



**SOCIO-CULTURAL AND SCHOOL-RELATED
DETERMINANTS OF ACHIEVEMENT IN
AND ATTITUDE TO INTEGRATED SCIENCE
AMONG JUNIOR SECONDARY SCHOOL
GIRLS IN ENUGU STATE, NIGERIA**

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Abridged Research Report No. 43

**RESEARCH PRIORITIES
FOR THE
EDUCATION OF
GIRLS AND WOMEN IN AFRICA**

**Published by
Academy Science Publishers
P.O. Box 14798
Nairobi, Kenya**

**© Academy Science Publishers 1998
ISBN: 9966-24-042-x**

**Typeset and Produced by
The AAS - FEMED Project Secretariat, Nairobi**

CONTENTS

List of tables	iv
List of abbreviations	iv
Preface	v
Main results	iv
Introduction	1
Research Objectives	3
Method	3
Instruments for data collection	4
Results	4
Policy implications and conclusions.....	21
References	22

LIST OF TABLES

1. Mean achievement scores in integrated science of JSS girls in Enugu State, Nigeria
2. Mean attitude towards integrated science score of JSS girls in Enugu State, Nigeria
3. Percentage variance contribution of socio-cultural determining factors of the girls achievement in integrated science
4. Percentage variance contribution of school-related determining factors of the girls' achievement in integrated science
5. Percentage variance contribution of socio-cultural determining factors of the girls' attitude towards integrated science
6. Percentage variance contribution of school-related determining factors of the girls' attitude towards integrated science

LIST OF ABBREVIATIONS

AAS:	African Academy of Sciences
ADEA:	Association for the Development of Education in Africa
JSS:	Junior Secondary School
JSSCE:	Junior Secondary School Certificate Examination
OAU:	Organisation of African Unity
NERC:	Nigerian Education Research Council
SSCE:	Senior Secondary School Certificate Examination
SPSS:	Statistical Package for Social Science
ISATAI:	Integrated Science Achievement Test and Attitude Inventory

PREFACE

The conference of Ministers of Education in Africa held in Harare, Zimbabwe in 1998 emphasized, among other issues, the need to promote the education of girls in Science and Technology especially at higher levels starting from secondary schools. In response to this, the Nigerian National Policy on Science and Technology (FMST, 1986), made adequate policy provision for ensuring gender equality in access to Science and Technology at all levels of formal education.

But despite this efforts, researchers have shown that there are many indications of gender difference in achievement in science in Nigeria. Female enrolment and female achievement in the science subjects are constantly lower than those of males, as reflected in the West African School Certificate of (WASC) examinations. The observed poor achievement of Nigerian girls in Science subjects in WASC examinations has been attributed to the girls' attitude towards science (Okeke et al (1992)).

National Assessment of Educational Progress, NAEP, (1979) and Gerogewill (1994) had shown that gender differences in attitude to and achievement in the sciences is related to students age; and specifically, NAEP (1979) observed that the gender difference in science achievement against girls is more pronounced at the age range of 9 to 17 years. According to her, girls within this age range describe science classes as "boring", "stupid" and "an endeavour in which they will not do well."

In Nigeria, the age of 12+ which falls within this age range is the age an average Nigerian student gets into Junior Secondary School (JSS). Thus, if the observation of NAEP and Georgewill is applied to Nigerian situation, it then follows that the JSS Nigerian girls are at the peak of their aversion to and low achievement in sciences. This underscores the importance of ensuring that any science education programme at this level should have valid information of the various factors that influence girls attitude to and achievement in the sciences program.

It is in this light that the African Academy of Sciences (AAS) in collaboration with the Association for the Development of Education in Africa (ADEA)-Working Group on Female Participation, sponsored a study that sought to determine the extent to which various socio-cultural and school-related sub-factors determine the achievement in and attitude to integrated science among JSS girls in Enugu State, Nigeria.

This is an abridge version of the original report by Dr. D.N. Ezech of the sub-Department of Science Education, University of Nsukka, Nigeria (principal researcher), with Dr. E. O. Ezeani and Mrs. C.N. Ezeani, both of the Department of Political Science, University of Nigeria, Nsukka, as co-researchers, who may be contacted in any subsequent follow-up.

