS2) physics students and 4 physics teachers from four purposively selected secondary schools from three Local Government Areas in Lagos State. Physics Achievement Test (PAT) of 50 items of five options multiple choice objective test drawn from the concept heat transfer, gravitational field, and electric field were used in collecting data.PAT was subjected to face and content validity. It was pilot tested in a neutral school and its reliability coefficient value r was found to be 0.73 using test retest method.

The students were made to select the correct answer from five options. PAT was used to measure the achievement of students in both pre-test and post-test. A purposive sample technique was used in selecting experimental group 2 and experimental group 4, while experimental group 1 and experimental group 3 used simple random technique.

Table 1: Distribution of Students across all Treatment Groups

Treatment	Exp. Group One	Exp. Group Two	Exp. Group Three	Exp. Group Four	Total
No of Students	50	15	33	113	211

Variables in the Study

There is only one independent variable varied at 4 levels. These are four different classroom interaction pattern known as experimental groups.

Experimental group 1: Student-student interaction pattern
Experimental group 2: Student-teacher interaction pattern
Experimental group 3: Small group interaction pattern
Experimental group 4: Entire classroom interaction pattern

Experimental Group 1

This is the student-student teaching group. Preliminary evaluation was identified based on their continuous assessment performance in the previous year. Here the teacher selects the intelligent students and appoint them as teachers to at least three students each. Each student teacher group consists of mixed abilities.

Instructional procedures

Step 1: The teacher shares the topic to be taught a week before teaching
Step 2: The student introduces the topic to other students
Step 3: The student explains the topic to other students.
Step 4: The student answers other students' questions
Step 5: The student solves examples
Step 6: The student asks other student questions
Step 7: The student gives exercises to other students
Step 8: The teacher marks students' class activity

Instructional Experimental Group 2

This is the individual student-teacher teaching group. Here, the teacher attends to students individually. The duration spent by a student with the teacher is 5 minutes (15x5=75minutes)

Procedure

Step 1: The teacher invites individual student to sit down.
Step 2: Teacher introduces the topic to the student (1minute)
Step 3: Teacher teaches the student. Teacher states laws and solve problems.(3minutes)
Step 4: Teacher asks questions from the student (20seconds)
Step 5: The teacher gives exercises to student.(200seconds)
Step 6: Teacher marks students exercise.(20seconds)
Step 7: Teacher gives feed back to student

Experimental Group 3

Small group interaction pattern, this is the independent teaching group. In this group, the student learns by themselves following guidelines from the teacher.

Instructional procedure
Step 1: the teacher informs each group on the topic a week before each group presents
Step 2: the teacher gives guidelines to the students on the topic.
Step 3: each group presents the topic to the teacher.
Step 4: the teacher asks the group questions
Step 5: the teacher marks each group's report

Experimental group 4
Entire Classroom interaction Group: Entire classroom interaction allows all students to interact with all of the other students in the classroom. This is important in several different ways, according to different theories. Students learn how it feels to be only a small part of a very large group. They need to learn to wait their turn to talk and be prepared to do much more listening than talking.

Instructional procedures
Step 1: The teacher introduces the topic to the students
Step 2: The teacher shows the students a five minute video on the topic
Step 3: The student jots down notes from the video display
Step 4: The teacher goes round to supervise classroom activities.
Step 5: The teacher asks the students questions on the topic
Step 6: the teacher gives the student time to interact amongst themselves
Step 7: The student raises up hands to answer questions after solving it individually or collectively
Step 8: The teacher answers the students' questions
Step 9: The teacher gives the students exercises
Step 10: The teacher marks the students' class activities

Results and Discussion
H0 1 : There is no significant main effect of treatment on students achievement towards physics

Table 2

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Intercept Hypothesis	38468.713	1	38468.713	388.078	.000
Error	512.325	5.168	99.126		
PRE Hypothesis	72.111	1	72.111	2.611	.108
Error	5688.881	206	27.616		
Treatment	1579.986	3	526.662	19.071	.000
Hypothesis	5688.881	206	27.616		
Error					

Significant of p<.05
Covariates Appearing in the Model are Evaluated at the Following Values:
PRE = 13.9052

Table 2 shows a significant main effect of treatment on students' achievement towards physics. Decision: Reject H_o1.To identify the instructional group that causes the significant difference, the estimated mean scores of the group is presented for post test score Table 3

Table 3

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
EXPGP1	32.778[a]	.748	31.302	34.253
EXPGP2	44.139[a]	1.360	41.458	46.819
EXPGP3	37.691[a]	.916	35.884	39.498
EXPGP4	35.949[a]	.495	34.974	36.924

From table 3, entire classroom interaction pattern has a mean of 35.949, the small group pattern has a mean of 37.691, and the student- teacher interaction pattern has the highest mean of 44.139 while the student-student interaction pattern has the lowest mean of 32.778.

