

# Effect of Guided-Discovery and Expository Instructional Methods on Secondary Schools Students Academic Achievement in Physics in Ikot Abasi Local Government Area, Akwa Ibom State, Nigeria

**Inyang, Francis Nicholas**

**Utibe, Uduak James**

**Uko, Patrick Joseph**

**Uboh, Daniel Effiong**

*Department of Science Education, Akwa Ibom State University*

*Ikot Akpaden, Mkpato Enin, Akwa Ibom State, Nigeria*

*E-mail: [Inyangfrancis524@gmail.com](mailto:Inyangfrancis524@gmail.com), [uduakutibe@aksu.edu.ng](mailto:uduakutibe@aksu.edu.ng)*

*[drpatrickuko@gmail.com](mailto:drpatrickuko@gmail.com), [ubohdaniel@gmail.com](mailto:ubohdaniel@gmail.com)*

## ABSTRACT

*This study determines the effect of guided-discovery and expository instructional methods on Senior Secondary students' academic achievement in Physics in Ikot Abasi, Akwa Ibom State, Nigeria. The design was a quasi-experiment using pretest and posttest non randomized groups. The population comprised all the Senior Secondary two Physics students of the 2022/2023 session in the public secondary schools. In all, a sample of 182 students (90 in the first and 92 in the second experimental groups) was selected for the study. Purposive sampling technique was used to select the schools. Physics Achievement Test on Waves (PATW) was the instrument used for data collection with reliability index of 0.85. The instrument was validated by experts consisting of Physics and Research, Measurement and Evaluation lecturers from Akwa Ibom State University and a Physics teacher in one of the selected schools. Two different teaching packages were prepared and used in the teaching of Waves. Data were analyzed using mean and standard deviation while Analysis of Covariance (ANCOVA) was used in testing the research hypotheses at a 0.05 level of significance. The findings showed a significant difference between the mean achievement scores of Physics students when taught waves using guided-discovery and expository instructional methods. It recommended guided-discovery and expository instructional methods in teaching waves to Physics students.*

**Keywords:** *Expository instructional method, guided-discovery, location, Physics, students' achievement*

## INTRODUCTION

Physics is a branch of science that explains matter and energy. It is a major subject in engineering and technology. Inyang, Uboh and Utibe (2022) described Physics as a branch of science that deals with matter and energy and their interactions. It is an important branch of

science, which enables learners to understand what happens around them, helping them to solve simple problems they encounter in daily life. It is a science subject that involves both theoretical and practical experiences. It provides students with analytical problem solving which are important for many sciences.

Mkpanang and Inyang (2019) defines Physics as a natural science that involves the study of physical properties of matter, its measurement, motion through space and time along with related concepts such as waves, energy, to help students understand how the universe behave and the laws applied to it. Physics as a branch of science and the pre-requisite subject for many fields of Science and Engineering prepare students to synthesize, analyze data and present findings in an understandable format. This implies that the study of Physics requires effective and efficient teaching for meaningful learning to take place (Mkpanang & Utibe, 2022).

The study of Physics equips students with useful concepts, principles and theories necessary for controlling and preserving the environment. The knowledge of Physics has been found to be very essential in the understanding of modern technology and the myriads of the scientific developments useful to mankind (Utibe, Madu & Uko, 2012; Damar, Hulda & Jonah, 2016). Physics generates fundamental knowledge needed for the future technological advances that will continue to drive the economic engines of the world and contributes to the technological infrastructure and the skills needed to take advantage of scientific advances and discoveries.

Through the application of Physics principles, communication, transportation and other social activities has been made more comfortable. Job opportunities are available for people with knowledge of Physics in the ministry of science and technology, oil companies and refineries. Construction and engineering industries require high level of Physics knowledge (Utibe & Agah, 2016; Utibe & Agwagah, 2016).

As laudable as the objectives of physics are, achieving them has seem difficult over time. Iji, Ogbole and Uka (2016), pointed out that the academic achievement of students in some physics concept is very poor, this fact calls for attention. Some factors can be identified as reasons for undesirable students' achievement and low enrolment in senior secondary school physics are poor supply of instructional materials, inadequacy of Physics teachers and the teaching method used.

