

# Development and Efficacy of Instructional Software on Secondary School Students' Interest and Achievement of Transport System in Keffi, Nigeria

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## Abstract

This study developed and tested the efficacy of an instructional software on interest and achievement in transport system among secondary school students in Keffi, Nigeria. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The study adopted quasi experimental, non-equivalent pre-test and post-test control group design. The sample was drawn from a population of 2,432 public senior secondary two (SSII) students in Keffi Education Zone. Two intact classes were sampled using multi-stage sampling technique. The two classes were randomly assigned to experimental and control groups. Two researcher developed and expert validated instruments namely: Transport System Achievement Test (TSAT) and Interest Scale on Transport System (ISTS) were used for data collection. The Split half reliability of TSAT was 0.79 while the Cronbach alpha reliability of ISTS was 0.85. The experimental group was taught using Transport System Instructional Software (TSIS) while the control group was taught Transport System using the Conventional method. The Transport System Achievement post-test was administered to both the experimental and control groups at the end of the treatment. Descriptive statistics of mean and standard deviations were used to answer the research questions while the null hypotheses were tested using ANCOVA. The results showed that students taught transport system using the instructional software achieved higher than those taught using the conventional teaching approach ( $F=75.195; P=0.000 < \alpha = 0.05$ ). However, there was a significant difference in the mean interest scores of Biology students taught transport system using the instructional software and those taught using conventional method ( $F= 115,736; P=0.000 < \alpha = 0.05$ ). The findings showed that TSIS can improve students' achievement. It is recommended among others that Biology teachers should be encouraged to develop and use TSIS to teach these concepts as it enhances Biology achievement among students.

**Keywords:** Development, Efficacy, Software, Instruction, Interest, Achievement, Transport system

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## Introduction

In Nigerian senior secondary schools, Biology is one of the science subjects that all science students prefer to offer at Senior Secondary School Certificate Examination. Most students opt for Biology in preference to chemistry and Physics because they consider it the least difficult of the science subjects. In spite of its importance and popularity among Nigerian students, performance at senior secondary school has been found to be poor. Hornby (2015) defines Biology as a branch of natural science that deals with the study of living organisms including their structures, functioning, evolution, distribution and inter-relationships.

Interest, according to Sambo, Kukwi, Eggari & Mahmuda (2014 a & b) is a feeling of wanting to know or learn about Transport System. Stimulating and sustaining interest in Education is a process that contributes to learning and achievement. It is a powerful motivational process that energizes learning, guides academic and career trajectories, and is essential to academic success. Interest is both a psychological state of attention and affect towards a particular object or topic; and an enduring predisposition of reengage over time. It is easier to learn something if the students are interested but students' interest is often diverse and wide-ranging. According to Gimba (2014), Sambo (2018), Sambo & Tagans (2020), One of the most important conditions for the sustenance of interest is the satisfaction derived from the awareness that one is progressing in what he / she sets out to do. Interest can hold a student's attention, encourage effort and support learning. Teacher's role in this direction therefore is to initiate and design packages on teaching approaches that would help the students to

derive maximum interest, achievement and retention from their study.

Achievement according to Sambo (2003), is the level at which the concept of transport system has been attained by the students after their exposure to transport system instructional software, Acknowledge acquisition level of the of transport system by SSII students after learning from the designed software. Student achievement is the amount of academic content a student learns in a given time frame. It is the extent to which a student, teacher or institution has attained their short or long-term educational goals. In the same vein, Samuel and Sambo (2019) opined that achievement is useful in testing the retention of information and skill. Biology concept achievement is important for the successful development of young people that are nation builder in the society. Students who do well in school are better able to make the transition into adulthood and to achieve occupational and economic success. Pieces of evidence abound to attest to students' poor achievement in Biology, according to Sambo (2003), Osuafor & Okonkwo (2013) and Sambo (2018) poor achievement in science especially Biology leads to low enrollment of candidates into science related careers in tertiary institutions, because a credit pass is required in Biology for admission into science - related careers such as medicine, physiology, biochemistry and others in Nigerian Universities. Pieces of evidence abound attesting to students' poor achievement in Biology. WAEC Chief Examiner's reports (2014 - 2019), revealed that candidates' weaknesses in Biology are prominent in the following areas: spelling of biological terms and technical words, Interpretation of the questions properly, Statement of the appropriate units of measurement, Graphic interpretations, Bio statistical knowledge, Technicalities in drawing and labeling, difficult biological concepts like of Genetics, Nutrition, Photosynthesis, Nervous coordination and Transport System.; also, inadequate or lack of instructional facilities and poor teaching.

