Assessing Students' Gender, School Type and Science Process Skills Acquisition of Senior Secondary Schools Students in Calabar Education Zone, Cross River State, Nigeria

Bassey A. Bassey & Eme O. I. Amanso
Department of Educational Foundations
University of Calabar,
Nigeria
babssey67@gmil.com

ABSTRACT

This study assessed the influence of gender and school type on science process skills acquisition among students in Calabar Education Zone of Cross River State, Nigeria. To achieve the purpose of the study, two hypotheses were formulated to guide the study Survey research design was adopted for the study. Using stratified random sampling technique, a sample of 413 science students was drawn from a population of 4212 for the study. The sample comprised 203 males and 210 females with 189 from private schools and 224 from public schools. A 32-item questionnaire was the instrument for data collection. The instrument was duly validated and the reliability estimates for the instrument were established through Cronbach alpha method. The estimates ranged from .73 to .91. Independent t-test analysis was used to test the two null hypotheses at .05 alpha levels. The results revealed that male science students differ significantly from their female counterparts in science process skills acquisition; and science students from public schools differ significantly from their counterparts in private schools in computation and making of inference skills. However, part of the results showed no significant difference in problem-solving skills between science students from private and public schools in the research area. Recommendations were made.

INTRODUCTION

The Nigerian education system is laden with students who lack basic scientific skills such as ability to organise, integrate and compute mathematical and physical quantities and variables, good logical inductive reasoning, making inferences, problem-solving, and good manipulative skills to carryout practical activities to support the theoretical basis of science. These are the major characteristics of science for students who must excel in scientific and technological knowledge. The future of any society lies squarely in knowledge, but the ability to generate new knowledge and use it innovatively depends upon having a scientifically literate population. Although people learn throughout their lives, good science education in schools is a vital preparation for scientific literacy in later life. However, despite its importance, science education in schools is threatened from a number of directions, such as shortage of well qualified science teachers, societal factors and students' identified factors (Sinha, 2003).

Nevertheless, there have been considerable efforts at brining quality to bear in science education through training and re-training of teachers, award of scholarship to science students as well as considerable emphasis in science-related subjects from basic education. Of all these efforts, and the widespread concern about the outcomes of science education at

school, not much has been achieved. Given the fact that the importance of science today cannot be overemphasised in the growth and development of any nation, it is from this backdrop that this study was designed to explore the direction of science students' inability to study science related subjects effectively, vis-a-vis, science process skills acquisition on the basis of students' sex and school type.

Science process skills acquisition refers to a variety of abilities that affect the acquisition, retention, understanding, organisation or use of verbal and/or non-verbal information. According to Hallahan and Mercer (2002), science process skills acquisition is a heterogeneous group ability manifested in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities, or of social skills. Among school-aged children, science process skills acquisition may be seen as different skills in computation, making of inferences, problem-solving, and short attention span. These forms of skills may impede and/or promote science learning outcomes in one way or the other. In a study conducted by Edet (2016) on assessment of selected science process skills acquisition among science students in Cross River State, Nigeria, it was revealed that their computation skills, problem-solving skills, and making of inference skills were significantly high. Effective learning revolves around computation, problem-solving., as well as making of inference from observations. Whether these differ with sex and school type is the concern of this study.

Researchers have advanced theories emphasising the importance of gender differences in the rates of maturation as well as learning. According to Richlan, Kronbichler and Wimmer (2011), numerous neuro development disorders, including celebral palsy, attention deficit hyperactivity disorder autism, speech and language disorders, science process skills acquisition and learning disabilities are diagnosed more often in boys than in girls. They stressed that students with science process skills acquisition are most likely to be males (52%) and the majority (60%) attend two-year institutions or less than two-year programmes.

Influence of gender on the basic learning skills has become another matter of a considerable debate among some authorities in the fields of psychology and education. It has been observed that various biological differences in human make-up such as are differently inherent in male and female students may be responsible for some disparities in school performance of the two groups (Verhoeven, 2000). The argument is that since no two human beings are the same in physical and intellectual attributes, then one should not expect both male and female students to perform uniformly in computation, problem-solving, and inference making skills, in their academic endeavours.