The teaching of Physics in senior secondary schools has not been encouraging due to the abstract nature of the subject, and there is a need for the use of instructional methods to facilitate students' learning (Ajayi, 2008). The performance of candidates in Physics examination conducted by West Africa Examinations Council (WAEC) has been experiencing a decline as shown in the summary of WAEC results for 2011 – 2016. The poor achievement of Physics students can be attributed to poor teaching methods adopted by teachers (Onwioduokit, 2013; Utibe & Agah, 2016). Since waves involve a lot of applications to real life situations and proofs, different methods are suggested for its teaching. Such methods include guided discovery and expository instructional methods.

Guided-discovery instructional method has been described by Utibe, and Onwioduokit (2019) as a process of allowing the student to take the leading role in their own learning experience under the guidance of a teacher; it is an instructional method whereby the student is featured as the active participant, where a teacher assumes the roles of a facilitator, mediator and assessor of learning. It helps in developing students' abilities in applying concepts and personal growth, developing positive attitudes and fostering motivation.

Herviana (2015) described expository instructional method as a method in which a teacher is the main source of all knowledge, it makes the generalizations, principles and answers questions. In teaching through an expository method, more information can be covered in less time than through other teaching methods. In expository method, teachers play an active role to explain the lesson material while the students just listen (Mhiliwa, 2015). Expository instructional method greatly depends on a teacher's preparation, knowledge, confidence, passion, enthusiasm, motivation and a variety of capabilities such as ability to communication and manages the classroom (Maheswari, 2013).

Inyang, Uboh and Utibe (2022) carried out a study to determine the effect of demonstration, guided-discovery and expository instructional methods on students' academic achievement in Physics in Ikot Abasi Local Government of Akwa Ibom State, Nigeria. Their findings showed that there was a significant difference among the mean achievement scores of Physics students when taught waves using Demonstration, Guided-discovery and Expository instructional methods, hence, Guided-discovery method should be used in teaching waves followed by Demonstration and Expository instructional methods to Physics students. Utibe and Onwioduokit (2019) carried out a study to examine the effect of Guided-Discovery, Demonstration Methods and Senior Secondary Physics Students' Acquisitions of Entrepreneurial Skills in household electrical circuit sketch and wiring skills in Akwa Ibom State. Guided-discovery and demonstration methods were recommended for teaching of entrepreneurial skills in household electrical circuit sketch and wiring skills to physics students. Daluba (2013) carried out an experiment on effect of demonstration method of teaching on students' achievement in Agricultural science among 195 senior secondary three (SS3) students in Kogi State. The students taught with the demonstration method were found to have high achievement score in the agricultural students' achievement Test (ASAT) than their counterparts in the control group that were taught with the conventional lecture method.

Umar and Samuel (2018) investigated school location as correlate of students' achievement in Basic Science using 236 Junior Secondary three (JSIII) students. The result showed significant difference in Basic Science achievements between urban and rural students. Students in urban schools had better achievement than those at rural settings. It is recommended that educators should fill the urban/rural dichotomy in students' achievement in Basic Science and parents in rural areas should help their children to maintain interest in Basic Science.

Awodun and Oyeniyi (2018) also examined the influence of school location on students' academic achievement in Junior Secondary School Basic Science in public secondary schools in Ekiti State, Nigeria. Computerized result sheets sent to each school by

the Ekiti State Ministry of Education for the Ekiti State Junior WAEC results were collected on the 2014-2017 May/June examinations for all the selected schools. The findings showed that there was no statistical significant difference in the academic achievement means scores of male and female students. The findings further revealed that there was statistical significant difference in the achievement mean scores of students in urban and rural schools. Conclusion and recommendations were also made in this paper.