Conventional Instructional Method (CIM) is a teaching-learning method in which instructors (teachers) dominate the class and students (learners) are listeners, note-takers and occasionally answer teacher's questions. Involved, interacting in a face-to-face manner in the classroom. These instructors initiate discussions in the classroom and focus exclusively on knowing content in textbooks and notes. In the same vein, Hudu, Yohanna, Oshafu, (2020) reported that this method of teaching is textbook centered, teacher dominant and exam-oriented.

Computer has played vital roles in the development of nations' instructional purposes. Several efforts have been made by many countries to train teachers for effective use of computer as a tool for enhancing teaching and learning. Gimba, Hassan, Abdulrahman, & Bashir (2014), and Tagans & Sambo (2021) disclosed that computer is a vital tool in educational setting which its importance includes motivation, transformation of abstract idea to reality, facilitates understanding and comprehension of the subject matter and facts, address the needs of the users, thereby making learners to learn at their own pace. Pleasurable and effective learning occurs when an instructor supports instructional materials with different voice, image and animations with innovative method, of which Computer Assisted Instruction (CAI) is one (Nwanne, 2017). Anyanwu (2020) revealed that the students exposed to CAI achieved better than their counterparts taught with the conventional instructional method. It is assumed that CAI based strategy will make teaching and learning process more effective, solving problems of learning difficulties, usage of poor teachings strategy and lack of resourcefulness, hence the use of CAI based strategy to teaching – learning is necessary, being one of the innovative methods that enhance learning and academic achievement in Biology.

Transport System (TS) is a system of tubes (i.e blood vessels called arteries, veins, and capillaries) with a pump (the heart) and valves to ensure one-way flow of blood, the main transport system of human is the circulatory system. Our bodies actually have two circulatory systems: the pulmonary circulation and the systemic circulation. The heart is the key organ in the circulatory system.

Development of Transport System Instructional Software (TSIS ) according to Homby (2015) refers to a package that comprises of collection of concepts, files and directories required for a software package on transport system(TS); this is a system of tubes with a pump (the heart) and valves to ensure one-way flow of blood, the main transport system of human is the circulatory system. Our bodies actually have two circulatory systems: The pulmonary circulation is a short loop from the heart to the lungs and back again, and the systemic circulation sends blood from the heart to all the other parts of our bodies and back again. It was designed by the researcher with the guidance of Nigerian Educational Research and Development Council (NERDC) Biology curriculum on Transport System ( in animals ) and built by the application developer after completing the development of the application code and so serves as instructional aids ; as it was discovered that incorporation of CAI package in teaching and learning processes boost students' interest and improves their achievement.

### Research Questions

The following research questions guided the study:

1. What are the mean interest scores of Biology students taught transport system using transport system instructional software (TSIS) and those taught using the conventional instructional method (CIM)?
2. What are the mean achievement scores of Biology students taught transport system using TSIS and those

taught using CIM?

### Objectives of the Study

The purpose of this study was to investigate the development and efficacy of instructional software on secondary school students' interest, achievement and retention of transport system in Keffi, Nigeria. Specifically, the study set out to:

1. Determine the mean interest scores of Biology students taught transport system using TSIS and those taught using the CIM.
2. Examine the mean achievement scores of Biology students taught transport system using TSIS and those taught using CIM.

### Hypotheses

To guide this study, the following hypotheses were formulated and tested at 0.05 level of significance.

**H<sub>01</sub>:** There is no significant difference in the mean interest scores of Biology students taught transport system using TSIS and those taught using the CIM .