H_o2 : There is no significant main effect of gender on students achievement towards physics

Table 4

Source	Type III Sum Of Squares	df	Mean Square	F	Sig
Intercept Hypothesis	38744.713	1	38744.713	390.969	.003
Error	191.445	1.932	99.099		
PRE Hypothesis	21.418	1	21.418	.657	.419
Error	6783.078	208	32.611		
Gender Hypothesis	485.788	1	485.788	14.896	.003
Error	6783.078	208	32.611		

Significant of $p<.05$

Table 4 shows a significant main effect of gender on students' achievement towards physics.

Decision: Reject H_o2.In order to identified the gender that causes the significant effect, the estimated mean is computed, Table 5

Table 5

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Female	34.958[a]	.485	34.003	35.914
Male	38.164[a]	.674	36.836	39.492

Covariates appearing in the model are evaluated at the following values: PRE = 13.9052.

From table 5, female students has mean of 34.958 while the male students has mean of 38.164. This indicates that the male students performed better.

H_o3: There is no significant interaction effect of treatment and gender on students' achievement towards physics

Table 6

Source	Type III Sum Of Squares	df	Mean Square	F	Sig
Intercept Hypothesis	38744.713	1	38744.713	390.969	.003
Error	191.445	1.932	99.099		
PRE Hypothesis	21.418	1	21.418	.657	.419
Error	6783.078	208	32.611		
Treatment hypothesis	1579.986	3	526.662	14.896	.000
Error	5688.881	206	27.616		
Gender hypothesis	485.788	1	485.788	14.896	.003
Error	6783.078	208	32.611		
Treatment Gender Hypothesis	58.863	2	29.431	1.075	.343
Error	5557.878	203	27.379		

Significant of $p<.05$

Table 6 shows no significant interaction effect of treatment and gender on students' achievement towards physics. Decision: Accept H_o3This shows that male and female students in each of the group performed equally.

Answers to Research Questions

What is the effect of classroom interaction patterns on achievement of students in physics?

Table 2 shows that classroom interactions have effect on achievement of students in physics. Table 3 shows that students exposed to group 2(student- teacher interaction pattern) performed best with a mean of 44.139;this is the highest mean .This is followed by students exposed to group 2 (the small group interaction pattern) with a mean of 37.691.Nest to this is the performance of students in group 4 (the entire classroom interaction pattern) with a mean of 35.949.The least is the performance of students in group 1(the student-student interaction pattern) which has the lowest mean of 32.778

1. Is there any influence of gender on achievement of students in physics? Table 4 shows that gender has effect on achievement of students in physics; with boys performing than girls see table 5 above.
2. Is there any interaction effect of gender and treatment on students' achievement in physics?

Table 6 shows there is no interaction effect of gender and treatment in students in physics.

3. How would classroom interaction pattern develop Nigerian Economy? Classroom interaction pattern (a pedagogical shift in classroom activities) when properly implemented will go a long way to improve the economics of this our own country Nigeria.

In the sense that every students would have acquired different and appropriate skills such as manipulative, innovative, problem solving skills etc that will make each of them to be productive in-terms of be able to apply appropriate theory in solving appropriate problem. For example the western world designed different instruments and machine to solve specific problems such as the problem of transportation which was solved through the inventions of different automobiles and jets. That of communication was solved by the invention of different devises such as land phones, wireless, mobile phones cellular etc. Problem of preservation was solved through the invention of refrigerator and problem of inadequate power supply was solved through tapping energy from alternative sources such as through water, wind and solar. These western students were exposed to the principles of physics through diverse classroom interaction patterns from the early stage; the very formative stage and they grow along with it. Nigerian students can do better if giving the opportunities through the exposition to the appropriate environment and materials in the course of study physics at the secondary school level ;the very level where Nigerian students offer physics. They can then interact with materials and people in order to acquire all the needed skills for a transformative Nigeria economy.