RESULTS

1. Results of this study have shown that JSS girls in Enugu State exhibit low achievement in and attitude towards integrated science. This reveals that the integrated science program introduced in the Nigerian education system, primarily to lay adequate foundation for positive disposition and higher performance in the sciences among the students at such an early age in their formal education as in the JSS, has not, for now, achieved these objectives with respect to the girls.
2. The socio-cultural factors that determine girls' **achievement** in integrated science, in decreasing order, are:
 - Belief in the masculine nature of science;
 - Belief in the role of science in marriage;
 - Belief in the role of science in religion;
 - Parental encouragement to study science; and,
 - Ethnic language.

3. The school-related factors that determine girls' **achievement** in integrated science, in decreasing order, are:
 - School ownership;
 - School type;
 - Schools' records of performance in the junior secondary school certificate examinations (JSSCE);
 - School location; and,
 - Sex of teacher.
4. The socio-cultural factors that determine girls' **attitude** in integrated science, in decreasing order, are:
 - Belief in the masculine nature of science;
 - Belief in the role of science in marriage; and,
 - Belief in the role of science in religion.
5. The school-related factors that determine girls' **attitude** in integrated science, in decreasing order, are:
 - Class size;
 - School ownership;
 - Sex of teacher;
 - Schools' records of performance in the junior secondary school certificate examinations (JSSCE);
 - School type; and,
 - School location.
6. Hausa speaking girls and girls who speak other languages other than Igbo, Hausa, and Yoruba achieve significantly higher than their Igbo, Hausa and Yoruba counterparts.
7. Parents economic status exert no influence on the girls' achievement in integrated science.

INTRODUCTION

Integrated Science is the form of science education adopted for Nigerian Junior Secondary Schools since 1982 to replace General sciences. The latter was found to be abstract and irrelevant to the pupils experience and needs. This created apathy to science generally at the lower forms of secondary education; which subsequently led to aversion and low enrollment and achievement in sciences at Senior Secondary Schools (Bajah, 1978). On the other hand, the newly adopted Integrated Science Program has been said to be a course which :

- (a) Is relevant to students needs and experiences
- (b) Stresses the fundamental unit of science
- (c) Lays adequate foundation for subsequent scientific study
- (d) Adds cultural dimension to science education (FME, 1986:V)

It therefore follows that for the curriculum to be functional and effective, adequate consideration of the needs, experiences and culture of the target users of the curriculum would have been taken more so because observations abound (Edem, 1987) that the failure of most school science programs in Nigeria is due to the culture-bias of the latter. Ogunniyi (1988) and Jegede (1990) had also attributed general low performance and apathy of Nigerian students in the sciences to the discrepancy arising from their African world view of science, developed during their early socialization in their socio-cultural milieu and the modern view of sciences presented in the schools. Accordingly, beliefs about women's role in marriage (Lonsdale, 1969; Odunsi, 1979; Okeke et al., 1992); religion (Okeke et al., 1992); parents attitude and expectations (Fox in Okeke et al., 1992) and sex-role stereotype (Vockell and Lobone, 1981) which are all rooted in the learners' socio-cultural environment have been shown to constitute obstacles to girls' performance in science.

There are also some school related factors which have been found to affect students performance in science in Nigeria. These are school type (Ormerod,

1975; Akpan, 1987); school ownership (Nwana, 1987); school location (Obioma and Ohuche, 1984; Nwana, 1987; Jegede, 1991); availability of science equipment (Bradley, 1968; Abdullahi, 1979; Azeke, 1982); and gender of the science teacher (Igwilu, 1993). These sources respectively reveal that:

- (i) Girls in co-educational schools perform better in science than their counterparts in girls-only type of school;
- (ii) Students in Federal Government owned schools in Nigeria outperform their counterparts in either State Government or privately owned schools;
- (iii) Urban located schools favor students performance in science than the rural located schools;
- (iv) Students tend to have higher disposition to the sciences and thus achieve higher in the discipline when taught by a teacher of the same gender than when taught by a teacher of the opposite gender..

However, in view of the fact that there was no pilot testing of the integrated science program, there is yet no empirical evidence of the extent to which these factors influence the JSS students in the new program, particularly the girls who had consistently been reported to be disadvantaged in science education in Nigeria. This gave the impetus for the researchers to address the following research questions in this study:

- (i) What are the levels of achievement in and attitude to integrated science among JSS girls in Enugu State in Nigeria?
- (ii) To what extent do various socio-cultural and school related sub-factors determine the achievement in and attitude to integrated science among JSS girls in Enugu State in Nigeria?