**H<sub>02</sub>:** There is no significant difference in the mean achievement scores of Biology students taught transport system using TSIS and those taught using CIM

### METHODOLOGY

The study adopted quasi - experimental non-equivalent pre-test and post-test control group design. The targeted population for the study consisted of all Senior Secondary II Biology students with computer Laboratory in Keffi Educational Zone (N=2,432).

Based on the educational statistics of Keffi educational zone, the zone has fourteen (14) secondary schools with six (6) co-educational senior secondary schools and population of 2,432 SS2 students for 2019 / 2020 academic session. The sample for the study comprised 100 students drawn from two public schools in Keffi. The sampled students were computer literate having 49 boys and 51 girls. A survey of Schools that had functional computers in their computer laboratory and that were co-educational.

The Transport System Achievement Test (TSAT) and Interest Scale on Transport System (ISTS ) were administered to different schools in the first week before the experimental treatment. Students' scores in this first administration served as the pre-test scores of the study. The instruments administered to both groups lasted for three weeks and TSAT was used by the experimental group throughout the treatment period while the lesson plans were used by the control group (conventional method). In experimental group the TSIS was installed in desktop computers in the schools' computer laboratory. The students in the experimental group were randomly assigned to ten groups consisting of five students per group/ computer. The students in the control group were also taught Transport System using the conventional method by the school Biology teacher, during their normal double and single periods for three weeks, with the prepared lesson plan by the researcher.

The research questions were answered using mean and standard deviations while the null hypotheses were tested at 0.05 alpha level using Analysis of Covariance (ANCOVA).

### Results.

#### Research Question 1

What are the mean interest scores of Biology students taught transport system using assisted instructional software and those taught using the conventional instructional method?

Table 1:

**Mean Interest Scores And Standard Deviations Of Biology Students Taught Transport System Using Transport System Instructional Software (TSIS) And Conventional Instructional Method (CIM)**

Group	N	Pre- Interest	Post -Interest
Mean		31.80	75.80
TSIS	50		
Std. Deviation		9.190	9.708
Mean		24.20	53.80
CIM	50		
Std. Deviation		4.986	6.667

Table1,shows that the students taught transport system with TSIS had mean interest rating of 31.80 and 75.80 in the pre-test and post –test respectively and standard deviations of 9.190 and 9.708 in that order. Students taught transport system in the control group, it was observed that they had mean interest rating of 24.20

and 53.80 in the pre-test and post –test respectively and standard deviations of 4.986 and 6.667 respectively.

**Null Hypothesis 1**

There is no significant difference in the mean interest scores of Biology students taught Transport system using assisted instructional software and those taught using the Conventional method.

**Table 2:**

**ANCOVA Results Of Mean Interest Scores Of Biology Students Taught Transport System Using TSIS And CIM**

Source	Type III sum of squares	df	Mean Square	F	Sig.	Partial Eta squared
Model	12907.767	2	6453.883	104.543	.000	.683
Intercept	18596.212	1	18596.212	301.230	.000	.756
Pre Interest	807.767	1	807.767	13.085	.000	.119
Group	7144.885	1	7144.885	115.736	.000	.544
Error	5988.233	97	61.734			
Total	438800.000	100				

In Table 2,  $F(1, 97) = 115.735$ ;  $P=0.000 < \alpha = 0.05$ . This table shows that the treatment (TSIS ) has a significant difference on students’ achievement in Transport system. The level of significance of the groups is 0.000, alpha is 0.05, the probability level is less than 0.000 ( $P < \alpha$ ).

Therefore, the hypothesis was rejected. This implied that, there was a significant difference in the mean interest scores of Biology students taught transport system using TSIS and CIM.

**Research Question 2**

What are the mean achievement scores of Biology students taught transport system using? Assisted instructional software and those taught using conventional method

**Table 3:**

**Mean And Standard Deviations Of Biology Students In TSAT**

Group	N	Pre-test	Post -Test
Means		6.52	37.26
TSIS	50		
Std Deviation		4.418	14.530
Mean		6.52	18.28
CIM	50		
Std. Deviation		4.418	5.139

Table 3, shows that the students taught transport system with TSIS had mean achievement rating of 6.52 and 37.26 in the pre-test and post –test respectively and standard deviations of 4.418 and 14.530 in that order. For the students in the control group, it was observed that they had mean interest rating of 6.52 and 18.28 in the pre-test and post –test respectively and standard deviations of 4.418 and 5.139 respectively.

