



## Effects of Number-Head Together Strategy on Academic Achievement and Interest of Secondary School Biology Students in Bichi Education Zone, Kano State, Nigeria

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### Abstract

Available records from the West African Examination Council's Chief Examiners' Report (WAEC, 2016 – 2019) and findings of many studies have revealed that Biology students in secondary schools of Bichi Education Zone performed inadequately in the Nervous system concept. Several such studies attributed these inadequacies to improper teaching methods employed by teachers. Consequently, therefore, this study investigated the effects of the Number-Head Together (NHT) strategy on academic achievement and interest in Biology among secondary school students in Bichi Education Zone, Kano-Nigeria. The study adopted a pre-test, post-test nonequivalent, quasi-experimental design. The population of the study consisted of 4349 SS II Biology students (3352 males and 997 females) while the sample of the study consisted of 169 subjects from four intact classes drawn through a simple random sampling technique. The nervous System Achievement Test (NSAT) with a reliability index of 0.708 and the Student's Interest Toward Biology Questionnaire (SIBQ) with a reliability index of 0.811 was used to measure students' academic achievement and interest towards Biology respectively. The result of the study revealed that there was a significant difference in the mean academic achievement and interest of Biology students in the two groups in favour of the experimental group. Additionally, it was shown that the mean achievement and interest scores of the biology students in the two groups did not significantly differ based on gender. To improve academic achievement and students' interest in biology, it was suggested that the NHT teaching strategy be incorporated into the secondary school curriculum.

**Keywords:** Number-Head Together, Academic Achievement, Interest, Nervous System

### Introduction

Science is a branch of knowledge that deals with a body of facts or truths that are arranged systematically and aims at a generalized conclusion (Ferr & Jones, 2016). It provides a body of knowledge that may be applied to solve different kinds of material, environmental, and human problems. It can alternatively be seen as consisting of two main complementary modes: the creation of materials and the acquisition of information via exploration and discoveries about the natural world (Rennie & Hackling, 2014). Science is made up of different fields of study which include Biology, Physics, Chemistry, and Agriculture, which when combined with education form the concept of science education. Science education is concerned with the sharing of science content and processes with individuals who are not considered traditional members of the scientific community; they could be students, farmers or a whole community. Science education generally concentrates on teaching and addressing misconceptions held by learners regarding science concepts (Chin, 2015). David (2018) explains that science education is very important to the development of any nation. Producing students who are literate in science and technology and who possess the ability to think critically, logically, creatively, and persuasively are the primary goals of science education. Students are expected to use their understanding of science, particularly biology, as a means of learning about and exploring phenomena that exist in both their environment and them, and to apply this knowledge to activities that they will encounter in their daily lives.

Biology is one of the branches of science that deals with the study of life (both plant and animal). According to the National Educational Research Development Council (NERDC, 2018), understanding the structure and function of living things as well as appreciating nature are among the major objectives of the biology curriculum. Other objectives include developing the necessary laboratory and field skills to conduct and assess biological

experiments and projects, acquiring the necessary scientific knowledge, such as how to observe, classify, and interpret biological data, and applying biological principles to issues that impact people's personal, social, environmental, and economic well-being. Teachers are thought to be one of the most important components in achieving the specified goals. Odusesan and Abel (2016) asserted that it is impossible to separate the process of teacher education from curriculum implementation. On the other hand, for teachers to discharge these responsibilities effectively, they must possess a mastery of content compiled with knowledge of principles and methods of teaching, classroom management, use of instructional materials and assessment. Furthermore, to make sure that the predetermined goals and objectives are successfully met, the implementation of any curriculum necessitates the monitoring, assessment, and evaluation of areas in teaching and learning.

