

# Station Rotation Model and Biology Students' Academic Performance and Retention in Secondary Schools in Obio-Akpor, Rivers State, Nigeria

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**Abstract:** *The study focused on station rotation model and biology students' academic performance and retention in secondary schools in Obio-Akpor, Rivers State, Nigeria. Three objectives of the study, three research questions, three null hypotheses guided the study. The study adopted a Quasi experimental design. The population of the study was 4,800 public secondary school one (SS1) Biology students, while the sample of the study was one hundred and ten (110) students. Purposive sampling technique was used in selecting the sample. The instruments used for the study were the Biology Students Academic Performance Test (BSAPT) and Biology Student Retention Test (BSRT). The instruments were properly validated and the reliability coefficients of 0.86 and 0.78 respectively. Mean, standard deviation and Analysis of Covariance (ANCOVA) were used and statistical tools for the study. The finding amongst others revealed that students exposed to Station Rotation Model of teaching and learning performed better than those in the control group who were not exposed to Station Rotation model of teaching. Thus, the study recommend that Station Rotation Model of teaching and learning should be adopted at secondary school level for the teaching of Biology. Also a 21<sup>st</sup> Century learning skills should be incorporated into classrooms which will provide learners with the opportunity to take charge of their learning especially at the secondary school level. Furthermore, proper attention should be given to the selection of teaching strategies by teachers for improved productivity.*

**Keywords:** students' performance, station rotation model, biology, retention and gender.

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## **INTRODUCTION**

Biology is a very important subject taught in secondary schools and many students are interested in learning this subject but the approaches used by some teachers in teaching and learning of this subject can either improve or reduce the academic performance of students. According to Esiobu (2015), many secondary school students are exhibiting low interest in Biology. This observation can be traced to poor performance in examinations. Research findings from Dinah, (2013) revealed that the education and occupation of parents positively influence the academic performance of students. The problem with inadequate supply of teaching and learning resources such as chemicals, charts, apparatus, models, local specimens, laboratories, textbooks and libraries has the potentials of leading to poor performance of students in any area of discipline. The irregularities on the part of the teachers of Biology such as irregularity in administration of practical, class discussion, teachers not allowing students to ask questions, teachers not giving prompt feedback on assignments or examinations, not making Biology subject interesting and teachers not conducting demonstration during practical contribute to poor performance in schools. Station rotational model is a 21<sup>st</sup> Century teaching and learning model that allows for flexibility between teachers and students. On the part of teachers, it gives them the opportunity to split up the classroom and work with small group instruction and use digital tools; while it allows collaboration among students and it encourages team work which helps to enhance students' performance and retention of concepts.

## **LITERATURE REVIEW**

The Station Rotation model is a blended learning model in which the teacher divides the students within a classroom into small groups. These groups rotate through a series of stations, one of which must be technology based (Horn & Staker, 2015, cited in Appricot, 2016). This implies that station rotation model involves collaboration amongst learners, splitting the students into various groups to collaborate over a given concept. In station rotation, students rotate within a classroom or set of classrooms. Rotations may include for example, individual learning using online learning programs, small group direct instruction with a teacher, and independent work at students' desks.

Station-rotation is one type of blended learning model that has been developed vastly. Based on the blended learning station-rotation model, learners take turns to have at least one online learning station besides other stations that have been designed previously; the process is called rotation. Through the model, it is expected that learners are exposed to more learning sources or in this case, two different learning environments. The first environment is guided, face-to-face environment, and the other is online learning environment. Each learning environment has its own benefits and shortcomings. Thus, when these two learning environments are combined into one learning environment, it is expected that both can complement each other.