A study carried out by Allahoki (2012) on effectiveness of guided-discovery teaching method on academic achievement in ecological concepts among secondary school students in Sabon Gari Educational Zone, Kaduna State showed that there is no significant difference between the achievement of males and females. Also it showed significant difference in students taught using guided-discovery method and those exposed to lecture method.

The researchers who teach under Akwa Ibom State schools and participate in the coordination and marking of West African Senior School Certificate Examination and National Examinations Council Senior School Certificate Examination for many years have observed decline on students' achievement in Physics. The poor achievement among Physics students calls for concern and pose a threat to knowledge input among students for future achievement. Effective teaching methods could improve learners' achievement in Physics. It is on this note that the researchers examine the effect of guided discovery and expository instructional methods on students' achievement in physics.

This study investigates the effect of guided-discovery and expository instructional methods on students' achievement in Physics. The study was designed to achieve the following specific objectives:

1. Compare the mean achievement scores of Physics students in waves when taught using guided-discovery, and expository instructional methods.
2. Determine the difference between the mean achievement scores of urban and rural Physics students in waves.
3. Determine the interaction effect of instructional methods and location (urban and rural) on the mean achievement scores of Physics students in waves.

### **Hypotheses**

To guide the research, the following null hypotheses were tested at a 0.05 level of significance.

H<sub>0</sub>1: There will be no significant difference between the mean achievement scores of Physics students in waves when taught using guided-discovery and expository instructional methods.

H<sub>0</sub>2: There will be no significant difference among the mean achievement scores of urban and rural Physics students in waves.

H<sub>0</sub>3: There will be no significant interaction effect of instructional methods and location (urban and rural) on the mean achievement scores of Physics students in waves.

The findings of this study would be useful to the Physics students, teachers, curriculum developers, and parents, Ministry of education, Physics textbooks publishers and

researchers. The findings would greatly benefit Physics students as the knowledge acquired using guided discovery and expository instructional methods would provide the students with a lifelong opportunity for self-development and improve academic achievement and retention in the concept of Waves. Physics teachers, curriculum developers, parents, Ministry of education, Physics textbooks publishers and researchers would also benefit from the findings as the results would reveal areas of improvement in guided discovery and expository instructional methods in Physics in the senior secondary school.

## METHOD

This study adopted a quasi-experimental research design using students from four purposely selected schools to form the two experimental groups. The study was conducted in coeducational secondary schools in Ikot Abasi Local Government Area of Akwa Ibom State, Nigeria. The reason for the choice of this local government for the study is that it suffers from the problem that this study is posing to solve.

The population of this study comprised of all the senior secondary two Physics students in the area. It covered the 12985 students in 2022/2023 academic session. The sample involved 182 senior secondary two (SS2) Physics Students (90 in the first and 92 in the second experimental groups). Systematic sampling technique was used in selecting four secondary schools from the eight secondary schools in the study area. Purposive sampling technique was used in selecting two schools in urban and two rural settings because location was a variable in the study. A class was assigned to a particular teaching method of either guided-discovery or expository.

The instrument for data collection was a researcher-made Physics Achievement Test on Waves with multiple choice items having four options lettered A – D with only one correct option and three distracters. The PATW was used for pre and posttests. The instrument was faced validated by experts in Physics, and Research, Measurement and Evaluation from Akwa Ibom State University and a Physics teacher in one of the selected schools. The content validity was done by the researchers using the table of specification for the test. Two lesson packages based on guided-discovery and expository instructional methods were prepared by the researchers and used with the trained research assistants in teaching the students the concept of waves. To establish the reliability index of the instrument, it was administered to a trial testing group of 40 students who were not part of the main subjects for the study but were found to be equivalent in all aspects of the subjects in the study. The result obtained during the administration using a test-retest method was subjected to  $KR_{21}$ . The analyses give a reliability index of 0.85. On the basis of the reliability index, the instrument was deemed suitable for the study. The data was analyzed using descriptive statistics for research questions and ANCOVA for the hypotheses at a 0.05 level of significance

## RESULTS AND DISCUSSION

**Table 1:** Mean Pretest/Posttest Scores of the Students taught with guided-discovery and expository instructional methods