In order to achieve these objectives, teachers must devise a strategy that will enhance the quality of instruction in the classroom. According to Rusman (2010), to meet the learning objectives, a teaching strategy that increased student engagement, interest, and effectiveness had to be used. Among many strategies that improve effective learning in science-based subjects is the Number-Head Together (NHT) strategy, which is a member of the family tree of cooperative learning (Purnomo, 2013). Slavin (2011) stated that cooperative learning strategy is a process in which students work on assignments together to help each other in a group, and the role of teachers in cooperative learning strategy is no longer dominating the learning activities. According to Sadker and Sadker (2005), the primary objectives of the cooperative learning approach model are to give students the information, ideas, abilities, and comprehension they need to become contributing members of society and happy individuals. The NHT approach prioritizes group work over solo work so that students can collaborate with one another in a cooperative environment and have plenty of chances to share knowledge and hone their communication skills. It's an instructional approach that makes every student responsible for mastering the content. After the students are divided into groups, each member of the group is assigned a number, which can range from one to a maximum of six. Students collaborate to find the solutions to the questions that the teacher gives. The instructor summons a particular group member to act as the group spokesperson. By having students work together in the group, this strategy ensures that each member knows the answers to the problems or questions asked by the teacher. Because no one knows which member will be called, all team members must be prepared. Thus, it promotes discussion and teamwork among students, and it helps in reviewing and discussing the content materials. NHT strategy was therefore used in this research to assess its effects on students' academic achievement and interest in Biology against the lecture teaching strategy.

The degree to which a student, instructor, or institution has met their immediate or long-term learning objectives is known as academic achievement (Okoro, 2011). A student's accomplishment in a variety of academic courses is measured by their academic performance. The common methods used by educators to gauge student achievement are graduation requirements, test scores, and classroom performance. NHT as one of the students' student-centred approaches to learning is used to find out whether students' academic achievement will be enhanced in teaching the concepts of the Nervous system. This is because the Nervous system requires active students' participation since it deals with how the body transmits signals between different parts of the body. Biology students nowadays are required to understand this concept very well for the betterment of their health, as many more people are suffering from sensory-related problems which include paralysis, stroke, poliomyelitis, and cerebral palsy among others. Most of the time students' academic achievement in a particular subject is influenced by their interest in that subject.

Interest is a potent motivating factor that propels learning, directs scholastic and professional paths, and is necessary for academic achievement. Interest is a psychological condition characterized by attention, feelings, and a tendency to revisit things or subjects over time. Interest can be described in two distinct (though often co-occurring) experiences. An individual momentary experience of being captivated by an object as well as more lasting feelings about that object is joyable and with further exploration. According to Hidi and Ainley (2008), interest is a psychological state that is defined by two things: a persistent tendency to revisit certain objects or topics over a specific period (individual interest) and an increase in attention, effort, and affect experienced in a particular moment (situational interest). For instance, students may find an engaging presentation about the nervous system to be enjoyable, get enthralled with their own strength or force, participate more actively in class, and develop an appreciation for the subject matter. Accordingly, when one is in a state of interest, learning and paying attention comes naturally, affective response, perceived value, and cognitive functioning all work together. Situational interest on the other side is related to self-regulation, task engagement and persistence (Sansone et al 2011). Therefore, since the NHT strategy requires student's active participation and thorough involvement it will help in arousing the interest of the students towards learning the concepts of the Nervous system. Upon this

background, this study is set to investigate the Effect of the Number-Head Together Strategy on Academic achievement and interest in Biology, among secondary school students in Bichi educational zone Kano-Nigeria.

### Problem Statement

In this era of a developed and modernized world particularly in the educational sector, there is a need to provide ways in which the teachers and students have to be creative and dynamic in order to make full implementation of science education curriculum. However, reports from the West African Examination Council chief examiner's report of the year 2016 through 2019 indicate that students of Biology show dwindling achievement in some topics. Reports of 2016 indicate that students spell technical terms wrongly, that of 2017 stated that students perform woefully in areas like genetics diagram construction, characteristics and features of microorganisms, that of 2018 affirmed that students do not even answer questions related to biological drawing and variations in living organisms, and reports of 2019 confirmed that students failed to answer questions in Nervous system. As a result, there is a need to review and explore certain teaching strategies to see whether the achievement and interest of the students will change. Despite the Nigerian government's decision to promote science education programs in the country, failure to answer questions on such topics affects the students and quality of science education in general. In the particular case of Biology, most of the teachers employed conventional teaching methods (Ezenwa, 2005). Nursyamsi and Corebima (2016) reported that some teachers in senior secondary schools have knowledge of the subject matter, but they lack proper methodologies in inculcating it to the students. This is perhaps why some researchers such as Adejoh (2014) blamed poor teaching methods as responsible for poor performance in Biology. As such, there is a need to find out means on how to adequately transfer the content from the teachers to the students, hence, the researcher sets out to investigate the effect of the Number-Head Together strategy on student academic achievement and interest in the Nervous system among secondary school students in Bichi education zone, Kano, Nigeria