Station Rotation offers many benefits in its application in schools. According to Graham, Allen and Ure (2004), three major reasons for adopting blended learning model are providing more effective pedagogy, increased convenience and access, as well as increased cost effectiveness. The Station-Rotation model allows students visit various stations during the allotted time for a specific subject. For example, during Biology period, students might rotate between one-on-one or small-group work

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with the teacher, working on computers or tablets, using additional stations that the teacher has set up using manipulatives, or working on projects. Station Rotation fosters students' engagement and creativity they tend to focus when allowed to take control of their learning. When using adaptive learning software that continually differentiates for students in real-time, they are able to move at their own pace and make self-directed choices. Also, teachers have better data and opportunities to differentiate for all students during whole class or small group work (Hudson, 2013). The ability to create personalized instruction to deliver via modern technology makes the Station Rotation model an especially wise choice for students in the 21<sup>st</sup> Century. Students have been long known for their short attention spans, but with the plethora of mobile devices and forms of distraction, most students will be able to focus on a given task for just between 10-20 minutes.

The station rotation model is engaging, entertaining, and informing much more effectively than a traditional classroom instead of choosing a single approach, teachers can introduce students to a variety of stations that are sure to keep students on their toes. Being exposed to diverse learning strategies make the learning process much more enjoyable and more importantly, engaging. This is an innovative teaching strategy that offers improved flexibility and customization (Bill, 2018). Station rotation model is particularly beneficial because it incorporates and reflect the many advantages offered by modern technology. The method provides, teachers with constant information on the performance of their students and allows for quick and easy modification in the event of a student requiring assistance. Caitlin (2018) has had enormous success using hyper docs which are interaction google docs that make self-pace learning much easier. Using hyper docs, students were provided with more opportunities in their learning process.

One potential option that has repeatedly proven to be successful in all situations is the station rotation model. This model is a form of learning model in which students alternate between the use of technology and face-to-face instruction in the classroom. Instruction is split evenly between these two modes of learning and follows a clearly defined schedule that ensures a proper balance. One strength of this Station-Rotation blended learning model is that teachers increase their opportunities to work with small groups of students. This component can be a welcome change for many educators who have been attempting to adapt to ever-increasing class sizes. Small group work with students makes it possible for educators to address the different needs of individual students and truly engage them in the subject based on their prior knowledge and depth of understanding. It also gives teachers more time to connect on a personal level with students and build relationships. Teachers' evaluation of groups is important in this model. Students will inevitably advance to more difficult levels towards mastery. If a teacher wants to keep information about students' progress, such students can be allowed to carry folders indicating their level. Four to six weeks of school resumption, a teacher should have some data on where the students are academically. The idea is each academic group comes to the teacher for direct instruction, while in the other stations activities are planned out for groups to do independent work. The model can be particularly effective in secondary schools because many teachers already use classrooms. Therefore, with the Station-Rotation model of blended learning, teachers do not have to completely revamp their approach to the classroom. They can simply include computer time as an additional station or as a replacement for an existing station. Teachers can use the data collected by the adaptive learning programs to individualize other students' learning experiences. The goal is to connect learners with appropriate lessons every day, and schools need both teachers and software that can make this goal a reality.

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The Station-Rotation model requires one keeping the lines of communication open and continually evaluate how well one's approach is working. Teachers, parents, and students should be empowered to ask questions, share comments, and raise concerns about classroom strategies and tactics. Unfortunately, if technology has been implemented without clear goals, it will be nearly impossible to determine the effectiveness of the blended learning model because the standards of success are unclear. Without these clear goals, it is also nearly impossible to choose effective learning software that engages students in critical thinking and develops conceptual understanding (Hudson ,2013). The pedagogy and design of learning software is just as important as the pedagogy and design of classroom lessons.