Instructional Methods	N	Pretest		Posttest		Mean Difference
		$\bar{x}$	SD	$\bar{x}$	SD	
Guided-discovery	90	14.44	4.29	66.92	10.71	52.48
Expository	92	12.56	3.27	60.72	9.92	48.16

The result in Table 1 shows that students taught waves using guided-discovery group had a pretest mean score of  $\bar{x} = 14.44$  (SD = 4.29) and a posttest mean score of  $\bar{x} = 66.92$  (SD = 10.71) with a mean difference of 52.48. While the expository method had a mean score of  $\bar{x} = 12.56$  (SD = 3.27) for pretest and  $\bar{x} = 60.72$  (SD = 9.92) for posttest with a mean difference of 48.16. The result shows that guided-discovery was more potent in improving the mean achievement scores of students in waves than expository method.

**Table 2:** Effect of Location on the mean achievement scores of Physics students in waves

Location	N	Pretest		Posttest		Mean Difference
		$\bar{x}$	SD	$\bar{x}$	SD	
Urban	100	12.05	3.54	65.36	10.21	53.31
Rural	82	11.28	4.16	61.87	11.43	50.59

The result in Table 2 shows the influence of location on the mean achievement scores of Physics students in waves. From the result the urban school students had a pretest mean achievement score of  $\bar{x} = 12.05$  (SD = 3.54) and a posttest mean score of  $\bar{x} = 65.36$  (SD = 10.21) with a mean gain score of 53.31 while the rural school Physics students had a pretest mean achievement score of  $\bar{x} = 11.28$  (SD = 4.16) and a posttest mean score of  $\bar{x} = 61.87$  (SD = 11.43) with a mean gain score of 50.59. Based on the result, the mean gain score of 53.31 and 50.59 for urban and rural school Physics students respectively shows that the mean achievement scores of urban Physics students on waves increased during the treatment period more than their rural counterparts.

**Table 3:** Interaction effect of treatment and location on the mean achievement scores of Physics students in waves

Instructional Methods	Location	N	Pretest		Posttest		Mean Gain Score
			$\bar{x}$	SD	$\bar{x}$	SD	
Guided-discovery	Urban	55	13.68	4.20	66.64	11.10	52.96
	Rural	47	15.20	4.32	67.20	10.52	52.00
Expository	Urban	45	13.28	2.92	62.24	8.49	48.96
	Rural	35	11.84	3.51	59.20	11.14	47.36

Table 3 shows the reveals the pretest and posttest mean score of the interaction effect of instructional methods and location (urban and rural) on the mean achievement scores of Physics students in waves. From the result, urban students exposed to guided-discovery had a higher mean gain score of 52.96 as against 52.00 for the rural students. This means that guided-discovery proved to be more effective in improving the mean achievement score of urban students in waves more than the rural students. Equally, the result shows that urban students under expository method had a higher mean score of 48.96 when compared to their rural counterparts with a mean gain score of 47.36. The result generally shows that the instructional methods are potent in increasing the mean achievement scores of urban Physics students in waves more than the rural students.

**Table 4:** Analysis of Covariance (ANCOVA) of the Effect of instructional methods on Physics students' achievement in waves

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6362.981 <sup>a</sup>	8	530.248	6.326	.000	.357
Intercept	28162.427	1	28162.427	336.009	.000	.710
Pretest	1191.971	1	1191.971	14.222	.000	.094
Instructional Method	539.128	2	269.564	3.216	.043	.045
Location	444.452	1	444.452	5.303	.023	.037
Instructional Method * Location	489.667	2	244.833	2.921	.057	.041
Error	11482.593	167	83.815			
Total	624844.000	180				
Corrected Total	17845.573	179				

a. R Squared = .357 (Adjusted R Squared = .300)

Table 4 shows that an F-ratio  $F(2,179) = 3.216$  ( $p < 0.05$ ,  $\eta^2_p = .045$ ) was obtained. Since the associated probability value of 0.043 is less than 0.05 set for the study, the null hypothesis that there is no significant difference between the mean achievement scores of Physics students in waves when taught using guided-discovery and expository instructional methods was rejected. There was a significant difference between the mean achievement scores of Physics students in waves when taught using guided-discovery and expository instructional methods. The result further showed an effect size of  $\eta^2_p = 0.045$ , indicating that 4.5% of the variance on Physics students' achievement scores in waves was due to the treatment.