### Research Questions

The following research questions were answered:

1. What is the difference in the mean academic achievement scores of Biology secondary school students taught Nervous System using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria?
2. Is there any gender difference in the mean academic achievement scores of Biology secondary school students taught Nervous System using NHT in Bichi Education zone, Kano, Nigeria?
3. What is the difference in the mean interest scores of Biology secondary school students taught Nervous System using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria?
4. Is there any gender difference in the mean interest scores of Biology secondary school students taught Nervous systems using NHT in Bichi Education zone, Kano, Nigeria?

### Hypotheses

At significance levels of 0.05, the following null hypotheses were developed and put to the test:

H0<sub>1</sub>: There is no significant difference in the mean academic achievement scores of Biology secondary school students taught Nervous systems using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria.

H0<sub>2</sub>: There is no significant gender difference in the mean academic achievement scores of Biology secondary school students taught Nervous system using NHT in the Bichi Education zone, Kano, Nigeria.

H0<sub>3</sub>: There is no significant difference in the mean interest scores of Biology secondary school students taught Nervous systems using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria.

H0<sub>4</sub>: There is no significant gender difference in the mean interest scores of Biology secondary school students taught Nervous system using NHT in Bichi Education zone, Kano, Nigeria.

### Methodology

This study adopted a pre-test, post-test nonequivalent, quasi-experimental design. The population of this study comprised four thousand three hundred and forty-nine (4349) subjects of which three thousand three hundred and fifty-two (3352) are males while nine hundred and ninety-seven (997) are female Biology students respectively. The sample size of the study consisted of one hundred and sixty-nine (169) Biology students which comprised seventy-three (73) males and ninety-six (96) females selected through stratified and simple random sampling techniques. The data were collected using the Nervous System Achievement Test (NSAT) and Students Interest toward Biology Questionnaire (SIBQ) and were face and content validated by experts in the field. The reliability

of the instruments was established through pilot testing using Pearson moment correlation for NSAT, and Cronbach alpha for SIBQ. The reliability coefficients were found to be 0.708 and 0.811 respectively. Mean and standard deviation was used in answering the research questions, while analysis of covariance (ANCOVA) was used for testing the hypotheses at 0.05 level of significance using Statistical Product and Services Solution (SPSS).

## Results

**Research Question 1:** What is the difference in the mean academic achievement scores of Biology secondary school students taught Nervous system using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria?

**Table 1: Mean and standard deviation of pre-test and post-test scores of experimental and control groups.**

Teaching Strategies	Pre-test scores			Post-test scores		Mean gain
	N	$\bar{X}$	SD	$\bar{X}$	SD	
NHT Strategy	66	11.73	2.63	77.83	1.50	66.1
Lecture	103	10.26	2.92	45.01	5.18	34.75
Mean Difference		1.47		32.82		31.35

Table 1 shows the mean scores and standard deviation of the pre-test and post-test administered to the experimental and control groups. The pre-test results revealed 11.73 and 2.63 as mean and standard deviation respectively for the experimental group, and 10.26 and 2.92 as mean and standard deviation respectively for the control group. The table also shows the post-test results indicating 77.83 and 1.50 respectively as the mean and standard deviation for the experimental group, and 45.01 and 5.18 respectively as the mean and standard deviation for the control group. Moreover, the mean gain scores between the pre-test and post-test for the experimental group are 66.1 and 34.75 for the control group. This shows that students taught Nervous system concept using NHT strategy performed better than those taught using lecture method of teaching.

**H0<sub>1</sub>:** There is no significant difference in the mean academic achievement scores of Biology secondary school students taught Nervous systems using NHT and those taught using lecture teaching strategies.