The following hypothesis which are tested at 0.05 level of significance guided the study:

HO1: There will be no significant influence of socio-cultural factors under study on achievement in integrated science of JSS girls in Enugu State, Nigeria.

- HO2:** There will be no significant influence of school related factors under study on the achievement in integrated science of JSS girls in Enugu State, Nigeria.
- HO3:** There will be no significant influence of socio-cultural factors under study on attitude towards integrated science of JSS girls in Enugu State, Nigeria.
- HO4:** There will be no significant influence of school-related factors under study on attitude towards integrated science of JSS girls in Enugu State, Nigeria.

Research objectives

To determine:

1. The level of achievement in and attitude towards integrated science among JSS girls in Enugu State, Nigeria; and
2. The individual influence of the socio-cultural and school related sub-factors influencing attitude towards integrated science among JSS girls in Enugu State, Nigeria.

METHOD

Design

This was an ex-post-facto type of design because it involved the influence of some independent variables (socio-cultural and school-related) on some dependent variables (achievement and attitude) for which the researchers had no control or could not manipulate.

Sample

The sample consisted of 1214 JSS girls (676 from urban schools and 538 from rural schools). The 20 schools consisted of 11 urban and 9 rural located schools. In each of the 20 sampled schools, 2 streams of JSS III were constituted as sample streams using simple random approach where there were more than 2 of such streams. Every girl in each of the sample streams constituted a subject for the study.

Instrument for data collection

An instrument known as Integrated Science Achievement Test and Attitude Inventory (ISATAI) which was developed and validated by the researcher was used for the study. The ISATAI had three sections labeled I, II and III.

Section I consists of 14 items which elicited information on the subjects' school-related and socio-cultural background characteristics. Section II, labelled Integrated Science Attitude Inventory (ISAI) contains 22 items designed to generate data on the subjects' attitudinal disposition towards integrated science. Its response format is of the 4-point Linker type in the form of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD) for positively used attitudinal statement with the order reserved for negatively used statements. Section III, which is the Integrated Science Achievement Test (SAT) component of the ISATAI contains 66 items developed based on a validated and comprehensive test blue print on the integrated science core curriculum for the JSS.

RESULTS

The results of this study are presented in tables 2 to 5 below. Tables 2 and 3 contain results of the subjects overall achievement in and attitude towards integrated science respectively.

Table 2: Mean Achievement scores in Integrated Science of Nigerian Enugu State JSS girls

Number	Maximum score obtainable	Mean score obtained	Standard deviation	% score obtained*	Interpretation
1214	80	31.63	10.36	39.53	Failure

Table 3: Mean Attitude scores in Integrated Science of Nigerian Enugu State JSS girls

Number	Maximum score obtainable	Mean score obtained	Standard deviation	Linkert -type scale value	Interpretation
1214	102	63.44	11.64	2.44	Low

Table 2 shows that the mean achievement score in integrated science by JSS girls in Enugu State is 31.63 (or 39.53%). As a score of 40% is often considered a minimum pass mark in achievement testing in Nigerian schools, the score of 39.5% scored by the JSS girls as shown in the study is a failure grade. Table 3 shows that the mean attitude towards integrated science score obtained by JSS girls in Enugu State is 63.44. This mean attitude towards integrated science score on conversion to a 4-point Linkert-type scale that formed the basis for developing the response format of the ISATAI is 2.44. This value is interpreted as low attitude.

Tables 4 and 5 are used to respond to the hypotheses that guide the study as follows:

HO1. *There will be significant effect of socio-cultural factors under study on achievement in Integrated science of JSS girls in Enugu State, Nigeria*

Table 4: Stepwise Multiple Regression analysis of socio-cultural determinants of achievement in Integrated science among Nigerian Enugu State JSS girls.

Sociocultural Variable	Multiple R	R ²	R ² change	B	Beta	Standard error	% variance added	F observed	F critical (P<0.05)
Belief in the masculine nature of science	0.27909	0.07789	0.07789	2.439495	0.20789	9.95455	7.789	102.38*	3.84
Belief in negative role of science in marriage	0.33475	0.11206	0.03417	1.596928	0.188632	9.77251	3.417	46.60*	3.00
Belief in negative role of science in religion	0.36528	0.13343	0.02137	1.862907	0.18881	9.65818	2.137	29.84*	2.60
Parental encouragement to study science	0.38232	0.14617	0.01274	1.628118	0.08854	9.59090	1.274	18.04*	2.37
Ethnic language	0.39266	0.15418	0.00801	1.528113	0.08664	9.54974	0.801	11.44*	2.21
Parents economic status	0.39369	0.15499	0.00081	-0.1895660	-0.02869	9.54912	0.081	1.16	2.01

* = significant at 0.05 level

Table 4 shows detailed data of stepwise multiple regression analysis of the six socio-cultural determinants of achievement in integrated science among Enugu State JSS girls considered in this study.