**Fig. 1.1: Station Rotation Model Framework**

**Source:** *Horn and Staker (2015)*

### Statement of the Problem

The poor academic performance of secondary school students both in internal and external examinations in Biology has raised serious concerns to science educators, stakeholders and parents about the effectiveness of teaching approaches adopted over the years. According to Aaina (2013), only 35% of the students who sat for Biology in 2012 WAEC passed at credit level, while 65% failed. Also, the West African Examination Council (WAEC) reports persistent poor performance in Biology at Senior School Certificate Examination as shown in the chief examiner's report for WAEC 2011-2015 in Biology. Based on these report the researcher is worried what could be responsible for this poor academic performance by student in Biology subject. Could it be that Biology is a very difficult subject? Could it be that the teaching strategy used in teaching Biology is not suitable to students? Based on this concerned circumstances the study intends to examined the station rotation model and biology students' academic performance and retention in secondary schools in Obio-Akpor, Rivers State, Nigeria

### Objective of the Study

The following objectives guided the study;

1. To find out the effect of station rotation model and lecture method on the academic performance of secondary school students taught Biology
2. To find out the difference in the academic performance of male and female students taught Biology using Station Rotation model and those taught with lecture method.

3. To ascertain the difference in the retention level of male and female students taught Biology using Station Rotation model and those taught with lecture method.

### **Research Questions**

The following research questions guided the study:

1. What is the effect of station rotation model on the academic performance of secondary school students taught Biology?
2. What is the difference in the academic performance of male and female students taught Biology using Station Rotation model and those taught with lecture method?
3. What is the difference in the retention level of male and female students taught Biology using Station Rotation model and those taught with lecture method?

### **Hypotheses**

The following hypotheses were formulated to guide the study:

1. There is no significant difference in the academic performance of secondary school students taught Biology using station rotation model and those taught with lecture method.
2. No significant difference exists in the academic performance of male and female secondary students taught using station rotation model and those taught with lecture method.
3. The retention level of Biology students taught with Station Rotation Model and those taught with the Lecturer method is not significantly difference.

### **METHODOLOGY**

The study adopted a quasi-experimental design. The population consisted of all the senior secondary school one (SS1) students from the twenty public schools in Obio-Akpor which is 4,800 male and female students. The sample of the study was one hundred and ten (110) students purposively selected. The instrument used for the study was Biology Students Academic Performance Test (BSAPT), and Biology Students' Retention Test (BSRT). The reliability coefficient of 0.86 and 0.76 respectively. Mean, standard deviation and Analysis of Covariance (ANCOVA) were used as statistical tools for the study.

### **RESULTS**

**Research Question 1:** What is the effect of station rotation model and lecture method on the academic performance of secondary school students taught Biology?

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**Table 1: Analysis of mean performance scores of students taught with station rotation model and those taught with lecture method**

Methods		Pretest	Posttest	Mean Difference
<b>Station Rotation Model</b>	Mean	24.00	29.52	5.52
	N	60	60	60
	Std. Deviation	4.10	4.09	2.33
<b>Lecture Method</b>	Mean	20.54	24.44	3.90
	N	50	50	50
	Std. Deviation	5.80	6.24	7.29
<b>Total</b>	Mean	22.42	27.20	4.81
	N	110	110	110
	Std. Deviation	5.22	5.75	5.24

Analysis of students' performance mean scores shown in table 1 result reveals that during the pre-test students in control group had (mean =20.540; SD= 5.803), and in posttest they had (mean=24.440; SD=6.243), while those in experimental group in the pre-test performed better in the experimental group with the (mean =24.000; SD=4.100) and in posttest (mean=29.516; SD=4.094) after the administration of the instrument.

**Research Question 2:** What is the difference in the academic performance of male and female students taught Biology using Station Rotation model and those taught with lecture method?

**Table 2: Analysis of male and female students taught Biology with station rotation model.**

Gender		Report		Mean Difference
		Pretest	Posttest	
Male	Mean	22.57	27.40	4.83
	N	60	60	60
	Std. Deviation	5.19	5.57	4.896
Female	Mean	22.30	26.98	4.72
	N	50	50	50
	Std. Deviation	5.34	6.00	5.72
Total	Mean	22.42	27.20	4.78
	N	110	110	110
	Std. Deviation	5.21	5.75	5.24

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The result shown in table 2 revealed performance mean scores of the pre-test and post-test mean value in terms of gender and treatment employed for the study in the experimental group. During the pre-test, male students had (mean=22.566; SD=5.192) and in posttest (mean=27.400; SD=5.572), while the female had pretest (mean=22.260; SD=5.298) and posttest (mean=26.980; SD=6.001). The findings of the study revealed that male students taught using station rotation model performed higher than their female counterpart in both the pre-test and the post-test.