**Table 2: Summary of ANCOVA of students' pre-test and post-test achievements scores of experimental and control groups**

Teaching Strategies	Pre-test			Post-test		DF	F-value	P-value	Decision
	N	$\bar{X}$	SD	$\bar{X}$	SD				
NHT	66	11.73	2.63	77.83	1.50	1	2174.24	0.000	Rejected
Lecture	103	10.26	2.92	45.05	5.18				

$p \leq 0.05$

Table 2 shows the summary of the ANCOVA results for the pre-test and post-test mean achievement scores of the experimental and control groups. The observed p-value of the treatment is 0.000 which is less than the significant p-value (0.05) with  $df = 1$ . The null hypothesis 1 is hereby rejected because the observed p-value (0.000) is less than the significant level (0.05). Therefore, there is a significant difference between the mean achievement scores of secondary school Biology students taught nervous system using the NHT teaching strategy and those taught using the lecture method of teaching in favour of the experimental group ( $F\text{-value} = 2174.24$ ,  $df = 1$ ,  $p=0.000 < 0.005$ ).

**Research Question 2:** Is there any gender difference in the mean academic achievement scores of Biology secondary school students taught Nervous system using NHT in Bichi Education zone, Kano, Nigeria?

**Table 3: Mean and standard deviation of pre-test and post-test scores of male and female Biology students**

Gender	Pre-test scores			Post-test scores		Mean gain
	N	$\bar{X}$	SD	$\bar{X}$	SD	
Male	28	11.15	3.18	26.08	9.22	14.93
Female	38	10.59	2.64	25.45	10.04	14.86
Mean difference		0.56		0.63		0.70

Table 3 presents the mean scores and standard deviation of the pre-test and post-test administered to male and female students in the experimental group. The pre-test results revealed 11.15 and 3.18 as mean and standard deviation respectively for the male, and 10.59 and 2.64 as mean and standard deviation respectively for the female. The table also shows the post-test results indicating 26.08 and 9.22 respectively as the mean and standard deviation for the males, and 25.45 and 10.04 respectively as the mean and standard deviation for the Females. Moreover, the mean gain scores between the pre-test and post-test for the Male is 14.93 and 14.86 for the Female. Based on this result, it is apparent that both male and female students taught the Nervous system concept using NHT techniques performed better, although the mean gain and mean difference of males is higher than that of females.

**H0<sub>2</sub>:** There is no significant gender difference in the mean academic achievement scores of Biology secondary school students taught Nervous system using NHT in the Bichi Education zone, Kano, Nigeria.

**Table 4: Summary of ANCOVA of Male and Female Biology students' pre-test and post-test mean achievement scores.**

Gender	Pre-test			Post-test		DF	F-value	p-value	Decision
	N	X̄	SD	X̄	SD				
Male	28	11.15	3.18	26.08	9.22	1	0.18	0.000	Rejected
Female	38	10.59	2.64	25.45	10.04				

$p \leq 0.05$

The results of the analysis in Table 4 show that, there is a significant difference in the academic achievement of students after the post-test,  $F = 0.18$  ( $df = 1$ )  $p = 0.00$ . Since the computed p-value (0.00) is less than the level of significance (0.05), the null hypothesis of no significant difference is rejected, which means there is a significant difference in the academic achievement of Male and Female Biology students taught using the Nervous system in favour of NHT teaching group.

**Research Question 3:** What is the difference in the mean interest scores of Biology secondary school students taught nervous system using NHT and those taught using lecture teaching strategies in Bichi Education zone, Kano, Nigeria?

**Table 5: Mean and standard deviation of pre-test and post-test interest scores of experimental and control groups**

Teaching Strategies	Pre-test scores			Post-test scores		Mean gain
	N	X̄	SD	X̄	SD	
NHT Strategy	66	39.86	5.94	77.83	1.50	37.97
Lecture	103	36.12	4.09	45.05	5.18	8.93
Mean Difference		3.74		32.78		29.04

Table 5 shows the interest mean scores and standard deviation of the pre-test and post-test administered to the experimental and control groups. The pre-test results revealed 39.86 and 5.94 as mean and standard deviation respectively for the experimental group, and 36.12 and 4.09 as mean and standard deviation respectively for the control group. The table also shows the post-test results indicating 77.83 and 1.50 respectively as the mean and standard deviation for the experimental group, and 45.01 and 5.18 respectively as the mean and standard deviation for the control group. Moreover, the mean gain scores between the pre-test and post-test for the experimental group are 37.97 and 8.93 for the control group. This indicated that students taught Nervous system concept using NHT strategy have higher mean interest scores than those taught using lecture teaching method.