Abiodun (2006) identified that female children always develop certain skills faster and better than male children. He also identified that by age 11, male children would catch up with their female counterparts in language skills. On the other hand, Oyebola (2008) stated that girls perform better than boys in mathematics (computations) until they reach age 11 when the two will begin to perform relatively the same in mathematics. However, Ademokoya (2008) found no significant difference in the incidence of male and female hearing impairment among secondary school students. However, Okuoyibo (2006) revealed that evidence suggests that boys are more likely to suffer from a science process skills acquisition than girls. In a study by Udousoro (2011), on students' perceived and actual science process skills acquisition in secondary school mathematics, a negative significant relationship (r=-.27) was found to exist between perceived and actual science process skills acquisition, while significant difference existed between the male and female actual science process skills acquisition all at 5% level of significance.

A parent once reported thus, my 5-year old son is currently a kindergartener in a public school. He is having a lot of trouble keeping up with the fast paced curriculum. My son is speeched delayed and has weak motor skills. The teacher says that he will have to re-

do kindergarten again. So, I am looking for a good private school. I am totally lost on where to go from here. Any advice is welcomed (Facebook Account). This report might have emerged as a result of fallen standard in the public schools. There are also many non public schools without a religious identity or affiliation. Some of these private schools are preparatory schools designed to prepare students for college. These schools often have a traditional or elite reputation and a long history.

Public schools expend considerable resources identifying children eligible for special services, both because they receive additional funds from federal and state governments if a child is identified as having a disability that affects their learning. Those obligations, rights and funding support do not apply if parents choose to place their children in private schools. By and large, private schools have not developed the capacity to identify children with disabilities, and many of them are reluctant to do so, as they believe it leads to stigmatisation of the children. In other words, a child who may be classified as in need of special education in a public school may not be classified as such if his or her family chooses a private school. As a result, any official statistics on the prevalence of students with disabilities in public and private schools can be highly misleading (Okuoyibo, 2006).

Approximately 5% of all public school students are identified as having one form of learning difficulty or the other (Lyon, 2006). The source reiterated that learning difficulty is not a single disorder, but includes disabilities in any of mathematics and problem solving. However, it is important to point out here that there can also be difficulty in inference making, among others. These separate types of science process skills acquisition frequently co-occur with one another and with social skills deficits and emotional or behavioural disorders. Most of the available information concerning learning disabilities relates to reading difficulty, and the majority of children with learning disabilities have their primary deficits in basic reading skills.

From the above observations, the question that arises is what is the influence of students' gender and school type on the science process skills acquisition among SS 2 science students in Calabar Education Zone of Cross River State, Nigeria?

STATEMENT OF HYPOTHESES
The following hypotheses were formulated to guide the study:
1. There is no significant influence of gender on science process skills acquisition among science students in terms of computation, problem-solving, and making of inference.
2. Science students in public schools do not differ significantly from their counterparts in private schools in science process skills acquisition in terms of computation, problem-solving, and making of inference.

METHODS
The research design adopted for this study is survey design. It was considered appropriate for this study because the study seeks to collect data and make objective analysis of data collected based on the situation on ground. It was also considered appropriate because it allows the researcher to make inferences and generalisation of the population by selecting and studying the sample for the study. The area of the study for this study is Calabar Education Zone, made up of seven local government areas, namely; Akamkpa, Akpabuyo, Bakassi, Biase, Calabar Municipality, Calabar South, and Odukpani-in Cross River State, Nigeria.

The population of this study consisted of all the senior secondary two (SS 2) science students in Calabar Education Zone of Cross River State, Nigeria. A breakdown of this figure shows that 2073 were male while 2139 were female, spread across 84 public and 36 private

secondary schools in the zone (Post-primary Education Board, Calabar 2016). The stratified random sampling technique was used to select schools on basis of local government areas (LGAs), as well as school types (public and private). Using this approach, two schools (one public and one private) were selected from each LGA. From each of the two schools drawn from each LGA, simple random sampling technique was adopted in the selection of 10% male and 10% of female science students from public and private schools as subjects for the study. Hence, 421 science students were randomly selected as the sample for the study.

A 32-item instrument titled: "Science Students' Process Skills Acquisition Test" constructed by the researchers was employed for data collection. The instrument had two sections, A and B. Section A had two items only that elicited respondents' personal information on gender and school type. Section B was designed to test respondents' ability in computation, problem solving, and inference making skills. It had 30 items, ten each for each for each of the three components of science process skills acquisition. Some of the items were structured to ensure that the respondents show calculation and clear working. The test was developed with the help of the test blue-print shown in Table 1.