**Research Question 3:** What is the difference in the retention level of male and female students taught Biology using Station Rotation model and those taught with lecture method.

**Table 4 Analysis of retention of male and female students taught using station rotation model.**

Gender		Posttest	Retention	mean_difference1
Male	Mean	27.40	32.11	4.72
	N	60	60	60
	Std. Deviation	5.57	6.31	4.69
Female	Mean	26.98	30.22	3.24
	N	50	50	50
	Std. Deviation	6.00	5.45	5.33
Total	Mean	27.20	31.34	4.04
	N	110	110	110
	Std. Deviation	5.74	5.97	5.02

The result shown in table 4 revealed that the retention mean score of male students taught Biology had (mean=32.116; SD=6.292), while the female students had (mean=31.254; SD=5.973) respectively. Therefore, the male students retained higher than their female counterpart.

**Hypothesis 1:** There is no significant difference in the academic performance of secondary school students taught Biology using station rotation model and those taught with lecture method.

**Table 4: ANCOVA of difference in the use of station rotation model and lecture method by students and academic performance.**

Tests of Between-Subjects Effects						
Dependent Variable: Posttest						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	
Corrected Model	1351.458 <sup>a</sup>	2	675.729	32.124	.000	
Intercept	1291.557	1	1291.557	61.401	.000	
Pretest	648.570	1	648.570	30.833	.000	
Methods	274.445	1	274.445	13.047	.000	
Error	2250.733	107	21.035			
Total	85039.000	110				
Corrected Total	3602.191	109				

a. R Squared = .375 (Adjusted R Squared = .363)

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The hypothesis shows the students mean scores when taught Biology using station rotation model and lecture method in the post-test tested at  $p < 0.05$  level of significance. The calculated value revealed .000 which is less than 0.05 level of significance. This therefore implies that the null hypothesis is therefore rejected. There is significance different in the academic performance of secondary school students taught Biology using station rotation model and those taught with lecture method.

**Hypothesis 2:** No significant difference exists in the academic performance of male and female secondary students taught using station rotation model and those taught with lecture method.

**Table 5: ANCOVA of difference in the performance level of male and female secondary school students on the use of station rotation model of learning.**

Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	1078.524 <sup>a</sup>	2	539.262	22.864	.000	
Intercept	1052.200	1	1052.200	44.612	.000	
Pretest	1073.713	1	1073.713	45.524	.000	
Gender	1.511	1	1.511	.064	.801	
Error	2523.667	107	23.586			
Total	85039.000	110				
Corrected Total	3602.191	109				

a. R Squared = .299 (Adjusted R Squared = .286)

The hypothesis shows main effect (use of station rotation model) on gender using the post-test tested at  $p < 0.05$  level of significant. The calculated value revealed .801 which is greater than 0.05 level of significance. This implies that the null hypothesis is therefore accepted. Thus, there is no significant difference in the academic performance of male and female secondary school students taught using station rotation model.