**H0<sub>3</sub>:** There is no significant difference in the mean interest scores of Biology secondary school students taught the Nervous system using the NHT teaching strategy in Bichi Education zone, Kano, Nigeria.

**Table 6: Summary of ANCOVA of students' pre-test and post-test mean interest scores of experimental and control groups**

Group	Pre-test			Post-test		DF	F-value	p-value	Decision
	N	X̄	SD	X̄	SD				
NHT Strategy	66	39.86	5.94	77.83	1.50	1	2174.24	0.000	Rejected
Lecture	103	36.12	4.09	45.05	5.18				

$p = 0.05$

Table 6 shows the observed p-value is 0.000 with  $df = 1$  and a significant p-value is 0.05. As shown, the observed p-value is less than the significant p-value, and this implies that the null hypothesis is rejected. Therefore, there is a significant difference between the mean interest scores of secondary school Biology students taught the Nervous system using the NHT strategy and those taught using the lecture teaching strategy in favour of the experimental (NHT) group ( $F$ -value = 2174.24,  $df = 1$ ,  $P$ -value = 0.000 < 0.05).

**Research Question 4:** Is there any gender difference in the mean interest scores of Biology secondary school students taught the Nervous system using the NHT teaching strategy in the Bichi Education zone, Kano, Nigeria?

**Table 7: Mean and standard deviation of pre-test and post-test interest scores of male and female students in the experimental group**

Gender	Pre-test scores			Post-test scores		Mean gain
	N	$\bar{X}$	SD	$\bar{X}$	SD	
Male	28	35.81	3.65	58.38	16.07	22.57
Female	38	38.94	5.80	57.45	17.01	18.51
Mean Difference		- 3.13		0.93		4.06

Table 4.7 shows the interest mean scores and standard deviation of the pre-test and post-test administered to male and female students. The results showed that the male has pre-test scores of 35.81 and 3.65 as mean and standard deviation respectively, while the female has pre-test scores of 38.94 and 5.80 as mean and standard deviation respectively. The table also shows the male’s post-test scores of 58.38 and 16.07 as mean and standard deviation respectively, as well as the female’s post-test scores of 57.45 and 17.01 as mean and standard deviation respectively. Therefore, the male mean gain scores between the pre-test and post-test are 22.57 and that of the female is 18.51 which shows that there is much difference in the mean interest scores of males and females. However, both groups show more interest in learning the concepts of the Nervous system through NHT, although the mean score for the male is higher than that of the female.

**H04:** There is no significant gender difference in the mean interest scores of Biology secondary school students taught the Nervous system using NHT teaching strategy in the Bichi Education zone, Kano, Nigeria.

**Table 8: Summary of ANCOVA of students’ pre-test and post-test mean interest scores of male and female students**

Gender	Pre-test			Post-test		DF	F-value	p-value	Decision
	N	$\bar{X}$	SD	$\bar{X}$	SD				
Male	28	35.81	3.65	58.38	16.70	1	3.58	0.60	Accepted
Female	38	38.94	5.80	57.45	17.01				

$p \leq 0.05$

Table 8 shows the summary results of the ANCOVA analysis for the pre-test and post-test mean interest scores of the male and female students. The observed p-value is 0.60 which is higher than the significant p-value (0.05) with  $df=1$ . The null hypothesis is hereby accepted because the observed p-value (0.60) is higher than the significant level (0.05). Therefore, there is a significant difference between the mean interest scores between male and female Biology students taught the Nervous system using NHT teaching ( $F$ -value=3.58,  $df=1$ ,  $P$ -value=0.60>0.05) in favor of the male students.