Table 1
Test-blue-print for science students' process skills acquisition test

Content (skills)	Comprehension (30%)	Application (46.7%)	Analysis (23.3%)	Total (100%)
Computation skills (33.3%)	2	3	5	10
Problem solving skills (33.30%)	3	6	1	10
Inference making skills (33.3%)	4	5	1	10
Total (100%)	9	14	7	30

The instrument was both face and content validated. Using Cronbach alpha method, the reliability estimates that ranged from .73 to .91 were established. Out of the 421 copies of the instrument administered to the respondents, only 413 retrieved were correctly filled. The remaining eight copies were invalidated because they were wrongly filled. The retrieved copies of the instrument were duly coded and collated for statistical analysis.

RESULTS
Hypothesis 1

There is no significant influence of gender on science process skills acquisition among science students in terms of computation, problem-solving, and making of inference.

The independent variable in this hypothesis is gender, while the dependent variable is science process skills acquisition, categorised into computation skills. Independent t-test statistical analysis was used to test this hypothesis at .05 alpha level. The result of the analysis is presented in Table 2.

Table 2
Independent t-test analysis of the influence of gender on science process skills acquisition (N = 413)

Variable	Gender	N	Mean	SD	t-value	p-value
Computation	Male	203	19.13	1.18	5.59*	.000

	Female	210	18.38	1.53		
Problem-solving	Male	203	18.22	1.50	-2.69*	.007
	Female	210	18.57	1.08		
Making of inference	Male	203	15.81	2.43	-6.99*	.000
	Female	210	17.23	1.62		

* Significant at .05; critical t = 1.96; df = 411.

The results of the analysis as shown in Table 2 revealed that the calculated t-values for computation (t=5.59), problem-solving (t=-2.69), and making of inference (t=-6.99) are each greater than the critical t-value of 1.96 at .05 level of significance with 411 degrees of freedom. With these results, the null hypothesis 1 was rejected. This implies that students' gender does have significant influence on their science process skills acquisition in terms of computation, problem-solving, and making of inference. A critical look at the mean values revealed that the direction of significance for computation skills is in favour of male students, while the directions of significance for problem-solving, and making of inference are in favour of female students.

Hypothesis 2

Science students in public schools do not differ significantly from their counterparts in private schools in science process skills acquisition, in terms of computation, problem solving, and making of inference.

The independent variable in this hypothesis is school type (public and private), while the dependent variable is science process skills acquisition, categorised into computation, problem solving, and making of inference skills. Independent t-test statistical analysis was used to test this hypothesis at .05 alpha level. The results are presented in Table 3.

Table 3
Independent t-test analysis of the influence of school type on science process skills acquisition (N = 413)

Variable	Gender	N	Mean	SD	t-value	p-value
Computation skills	Private	189	19.09	1.23	4.66*	.000
	Public	224	18.46	1.49		
Problem-solving	Private	189	18.29	1.48	-1.59	.114
	Public	224	18.49	1.15		
Making of inference	Private	189	15.96	2.39	-5.09*	.000
	Public	224	17.02	1.83		

* Significant at .05; critical t = 1.96; df = 411.

The result of the analysis as presented in Table 3 revealed that the calculated t-values for computation skills (t=4.66), and making of inference skills (t=-5.09) are each greater than the critical t-value of 1.96 at .05 alpha level with 411 degrees of freedom. With those results, the null hypothesis 2 was rejected with respect to computation sills and making of inference skills. This implies that science students in public schools differ significantly from their counterpart in private schools in science process skills acquisition in terms of computation and making of inference. A critical look at the mean values in table 3 revealed that the direction of significance for computation skills is in favour of science students in private schools, while that for making of inference skills is in favour of science students in public schools.

But the t-value for problem-solving (t=-1.59) is less than the critical t-value of 1.96 at .05 alpha level with 411 degrees of freedom. This implies that science students in public schools do not differ significantly from their counterparts in private schools in science process skills in terms of problem-solving skills. However, a critical look at the mean value for problem-solving skills for science students in public schools (x=18.49) is greater that for private schools (x=18.29), but the difference is not large enough to be significant.