From these data, it is observed that:

- (i) The proportion of variance of the girls' achievement in integrated science attributed to their belief in the masculine nature of science is 0.07789 and the percentage variance due to this single factor is 7.789. The observed F-value in respect of this factor is 102.38 as against the critical value of 3.84 at 0.05 significant level. This means that the variance in achievement in integrated science due to differentiated belief in the masculine nature of science is significant and not attributed to chance.
- (ii) The proportion of variance of the girls' achievement in integrated science attributed to the combined influence of two of the six socio-cultural factors (belief in the masculine nature of science, and belief about negative role of science in marriage) is 0.11206. The change in the variance of science achievement due to the stepwise addition of the single factor of belief about negative role of science in marriage to the other factor is 0.03417 (or 3.417%).
- (iii) The proportion of variance of the girls' achievement in integrated science due to the combined influence of three of the six socio-cultural factors (belief in the masculine nature of science, belief about negative role of science in marriage and belief about negative role of science in religion) to the other two socio-cultural factors is 0.013343. The change in the variance of science achievement due to the stepwise addition of the single factor of belief in the negative role of science in religion is 0.02137 (or 2.137%). With the observed F-value of 2.60 at 0.05 level, the influence of girls' different belief on the negative role of science in religion on their achievement in science is significant at 0.05 level.

- (iv) The proportion of variance of the girls' achievement in integrated science attributed to the combined influence of four of the six socio-cultural factors (belief in the masculine nature of science, belief in the negative role of science in marriage, belief in the negative role of science in religion and agreement of parental encouragement to the study of science) to the other three factors is 0.14617. The change in the variance of science achievement due to the stepwise addition of the single factor of science is 0.01274 (or 1.274%). The observed F-value of 18.04 in respect of this factor is higher than the critical F-value of 2.37 at 0.05 significant level. This implies that the influence of the differences in the extent of the girls' parental encouragement to the study of science on science achievement is significant.
- (v) The proportion of variance of the girls' achievement in integrated science due to the combined influence of five of the six socio-cultural factors (belief in the masculine nature of science, belief in negative role of science in marriage, belief in negative role of science in religion, agreement that parents encourage them to read science and ethnic language) is 0.15418. The change in the variance of science achievement arising from the single factor of ethnic language to four of the other socio-cultural factors is 0.00801 (or 0.801%). The observed F-value in respect of this factor is 11.44 as against the critical F-value of 2.21 at 0.05 significant level. Since the observed F value is greater than the critical F value, the influence of ethnic language on the girls' achievement in integrated science is significant and this cannot be attributed to chance.
- (vi) The proportion of variance of the girls' achievement in integrated science attributed to the combined influence of the six socio-cultural factors under study (masculine nature of science, role of science in marriage, role of science in religion, parents encouragement to study science, ethnic language, parents economic status) is 0.15499. The change in the variance of the achievement due to the stepwise addition

of the single factor of parents economic status to the other five socio-cultural factors is 0.00081 (or 0.081%). Since the observed F value of 1.16 in respect of this factor is less than the critical value of 2.01 at 0.05 level, the influence of parent economic status on the girls achievement in integrated science is not significant. In other words, any observed difference in the mean achievement of girls from parents of economic status is attributed to chance.

From the foregoing, five of the socio-cultural factors : belief in the masculine nature of science, belief in the negative role of science in marriage, belief in the negative role of science in religion, agreement that parents encourage girls to study science and ethnic language, influence achievement in integrated science in JSS girls in Enugu State while parents economic status has no influence in their achievement in the subject.

HO2. *There will be significant influence of school related factors under study on achievement in integrated science of JSS girls in Enugu State, Nigeria*

Table 5 shows the general data of the stepwise multi-regression analysis of the eight school-related determinants of achievement in integrated science among Nigerian Enugu State JSS girls.

Table 5: Stepwise Multiple Regression analysis of school-related determinants of integrated science achievement among Nigerian Enugu State JSS girls.