Discussion of Finding

Results shows that

i. Students exposed to the individual student-teacher interaction performs the best in the Physics Achievement Test with a mean of 44.139 because the teacher identified individual learners learning problems took the time to interact with students individually thereby understanding the students' distinct learning problems and selecting the appropriate teaching method to aid teaching and learning.

ii. The small group interaction pattern or independent teaching group has the next highest mean of 37.691. The students performed better because they could interact with their teachers, their fellow students and the subject matter.

iii. The entire classroom interaction pattern has a mean of 35.949 where the teacher interacts with the whole classroom at a time. Here, the teacher does not relate with the students independently therefore, students with low cognitive abilities finds it difficult to perform well in the classroom activities.

iv. The student-student interaction pattern scored the lowest at 32.778. Here, the teacher does not supervise the students. The intelligent student which was selected to teach a group of 3 students each do not have the skills to impact learning and cannot carry out the process of teaching and learning. Hence, all the students perform poorly.

v. Hypotheses 1 and 2 were rejected while Hypothesis 3 was accepted. There was a significant main effect of gender on achievement of students this results is at variance with the findings of Babajide (2000), Ogunleye and Babajide (2011), but agreed with the findings of Ogunneye (2003) , Okwo and Otubar (2007) who found that boys perform better than girls in physics. While an interaction effect of treatment and gender on students' achievement in physics was not significant.

Conclusion

The study has found that classroom interaction pattern (Pedagogical shift in classroom instruction) has enhanced the performance of students in physics, Also, boys performed better than girls in the physics concepts they were exposed to. There was no interaction effect of treatment and gender on achievement of students in the physics concepts exposed to.

Recommendations

Researchers recommended that a pedagogical shift in classroom instruction through the adoption of varied forms of classroom interaction patterns is needed for teaching physics for a transformative economy in Nigeria. Classes with large population in science classrooms should be divided so that teacher-student gap can be minimized. All classroom instructional interaction packages that will identify individual student learning problem should be encouraged, so that teacher can attend to individual students' need.

References

Babajide, V. F. T. (2010), "Generative & Predict-Observe-Explain Instructional Strategies as Determinants of Senior Secondary School Students: Achievement & Practical Skills in Physics." Unpublished PhD Thesis. Nigeria: University of Ibadan.

Busari, T. (2006), "Teaching Secondary School Science." Lagos: Published by University of Lagos Press

Hamre, B. K., Pianta, R. C., Mashburn, A. J., & Downer, J. T. (2010), "Building a Science of Classrooms: Application of the Class Framework in over 4,000 U.S. Early Childhood and Elementary Classrooms." Manuscript submitted for publication.

Ogunleye, B. O & Babajide, V. F. T. (2011), "Commitment to Science & Gender as Determinants of Students Achievement & Practical Skills in Physics." Journal of Science Teachers Association of Nigeria. Vol 46 issue 1pp125-148

Ogunneye W. (2003), "Students Understanding of Concept of Gradient in Physics: A Case Study of Physics Students from Tai Solarin College of Education Ijebu Ode." Journal of Science Teacher Association of Nigeria 38(1&2) 100-106

Okwo,F .A & Otubar, S. (2007), "Influence of Gender & Cognitive Style on Students: Achievement in Physics Text." Journal of Science Teacher Association of Nigeria 42(1& 2)

Pianta, R. C., Hamre, B. K. & Allen J. P. (2012), "Teacher-Student Relationships & Engagement: Conceptualizing, Measuring, & Improving the Capacity of Classroom Interactions."

Schratzenstaller, A., Mäkitalo-Siegl K., Zottmann J., Kaplan F., & Fischer F. (2010), "The Classroom of the past." (Eds.) Classroom of the future: Orchestrating Collaborative Spaces (pp. 15-39).

Seidel, T., Rimmele, R., & Prenzel M. (2005), "Clarity & Coherence of Lesson Goals as a Scaffold for Student Learning." Learning & Instruction, 15(6), 539-556.