**Null Hypothesis 2**

There is no significant difference in the mean achievement scores of Biology students taught transport system using computer assisted instructional software and those taught using Conventional instructional method.

**Table 4:**  
**ANCOVA Results Analysis Of TSAT Mean Achievement Scores Of Biology Students Taught Transport System Using TSIS And CIM**

Source	Type III sum of squares	df	Mean Square	F	Sig.	Partial Eta Squared
Model	9028.185	2	4514.092	37.690	.000	.437
Intercept	22738.208	1	22738.208	189.852	.000	.662
Pre Interest Group	22.175	1	22.175	.185	.668	.002
Error	9006.010	1	9006.010	75.195	.000	.437
Total	11617.525	97	119.768			
Corrected total	97763.000	100				
	20645.710	99				

In Table 4,  $F = 75.195$ ;  $P = .000 < \alpha = 0.05$ . This shows that the level of significant for the groups was 0.000.  $P < \alpha = 0.05$ . There is significant difference in the mean achievement scores of Biology students taught transport system using transport system instructional software and those taught using conventional instructional method as this led to the hypothesis being rejected.

### Discussion of Findings

TSIS and students' interest: The findings showed that the TSIS significantly improved students' interest in transport system. This is again in agreement with Anyanwu (2020) who reported that the students exposed to CAI achieved better than their counterparts taught with the lecture method. It is also in agreement with Agu (2017) who found that students taught MECP using the CAI package performed better than those who were taught using conventional method. Also, the study is in agreement with Nwanne (2017). The use of this software enabled male students to perform better than female students. This means that the use of this software is gender-biased in favour of male students, this is in agreement with Adepeko (2019), who found out that there was a significant difference among male and female students' performance in Physics using Computer-Assisted Instruction and in disagreement with Abubakar, Yahaya and Karar (2018) who reported that female students taught Biology with CAI in senior secondary school Kebbi state performed slightly better than male counterparts taught with the same method.

The findings showed that the TSIS significantly improve student's achievement in transport system. This is in agreement with Anyanwu (2020) who reported that the students exposed to CAI performed better than their counterparts taught with the lecture method. It is also in agreement with Agu and Esson (2017) who revealed that students taught Mechanical Engineering Craft Practice using the CAI package performed better than those who were taught using conventional method. Also, the study is in agreement with Nwanne (2017). The use of this software enabled male students to perform better than female students. This means that the use of the software is gender-biased in favour of male students, this is in agreement with Adepeko (2019), who found out that there was a significant difference among male and female students' performance in Physics using Computer-Assisted Instruction and in disagreement with Abubakar (2018) who reported that female students taught Biology with CAI in senior secondary school Kebbi state performed slightly better than male counterparts taught with the same method.

TSIS package is more efficacious than the conventional strategy in teaching transport system, students taught transport system using TSIS Package achieved better than those taught using conventional approach. Students taught using TSIS Package generally had a higher mean achievement scores than those taught using conventional approach. This provides the basis upon which Biology teachers could build upon to enhance their teaching using the appropriate instructional strategy. This implies that, development and efficacy of instructional software on secondary school students' transport system would not only enhance students' achievement but it will engender more of their interest towards transport system as a concept.

### Conclusion

From the result of this study, the following conclusions were made:

- i. Students taught using TSIS Package generally had a higher mean achievement scores than those taught using conventional approach. This provides the basis upon which Biology teachers could build upon to enhance their teaching using the appropriate instructional strategy.
- ii. The mean interest scores of students taught transport system using TSIS Package in transport system was higher than those taught using conventional strategy approach. There is significant difference in the mean interest scores of male and female students taught transport system using TSIS Package and those taught using conventional strategy.



## Recommendation

Nigeria public schools should be equipped with necessary ICT facilities and Effective / constant electricity supply by the government and NGOs; to leverage the potentials of ICT in the schools

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