**Hypothesis 3:** There is no significant difference in the retention level of Biology students taught with Station rotation model and those taught with the lecture method



**Table 6: ANCOVA of difference in the retention level of students taught with station rotation model and those taught with lecture method.**

Dependent Variable: Retention						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	2167.655 <sup>a</sup>	2	1083.828	67.376	.000	
Intercept	1333.930	1	1333.930	82.924	.000	
Posttest	600.662	1	600.662	37.340	.000	
Methods	609.478	1	609.478	37.888	.000	
Error	1721.218	107	16.086			
Total	111342.000	110				
Corrected Total	3888.873	109				

a. R Squared = .557 (Adjusted R Squared = .549)

The hypothesis shows students' retention level taught using station rotation model and lecture method in the post-test which was tested at  $p < 0.05$  level of significant. The calculated value revealed .000 which is less than 0.05 level of significance. This therefore implies that the null hypothesis is rejected. Thus there is significant difference in the retention level of Biology students taught with Station Rotation model and those taught with the lecture method.

## DISCUSSION OF FINDINGS

The result in table 1 suggests a significant difference between the academic performance mean scores of students in the station rotation model class and those in the lecture method class. The academic performance mean scores using station rotation model revealed that students performed better with the (mean=29.516; SD=4.094) than the control group with (mean=24.440; SD=6.243) after the administration of the performance test. This result is so because station rotation model of blended learning offers students various opportunities of exploring the content of their lesson through collaboration. This finding is in agreement with that of Olelewe (2014) who asserted that Station Rotation model affords students the opportunity to follow a collaborative learning plan. This is especially helpful to students who need to dedicate more time to understanding a specific topic area, at-risk students who need a specialized plan to get back on track to graduate, or advanced students who need a quicker pace to remain fully engaged. Collaborative learning opens an educational path for students to address their specific needs and prepare them for graduation and success beyond present schooling.

The result in table 2 revealed the performance mean score for male and female students taught using station rotation model. The male indicated (mean=27.400; SD=5.572), while that of female was (mean=26.980; SD=6.001). The findings of the study revealed that male students taught using station rotation model performed slightly higher than their female counterparts. The result is so because of

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the interaction between station rotation model and gender cannot be predicted on sex. This result is in agreement with that of Yapici and Akbayin (2012) who studied the effect of blended learning model on high school students' Biology achievement and gender towards the use of the internet, and the result indicated a higher academic performance among male participants who used blended learning approach for learning than those of female participants who did not.

The result in table 3 revealed that the retention mean score of students that were taught using station rotation model indicated (mean=34.700; SD=3.557), while that of the control group had (mean=27.120; SD=5.669). The finding therefore implies that students retained higher in the experimental group than their counterparts in the control group. The finding is in agreement with that of Ibrahim and Mehmet (2014) who conducted a study on effect of teaching approach on college students and the results revealed that students retained better when a blended approach is used in teaching. The result of the study revealed that the retention mean score for male and female students that were taught using station rotation model indicated male retention mean (mean=32.116; SD=6.292), while that of the female had (mean=31.254; SD=5.973). The finding therefore implies that male students retained higher than the females when station rotation model was used in teaching. The findings is in agreement with that of Appricot (2016) who conducted a study on the correlation between gender and academic retention of secondary school students and the findings revealed that male students retained higher than their female counterparts especially when it has to do with blended courses. Some of the areas of retention measurement are as follows: to determine the relative effectiveness of a programme in terms of students' interactive productivities; to ascertain students' development in attaining desirable skills and values so as to enable teachers determine their teaching efficiency.

## CONCLUSION

Based on the finding of this study, the following conclusions were drawn that exposing students to various blended learning models such as station rotation model gives learners the opportunity to expand more into the scope of their learning which in turn improves their performance and retention levels. Stations rotation model affords students the opportunity to follow a collaborative plan that enhances their learning performance.

## Recommendations

Based on the findings of this study, the following recommendations were made;

1. Collectively, teachers should adopt a station rotation model in teaching Biology in secondary schools in order to promote students learning and retention.
2. Gender equality should not be over emphasized especially when considering station rotation model in teaching since it has no significant effect on students' academic performance among secondary school students.
3. Teaching method should be given proper attention by government by way of providing infrastructures such as good computer laboratories, suitable power supply and organizing workshops for science teachers on how to use digital tools for better performance and retention among secondary school students.

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