Sociocultural Variable	Multiple R	R ²	R ² change	B	Beta	Standard error	% variance added	F observed	F critical (P<0.05)
School ownership	0.40773	0.16625	0.16625	-10.91754	-0.39799	9.46572	16.625	241.67*	3.84
School type	0.42509	0.18070	0.01445	2.398673	0.10499	9.38720	1.445	21.36*	3.00
School performance in JSSCE	0.43506	0.18927	0.00858	1.809625	0.09622	9.34180	0.858	12.78*	2.60
School location	0.43804	0.19188	0.00260	-1.39098	-0.06686	9.33064	0.260	3.90*	2.37
Science teachers sex	0.44081	0.19431	0.00243	-1.296240	-0.06273	9.32043	0.243	3.65*	2.21
Class size	0.44152	0.19494	0.00062	-0.4212502	-0.02396	9.32096	0.062	0.93	2.09
Type of studentship	0.44219	0.19553	0.00060	-0.9276178	-0.02741	9.32110	0.060	0.891	2.01
Science equipment availability	0.44254	0.19584	0.00031	-0.2217294	-0.01953	9.32319	0.031	0.46	1.94

* = significant at 0.05 level

* = significant at 0.05 level

- (i) The proportion of variance of the girls' achievement in integrated science attributed to the factor of type of school ownership is 0.16625 (or 16.625%). The observed F value in respect of this factor is 24.61 as against the critical F value of 3.48 at 0.05 significant level. As the observed value is higher than the critical value, then the type of school ownership as a determinant of girls' achievement in integrated science is significant at 0.05 level.
- (ii) The proportion of variance of the girls' achievement in integrated science due to the combined influence of two of the eight school-related determinants (school ownership, school type) is 0.18070. The separate influence of school type as a result of its stepwise combination with school ownership of variance of the girls' achievement in science is 0.01445 (or 1.445%). As the observed F value of 21.36 is higher than the critical value of 3.00 at 0.05 significant level, then the influence of school type on the girls' achievement is significant at 0.05.
- (iii) The proportion of variance of the girls' achievement in integrated science attributed to the combined influence of three of the eight school-related determinants (school ownership, school type, school performance in the JSSCE) is 0.18927. The change in the variance of science achievement due to the step-wise combination of the factor of schools performance in JSSCE with the other two factors (school ownership and school type) is 0.00858 (or 0.858%). The observed F value in respect of the influence of this factor is 12.78. This value is higher than the critical F values of 2.60 at 0.05 significant level. Consequently the influence of schools performance in JSSCE on the girls' achievement in integrated science is significant and is not attributable to chance.
- (iv) The proportion of variance of the girls' achievement in integrated science arising from the combined influence of four of the eight school-related determinants (school ownership, school type, school

performance in the JSSCE and school location) is 0.19188. The change in the proportion of variance of science achievement due to the step-wise addition of a single factor of school location to the other three factors (school ownership, school type and school performance) is 0.00260 (or 0.260%). With the observed F value of 3.90 in respect of this factor being higher than the critical value of 2.37 at 0.05 significant level, the influence of school location of the girls' achievement in integrated science is significant at that level.

- (v) The proportion of variance of the girls' achievement in integrated science attributed to the combined effect of five of the eight school-related determinants (school ownership, school type, school performance in the JSSCE, school location, and school teachers gender) is 0.19431. The change in the proportion of variance of integrated science achievement due to the step-wise addition of a single factor of school teachers gender to the other four factors is 0.00243 (or 0.243%). The observed F value of 3.65 is higher than the critical F value of 2.21 at 0.05 significant level in respect of this.
- (vi) The proportion of variance of the girls' achievement in integrated science attributed to the combined influence of six of the school-related determinants (school ownership, school type, school performance in the JSSCE, school location, school teacher's gender and class size) is 0.19494. The change in the proportion of variance of integrated science achievement due to the step-wise addition of a single factor of class size to the other five factors is 0.00062 (or 0.062%). With the observed F value of 0.93 in respect of this factor being less than the critical F value of 2.09 at 0.05 significant level, the influence of class size on the girls achievement in integrated science is not significant.
- (vii) The proportion of variance of the girls' achievement in integrated science influenced by the combination of seven of the eight school-related determinants (school ownership, school type, school

performance in the JSSCE, school location, school teacher's gender, class size and type of student ship) is 0.19553. The change in the proportion of variance of integrated science achievement due to the step-wise addition of a single factor of type of student ship to other six factors is 0.00060 (or 0.060%). As the observed F value of 0.8993 is less than the critical F value of 2.01 at 0.05 significant level in respect to this factor, the influence of type of student ship on the girls' achievement in integrated science is not significant.