DISCUSSION OF FINDINGS

The result of the hypothesis 1 revealed that there is a significant influence of students' gender on science process skills acquisition among science students in terms of computation, problem-solving, and making of inference. This is somewhat in agreement with Richlan, Kronbichler and Wimmer (2011) who stressed that students with high science process skills acquisition are mostly to be males. This was true for this study with respect to computations skills only. With respect to problem-solving skills and making of inference skills, female science students had higher (with higher mean values) science process skill acquisition than male science students. This could be explained by the fact that girls with science process skills acquisition may be underestimated, putting them at risk for academic, social and emotional challenges.

This finding also agrees with Udousoro (2011) that significant difference exists between the male and female actual science process skills acquisition, all at 5% level of significance. But this study finding is not in consonance with Okuoyibo (2006) who revealed that boys are more likely to suffer from science process skills acquisition than girls. The influence of gender on the basic learning skills is inconclusive. It could be deduced that various biological and genetical differences in human make-up such as are differently inherent in male and female students may be responsible for some disparities in school performance or learning abilities of the two groups (male and female). The plausible argument is that since no two human beings are the same in physical and intellectual attributes, then one should not expect both male and female students to perform uniformly, even in computation, problem-solving, and making of inference, in their academic endeavours.

The result of the hypothesis 2 revealed that for computation skills and making of inference skills, there is a significant difference between science students from public and private schools, while for problem-solving skills there was no significant difference between science students from public and private schools. This is in consonance with Vaughn, Linan-Thompson and Hickman (2003) who opined that identification rate in the public schools appear to be 60% higher than in the private schools.

A closer look at the result revealed a somewhat surprising finding – that science students from private schools had a higher mean value than those from public schools in computation skills. Why this? All things being equal, it could be that student's population in private school is usually small, students have closer individual attention/intervention with their academic teams and learn much nitty-grity in computation. It could also been adduced that it is because private schools can either accommodate the students themselves, using whatever resources they have or negotiate with public school officials regarding the provision of special services to the students by the public school system with additional public funds.

The finding of this study also agreed with Lyon (2006) who stated that approximately five percent of all public school students are identified as having one form of learning disability or the other. The source reiterated that leaning disability is not a single disorder, but includes disabilities in any of computation skills and problem-solving skills. However, it is important to point out here that there can also be difficulty in inference making, among others.

CONCLUSION

Based on the findings of this study, it was concluded that there is a significant influence of students' gender on their science process skills acquisition among science students in terms of computation, problem-solving, making of inference; and that students' science process skills acquisition in public schools differ significantly from their counterparts in private schools in terms of computation, and making of inference skills. However, there was no significant difference in terms of problem-solving skills.

RECOMMENDATIONS

1. Science teachers should re-examine and evaluate their present teaching strategies so as to be effective and should stop using gender-stereotype or abstract terms/concepts in class/laboratory.
2. The governments/proprietors should give priority to equipping the science laboratories and improving the teaching and learning environment.

REFERENCES

Edet, E. B. (2016). Assessment of selected science process skills acquisition among senior secondary school students in Calabar Education Zone of Cross River State, Nigeria. Unpublished M.Ed thesis, University of Calabar, Calabar, Nigeria.

Hallahan, D. P. & Mercer, C. D. (2007). Learning disabilities: Historical perspectives. In R. Bradley, L. Danielson, and D. P. Hallahan (Eds.). *Identification of science process skills acquisition: Research to practice* (pp.1-67). Mahwah, N. J.: Erlbaum.

Lyon, G. R. (2006). Toward a definition of dyslexia. *Annals of D*yslexia, 45*3-30.*

Okuoyibo, J. M. (2006). Educating the child with hearing-impairment: The place of the educational audiologist. In T. Adelowo, N. Osatuyi, & A. Ajobiewe (Eds.) *Special education in Nigeria: A search for new direction* (pp.281-293). Ibadan: Gloryland Publishing Coy.

Oyebola, M. (2008). Sociological background and academic achievement of the hearing-impaired. *Nigerian Journal of Health, Education and welfare of Special People, 2*(2), 36-46.

Richlan, F., Kronbichler, M., & Wimmer, H. (2011). Meta-analyzing brain dyfunctions in dyslexic children and adults. *Neuroimage, 56,* 1735-1742.