Table 4 also shows that the F-ratio  $F(1,179) = 5.303$  ( $p < 0.05$ ,  $\eta^2_p = .037$ ) was obtained. Since the associated probability value of .023 obtained is less than a 0.05 level of

significance set for the study, the null hypothesis that there is no significant difference between the mean achievement scores of urban and rural Physics students in waves was rejected. There was a significant difference between the mean achievement scores of urban and rural Physics students in waves. The result further showed an effect size of  $\eta^2_p = .037$ , which means that only 3.7% of the variance in the mean achievement scores of Physics students in waves was due to the influence of location.

Table 4 further shows that an f-ratio  $F(2,179) = 2.921$  ( $p < 0.05$ ,  $\eta^2_p = .041$ ) was obtained. Since the associated probability value of .057 is higher than 0.05 set for the study, the null hypothesis that there is no significant interaction effect of instructional methods and location (urban and rural) on the mean achievement scores of Physics students taught waves was retained. There is no significant interaction effect of instructional methods and location (urban and rural) on the mean achievement scores of Physics students taught waves. The result further showed an effect size of  $\eta^2_p = .041$ , which means that only 4.1% of the variance in the mean achievement scores of Physics students in waves was due to the joint influence of instructional methods and location.

The findings show that there was a significant difference due to instructional methods in favour of guided-discovery instructional method. The reason for this result might be due to the fact that when students are allowed to think on their own they gain more which reflects in the high mean achievement scores. The finding of this study was in line with the work of Utibe and Onwioduokit, (2019) that carried out a study to examine the effect of Guided-Discovery, Demonstration Methods and Senior Secondary Physics Students' Acquisitions of Entrepreneurial Skills in household electrical circuit sketch and wiring skills in Akwa Ibom State.

The findings further show that there was a significant difference between the mean achievement scores of urban and rural students in the concept of waves in favour of urban students. The reason for this result might be due to the fact that urban students spends more time studying the subject than the rural students who sometime might be engage in farm and other domestic activities. The finding was in line with works of Umar and Samuel (2018) who investigated school location as correlate of students' achievement in Basic Science. The result showed that students in urban schools had better achievement than those at rural settings.



## CONCLUSION

On the bases of the findings, the following conclusions were drawn:

1. The effectiveness of guided-discovery instructional method over expository instructional methods on Physics students' achievement in waves was significant.
2. Urban students significantly achieved more than the rural students on waves in Physics.
3. There was no significant interaction effect of teaching methods and location on the mean achievement scores of students on waves in Physics.

## RECOMMENDATIONS

Based on the results of the study, the following recommendations were made:

1. Based on the finding of the study it was recommended that teachers should use guided-discovery and expository instructional methods to teach Physics to students.
2. Teacher need to make right selection of appropriate methods that will meet the teaching needs of the learners irrespective of their location.