- (viii) The proportion of variance of the girls' achievement in integrated science due to a combination of the eight school-related determinants under study (school ownership, school type, school performance in the JSSCE, school location, school teacher's gender, class size, type of student ship, school equipment availability) is 0.19584. The change in the proportion of variance of integrated science achievement due to the step-wise addition of a single factor of science equipment availability to the other seven factors is 0.00031 (or 0.031%). As the observed F value of 0.46 is less than the critical F value of 1.94 at 0.05 significant level in respect to this factor, the influence of science equipment availability on the girls' achievement in integrated science is not significant.

HO3. *There will be significant influence of socio-cultural factors under study on attitude towards integrated science in JSS girls in Enugu State, Nigeria.*

Table 6: Stepwise multiple regression analysis of socio-cultural determinants of attitude towards Integrated science among Nigerian Enugu State JSS girls.

Sociocultural Variable	Multiple R	R ²	R ² change	B	Beta	Standard error	% variance added	F observed	F critical (P<0.05)
Belief in the masculine nature of science	0.31607	0.09990	3.607326	0.27358	11.05120	11.05120	9.9990	134.52*	3.84
Belief in negative role of science in marriage	0.33875	0.11475	0.01485	1.93584	0.12327	10.96416	1.485	20.30*	3.0
Belief in negative role of science in religion	0.34653	0.12008	0.00533	0.7718633	0.07103	10.93564	0.533	7.32*	2.60
Parental agreement to study	0.34777	0.12094	0.00086	0.3067209	0.03016	10.93479	0.086	1.19	2.37
Parents economic status	0.34859	0.12152	0.00057	-0.1766598	-0.02366	10.93575	0.057	0.79	2.21
Ethnic language	0.34860	0.12153	0.00001	0.57658130	0.00291	10.94023	0.001	0.01	2.01

* = significant at 0.05 level

Table 6 shows detailed data of the stepwise multi-regression analysis of the six socio-cultural determinants of attitude towards integrated science among JSS girls in Enugu State, Nigeria considered in this study.

From this data the following observations are made:

- (i) The proportion of variance of the girls' attitude towards integrated science score attributed to one of the socio-cultural determinants (belief in the masculine nature of science) is 0.09990 (or 9.9990%). The observed F value in respect of this factor is 134.52. This is higher than the critical F value of 3.84 at 0.05 significant level. This implies that the influence of girls' belief in the masculine nature of science on their attitude towards integrated science is significant at 0.05 level.
- (ii) The proportion of variance of the girls' attitude towards integrated science score attributed to the combined influence of two of the socio-cultural determinants (belief in the masculine nature of science, belief in the negative role of science in marriage) is 0.11475. The change in the proportion of variance attitude towards integrated science score as a result of the stepwise addition of the single factor of belief in the negative role of science in marriage is 0.01485 (Or 1.485%). With the observed F value in respect of the influence of the factor on attitude towards integrated science of 20.32 being higher than the critical F value of 3.00, the influence of the girls' belief in the negative role of science in their attitude towards sciences is significant.
- (iii) The proportion of variance of the girls' attitude towards integrated science score attributed to the combined influence of three of the socio-cultural determinants (belief in the masculine nature of science; belief in the negative role of science in marriage; belief in the negative role of science in religion) is 0.12008. The change in the proportion of variance of the girls' attitude towards integrated science score as a result of the stepwise addition of the single factor of belief in the

negative role of science in religion to the other two factors is 0.0533 (or 0.533%). As the observed F value of 7.32 in respect of the influence of the factor on the girls' attitude towards integrated science is higher than the critical F value of 2.60, the influence of the girls' belief in the negative role of science in religion is significant at 0.05 level.