### Discussion

This study investigated the effect of NHT strategy on the academic achievement and interest of Biology secondary school students in the Nervous System in Bichi Education zone, Kano, Nigeria. The findings revealed that there is a significant difference in the mean academic achievement scores between Biology students taught the Nervous system using NHT and those taught using lecture teaching methods in favor of those that were taught using NHT teaching method. This implies that the use of NHT technique in teaching Biology concepts enhances student’s academic achievement in the subject. The findings agree with the findings of Juveto (2015), Yelvema (2015), Nursyamsi et al.(2016), Dwi and Ikrar (2017), and Mahanal (2018), who found that students’ learning activities, participation, performance and achievements are improved while using NHT than the conventional lecture teaching method. The reasons for this finding could be as a result of the processes in the NHT teaching style which involves giving students equal chances and opportunity to manipulate and develop the learnt materials in the

lesson. The lesson was interactive where each and every student was allowed to contribute or construct knowledge based on their own personal and individual differences in which the teacher guided the students to a correct and right decision. The students are given a chance to undergo deep thinking and provide answers or solution to a given task and allow the teacher to judge and provide a concrete solution.

It was also observed in the study that there is no significant gender difference in the mean achievement scores of Biology students when exposed to the NHT teaching strategy. This implies that there is not much statistical difference in the mean achievement scores of male and female Biology students exposed to learning activities based on the NHT teaching strategy. The possible reasons behind these equal performances across the genders in this study might include the nature of NHT classes that look like play well and fashion teaching styles. This makes both genders participate rigorously, deeply and actively with all that they can as they love fashion, play and like something new all the time. This finding is in agreement with findings of Oluwatele (2015) and Danjuma (2015) who reported that there is no significant gender difference after students were exposed to the Number-Head Together teaching strategy.

The finding of this study also showed that there is a significant difference in the mean interest scores of Biology students taught using NHT and those taught using lecture teaching methods in favour of the NHT teaching method. This means that when the NHT teaching method is used to teach Biology concepts, it arouses the student's interest. This is in agreement with Eriba and Samuel (2018) and Hafeez (2021). This could be a result of the nature and manner in which the lesson was delivered to the Biology students through NHT. In this model, students become more interested in new and unique teaching styles, so they become very attentive and participative in order to learn the concepts as they see the strategy as something new and exciting to them. It was also observed that there is a significant gender difference in the mean interest scores of Biology students when exposed to the NHT teaching strategy. This observation pointed out clearly that both male and female Biology students become more interested in learning Biology concepts using the NHT model with males exhibiting more interest than the female. The male and female students become more interested in the kind of interaction taking place in the NHT teaching strategy. This also indicated that NHT strategy is suited to all Biology secondary school students. These findings are found to be in contrast with the findings of Eriba and Samuel (2018) and Hafeez (2021) whose reports showed that there is no significant gender difference in student's interest that were exposed to the NHT teaching strategy.

### Conclusion

Based on the findings of the study, it was concluded that the use of the NHT strategy in teaching Biology concepts improves student academic achievement and was found to be gender friendly as it improves academic achievement of both male and female Biology students. Also, the NHT strategy arouses student interest in learning Biology concepts, since students taught Biology concepts through NHT developed more interest in the subject than those instructed using the lecture method although males showed more interest than females.

### Recommendations

1. The government through the Ministry of Education, curriculum planners and professional bodies like WAEC, NECO, and NABTEB should ensure that NHT teaching strategy is inculcated into mainstream teaching in secondary schools in order to improve the academic achievement of the students. Moreover, if Biology teachers teach in line with the NHT strategy, this could result in creative thinking, active participation and manipulation of the learnt materials.
2. Schools should encourage Biology teachers to adopt NHT strategy in teaching and learning of Biology and other science concepts because it is gender friendly. This will also facilitate the achievement of science standard for all students irrespective of gender, individual difference and ethnicity.
3. NHT strategy arouses student interest in learning Biology concepts as such Biology teachers should be discouraged from teaching Biology using the lecture method. This study found the lecture method of teaching less effective with respect to the student's interest in learning Biology concepts.
4. To ensure equal access and opportunity in terms of education, educational associations like STAN should encourage Biology teachers to use the NHT teaching strategy in teaching Biology and other science subjects during the annual lectures, workshops, seminars, conferences and other gatherings of the association because of its yielded outcomes as seen from this study.

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