## REFERENCES

- Ajayi P O (2008). Evaluation of instructional materials for the implementation of senior secondary school Physics curriculum in Nigeria. *Nigerian Journal of Counseling and Applied Psychology*, 4(1), 100 - 110.
- Allahoki, O. B. (2012). Effectiveness of Guided-Discovery Teaching Method on Academic Achievement in Ecological Concepts among SSS in Sabon Gari Education Zone, Kaduna State, Nigeria
- Awodun, A. O. and Oyeniyi, T. D. (2018). Effects of instructional simulation on students' academic performance in Basic Science in junior secondary school in Ekiti State *Journal of Emerging Technologies and Innovative Research (JETIR)* Available <http://www.jetir.org/papers/1806519/6/2019>
- Daluba, N. E (2013). Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science *International Journal of Modern Social Sciences* 3(6), 65-71 <https://www.sciedu.ca/wje/Retri18/8/2021>
- Damar, D. N., Hulda, M. D. and Jonah, M. D. (2016). Impact of Iconic Models on Senior Secondary School Students' Academic Achievement in Physical Geography in Plateau State, Nigeria. *Asia Pacific Journal of Education, Arts and Science*, 3(1), 121-127
- Herviana, S. (2015) "Expository Teaching Strategies in Teaching Learning Process a Study at SMA Kartika 1-5 Padang". STKIP PGRI Sumatera Barat.2015
- Iji, C. O., Ogbole, P. O. and Uka, N. K (2016). Effect of Improvised Instructional Materials on Students; Achievement in Geometry at the Upper Basic Education Level in Makurdi Metropolis, Benue State, Nigeria. *American Journal of Educational Research*, 2(7), 538-542.
- Inyang, F. N., Uboh, D. E. and Utibe, U. J. (2022). The effect of demonstration, guided-discovery and expository instructional methods on senior secondary students' achievement in Physics in Ikot Abasi local government, Nigeria. *Journal of Research in Education and Society*, 13(3), 124 – 135.
- Mhiliwa, J. A. (2015). The effects of school location on learner's academic performance: A case of community secondary schools in Makambako Town Council, Njombe. An Unpublished Masters Dissertation of Education, Administration, Planning and Policy Studies of the Open University of Tanzania.
- Mkpanang, J. T. and Inyang F. N. (2019). Effects of Active and Cooperative Learning Strategies on Students' Academic Achievement in the concept of Electric Circuit in Physics. *Nigerian Journal of Science and Science Education*, 8, (3) 0189-0200
- Mkpanang, J. T. and Utibe, U. J. (2022). Educational implications that arise from assessing teachers' level of implementation of physics curriculum in secondary schools in Uyo, Nigeria. *International journal of education and ethical issues in research*, 3(1), 2022.
- Nworgu, B. G. (2014). Problem-centered investigate approach to science practicals in secondary schools: Pilot study. *Journal of Creativity in Teaching*, 2(5), 155-157.

- Onwioduokit, F. A. (2013). The Ordeal of Science Teaching in the Contemporary Society: A Need for Paradigm shift for the New Generation. The 36th Inaugural Lecture Series, University of Uyo University of Uyo Press. p.31.
- Umar, U.S. and Samuel, R.I. (2018). School Location as Correlate of Students' Achievement in Basic Science *International Journal of Innovative Education Research*, 6(3):14-17
- Utibe, U. J. & Agwagah, U. N. (2015). A Decade of Candidates' Performances in NECO-SSCE Mathematics in Nigeria. *Journal of Education and Practice*, 6 (25), 25–29.
- Utibe, U. J. & Agwagah, U. N. V. (2016). Creating entrepreneurs using physics and mathematics: Implications for economic development in South-South Nigeria. *International Journal of Multidisciplinary Approach and Studies*, 3 (2), 18 – 28.
- Utibe, U. J. and Agah, J. J. (2016) Creating entrepreneurs using physics and mathematics: Implications for economic development in South-South Nigeria. *International Journal of Multidisciplinary Approach and Studies*, 2(2) 48-57 <https://www.ijmas.com/3/6/2021>
- Utibe, U. J.; Madu, B. C; & Uko, P. J. (2012). Best Practices in Physics Curriculum Development in Secondary Schools. *Curriculum and Media Technology Research. Journal of CUDIMAC*, 4 (1), 80 – 89.
- Utibe, U. J. and Onwioduokit, F. A. (2019). Guided-Discovery, Demonstration Methods and Physics Students' Acquisitions of Entrepreneurial Skills in Household Electrical Circuit Sketch and Wiring in Akwa Ibom State. *Journal of CUDIMAC (J-CUDIMAC)* 6(1) 2651-6063 <https://cudimac.unn.edu.ng/journals-2/4/2019>.