- (iv) The proportion of variance of the girls' attitude towards integrated science score attributed to the combined influence of four of the socio-cultural determinants (belief in the masculine nature of science; belief in the negative role of science in marriage; belief in the negative role of science in religion; parents encouragement to the study of science) is 0.12094. The change in the proportion of variance of the girls' attitude towards integrated science score as a result of the stepwise addition of the single factor of parents encouragement to the study of science to the other three factors is 0.00086 (or 0.086%). The observed F value of 1.19 in respect of the influence of the factor on the girls attitude towards integrated science is less than the critical F value of 2.37. This means that parents' encouragement to the study of science does not significantly influence the girls' attitude towards integrated science.
- (v) The proportion of variance of the girls' attitude towards integrated science score attributed to the combined influence of five of the socio-cultural determinants (belief in the masculine nature of science; belief in the negative role of science in marriage; belief in the negative role of science in religion; parents encouragement to the study of science; parents annual income) is 0.12153. The change in the proportion of variance as a result of the stepwise addition of the single factor of parents' annual income to the other four of the socio-cultural determinants is 0.00057 (or 0.057%). The observed F value of this factor is 0.79 which is less than the critical F value of 2.21 at 0.05 level of significance. Consequently, the influence of parents' economic status on the girls' attitude towards integrated science is not significant.

- (vi) The proportion of variance of the girls' attitude towards integrated science score attributed to the combined influence of six of the socio-cultural determinants (belief in the masculine nature of science; belief in the negative role of science in marriage; belief in the negative role of science in religion; parents encouragement to the study of science; parents economic status; ethnic language) is 0.12153. The change in variance as a result of the stepwise addition of the single factor of ethnic language to the other five factors is 0.00001 (or 0.001%). With the observed F value of 0.01 in respect of this factor being less than the critical value of 2.01 at 0.05 significant level, the influence of the girls' ethnic language on their attitude towards integrated science is not significant.

It is therefore shown that belief in the masculine nature of science; belief in the negative role of science in marriage and belief in the negative role of science in religion are significant and have an influence on the girls' attitude towards science. Parents' encouragement to the study of science; parents economic status; and ethnic language do not influence girls' attitude towards science.

HO4. *There will be no significant influence of school related factors under study on attitude towards integrated science in JSS girls in Enugu State, Nigeria.*

Table 7: Stepwise multiple regression analysis of school-related determinants of attitude towards integrated science among Nigerian Enugu State JSS girls.

Sociocultural Variable	Multiple R	R ²	R ² change	B	Beta	Standard error	% variance added	F observed	F critical (P<0.05)
Class size	0.10556	0.01114	0.01114	-2.342888	-0.11661	11.58326	1.114	13.66*	3.84
School ownership	0.13410	0.01798	0.00684	-2.863477	-0.09290	11.54790	0.684	8.43*	3.00
Science teachers sex	0.15223	0.02317	0.00519	-1.545508	-0.06686	11.52209	0.519	6.43*	2.60
Type of student ship	0.16516	0.02728	0.00410	-2.230796	-0.5866	11.50261	0.410	6.10*	2.37
School performance in JSSCE	0.17253	0.02977	0.00249	1.286328	0.06087	11.49265	0.249	3.10*	2.27
School type	0.17943	0.03219	0.00243	-0.05336	-0.05254	11.48301	0.243	3.03*	2.09
School location	0.18467	0.03410	0.00191	-1.191001	-0.05087	11.47645	0.191	2.38*	2.01
Science equipment availability	0.18809	0.03538	0.607815	0.6078152	0.03980	11.47361	0.128	1.60	1.94

* = significant at 0.05 level

Table 7 shows the comprehensive data of the stepwise multiple regressive analysis of the eight school-related determinants of attitude towards integrated science among JSS girls in Enugu state considered in this study.

- (i) The proportion of variance of the girls' attitude towards integrated science score attributed to one of the school-related factor of class size is 0.01114 (or (1.114%). The observed F value in respect of this factor is 13.66 which is higher than the critical F value of 3.84 at 0.05 significant level. This means that the influence of girls' class size on their attitude towards integrated science is significant at that level.
- (ii) The proportion of variance of the girls' attitude towards integrated science score influenced by a combination of two of the school-related determinants (class size; school ownership) is 0.01748. The change in the proportion of the variance as a result of the stepwise addition of the single factor of school ownership to the factor of class size is 0.60684 (or 60.687%). With the observed F value in respect of this factor being 8.43 which is higher than the critical F value of 3.00 at 0.05 significant level, the influence of school ownership on the girls' attitude towards integrated science is therefore significant at that level.
- (iii) The proportion of variance of the girls' attitude towards integrated science score influenced by a combination of three of the school-related determinants (class size; school ownership; and science teacher's gender) is 0.02317. The change in the proportion of the variance as a result of the stepwise addition of the single factor of science teacher gender to the other school-related factors is 0.00519 (or 0.519%). As the observed F value of 6.43 in respect of this factor is higher than the critical F value of 2.60 at 0.05 significant level, then the influence of science teacher's gender on the girls' attitude towards integrated science is significant at that level.
- (iv) The proportion of variance of the girls' attitude towards integrated

science score influenced by a combination of four of the school-related determinants (class size; school ownership; science teacher's gender; and type of student ship) is 0.02728. The change in the variance proportion as a result of the stepwise addition of the single factor of type of student ship to the other three factors is 0.00410 (or 0.410%). The observed F value of 6.10 for this factor which is higher than the critical F value of 2.60 at 0.05 significant level, implies that the influence of type of student ship on the girls' attitude towards integrated science is significant at that level.

- (v) The proportion of variance of the girls' attitude towards integrated science score influenced by a combination of five of the school-related determinants (class size; school ownership; science teacher's gender; type of student ship; and school performance in JSSCE) is 0.02977. The change in the variance proportion as a result of the stepwise addition of the single factor of school performance in JSSCE is 0.00249 (or 0.249%). The corresponding observed F value of 3.10 is higher than the critical F value of 2.27 at 0.05 significant level. Consequently, the influence of school performance in JSSCE on the girls' attitude towards integrated science is significant.
- (vi) The proportion of variance of the girls' attitude towards integrated science score influenced by a combination of six of the school-related determinants (class size; school ownership; science teacher's gender; type of student ship; school performance in JSSCE and school type) is 0.03214. The change in the variance proportion as a result of the stepwise addition of the single factor of school type to the other five factors is 0.00243 (or 0.243%). The observed F value of 3.03 in respect of this factor is higher than the corresponding critical F value of 2.04 at 0.05 significant level.
- (vii) The proportion of variance of the girls' attitude towards integrated science score influenced by a combination of seven of the school-related determinants (class size; school ownership; science teacher's

gender; type of student ship; school performance in JSSCE, school type and school location) is 0.0314. The change in the variance proportion contributed by the stepwise addition of the single factor of school location to the other six school-related factors is 0.00191 (or 0.191%). With the corresponding observed F value of 2.38 in respect of this factor being higher than the critical F value of 2.01 at 0.05 significant level, then the influence of school location on the girls' attitude towards integrated science is significant.

- (viii) The proportion of variance of the girls' attitude towards integrated science scores influenced by a combination of eight of the school-related determinants (class size; school ownership; science teacher's gender; type of student ship; school performance in JSSCE; school type; school location; science equipment availability) is 0.03538. The change in the variance proportion resulting from the stepwise addition of the single factor of science equipment availability to the other seven school-related factors is 0.00128 (or 0.128%). Since the observed F value of 1.60 in respect of this factor is less than the corresponding critical F value of 1.44 at 0.05 level of significance, the influence of science equipment availability on the girls' attitude towards integrated science is not significant at that level.

From the foregoing, it has been shown that apart from science equipment availability, all the other seven school related factors of class size, school ownership, science teacher's gender, type of student ship, school performance in JSSCE, school type and school location significantly influence the attitude towards integrated science of JSS girls in Enugu state.

Policy Implications and Conclusions

There is need to initiate valid revision of the current Nigerian Integrated Science Program. Such revisions should among other things aim at:

- (i) Evolving an integrated science program for Nigerian JSS with gender-neutral or gender-equitable proportion of learning experiences relevant to the students' immediate environment.
- (ii) Evolving an integrated science program composed of relevant contents on learning experiences with potential for resolution of possible discrepancies between the Nigerian student's socio-cultural view of science and the orthodox Western view of science, particularly as this influences the status of women and their expectations in a typical Nigerian society.
- (iii) Establishing more girls-only JSS types than the mixed type of JSS in urban locations and/or providing the rural located girls-only type JSS with relevant facilities and environmental experiences parallel in quantity and quality with their urban-located counterparts.
- (iv) Assigning male science teachers to teach science to JSS girls.
- (v) Encouraging JSS girls to be day students.
- (vi) Disseminating and popularizing information among parents and guardians, on the diverse and abundant opportunities and prospects available for girls who complete their JSS level study and do well in the sciences. This would sensitize parents/guardians towards encouraging or motivating the girls to study science at the JSS level.

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