



Attitude of Secondary School Physics Students to Mathematics: a Case Study of Nsukka Education Zone in Nigeria and Adamawa Region in Cameroon

KEYWORDS

Attitude, Mathematics, Physics, Nigerian students, Cameroonian students

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ABSTRACT *The study investigated the attitude of secondary school physics students to mathematics. The design adopted was a descriptive survey. The sample was 561 comprising four physics students in the four Anglo-Saxon secondary schools in Adamawa Region of Cameroon and 355 physics students in six sampled public secondary schools in Nsukka Education Zone of Enugu State, Nigeria. The instrument for data collection was a 16 item mathematics attitude scale (MAS) developed by the researchers. The internal consistency of MAS was .98 obtained using Cronbach alpha procedures. Data obtained were analyzed using means and standard deviation and t-test. The findings indicated that physics students had a positive mathematics attitude; that female physics students had a higher positive attitude to mathematics than their male counterparts. Nigeria physics students had a more positive attitude to mathematics than their Cameroonian counterparts. There was no significant gender influence on students' mathematics attitude. Mathematics attitude differed significantly between Cameroonian and Nigerian physics students.*

1. Background

Any nation which values its socio-economic development does not need to be reminded of the importance of science and technology. Indeed, science and technology have been recognized as the basis for socio-economic development (Njoku, 2001). In the face of current globalization and environmental crisis, developed and developing nations struggle to meet up the emergent challenges by revolutionizing their science and technology potentials. The school subject physics is the axis about which science and technology rotates. In Nigeria, students take physics under integrated science from Junior Secondary School (JSS) 1 to JSS 3 whereas in Cameroon physics is a school subject taken from the first year in the secondary school. Research in Nigeria and Cameroon indicate low enrolment and poor achievement in physics (Ogunleye, 2001; Akem, 1993; Etah, 1990). When students in Nigeria embark on the study of physics in senior secondary school (SSS) 1, unlike their counterparts in Cameroon, they are not really aware of the mathematics which is involved in the study of physics as a result of inexperienced integrated science teachers. The students in Cameroon are at least aware of the mathematics which is involved in the study of physics because they take physics as a school subject from the first year of secondary school.

There are findings in Nigeria revealing that teachers who teach integrated science concentrate more on the biology section and neglect the chemistry and physics sections for lack of experience. This is evidenced from the findings of a survey carried out by Okoye (1999) who did an appraisal study of teachers of science, technology and mathematics (STM) in 35 sampled secondary schools in Anambra state. He reported that there were no qualified integrated science teachers in any of the 35 sampled schools. Also, Usman and Shaibu (2002) surveyed the effect of NISTEP modes of teaching on students' academic achievement in integrated science among Junior Secondary School students in Kaduna state of Nigeria. They reported paucity of specialists' teachers in integrated science. In Nigeria, the students take the Senior Secondary School Certificate Examination (SSCE) in their fi-

nal year of the three year senior secondary while in Cameroon, the students write the Cameroon General Certificate Examination (CGCE) in their final year which is the fifth year of the first cycle of the secondary school. In both examinations, mathematics is a compulsory subject to be taken by all the candidates. This might mean that the students starting physics in SSS 1 are not well grounded especially in the basic mathematics content of physics owing to low physics content knowledge of integrated science teachers.

The fact that physics is like two subjects in one (mathematics and physics) might pose a big problem to students in physics. According to Igboke (2001), students exhibit fear, dislike and evidence of very shallow understanding of mathematics components of physics. The amount of mathematics content in physics compounds students' phobia for physics. In Cameroon, the students from their year one encounter mathematics in physics until year four when they decide to take or drop physics, whereas physics students in Nigeria start physics in year four and only then begin to encounter the mathematics content of physics. Surprisingly, both Cameroonian and Nigerian students shy away from physics (Akem, 1993; Njoku, 2001). It is not clear whether these students find physics inherently difficult to understand or whether the problem lies in students' mathematics phobia which they express in generalized anxiety and defeatist disposition to subjects that demand computational ability.

Disposition to a school subject may manifest in the form of attitude. Attitude according to Kosslyn and Rosenberg (2004:674) "is an overall evaluation about some aspect of the world". One's attitude affects the interpretation, evaluation, disposition or temperament towards that aspect of the world, people, issues or objects. Attitude also determines behaviour or how one feels about something or somebody. If a positive attitude could be cultivated towards a learning activity, it will likely lead to achievement in that activity. Mbamalu (1990) investigated students' attitude towards physics in Anambra state secondary schools and found that students with low attitude to physics not only dropped the subject but discour-

aged others from entering the course in general certificate examination. Gender influence has been implicated both in science enrolment and science achievement. Low enrolment coupled with poor achievement in physics has been reported among girls in Cameroon (Cameroon General Certificate of Education Board report of 2006, 2007 and 2008). According to Okeke (1990), education from the colonial era discriminated against women. Limited access to secondary level education also placed a class ceiling to female students' chances in science, technology and mathematics in many African societies. Nzewi (1999), in a study of girls' movement away from science: a look at the influence of teacher classroom behaviour concluded that perception of science as difficult created a barrier for girls which became difficult to overcome. Nzewi further stresses that girls viewed success in sciences unfeminine and this was confounded by the absence of female role model especially when mathematics, chemistry and physics classes were mainly taught by males.

a. Problem of the study

Low enrolment and poor achievement in physics indicate that secondary school students are scared of physics. It would appear that the content of physics scares students from physics. Physics as a subject matter has its contents very logically related to each other with concepts grounded in mathematical calculations. It is not clear whether it is the mathematics components of physics that make students shy away from the study of physics. The problem of the study therefore stated in question form is; what is the attitude of secondary school physics students to mathematics?

Research Questions

The following research questions guided the study:

1. What is the mean score of secondary school physics students on the Mathematics Attitude Scale?
2. To what extent does the mean score of Cameroonian physics students and Nigerian students differ on the MAS?
3. To what extent does the mean score of male and female physics students differ on the MAS?

Hypotheses

The following null hypotheses were tested at 0.05 level of probability.

H₀₁: The mean scores of secondary school physics students on the MAS are independent of gender.

H₀₂: The mean scores of secondary school physics students on the MAS do not significantly depend on nationality.

b. Method

The method adopted for the study is a descriptive survey. The population is made up of all form 4 students in Anglo-Saxon subsystem in Cameroon and all senior secondary (SS 1) students in Nigeria. The sample comprises all 206 form 4 students in the Anglophone section of the four secondary schools in Adamawa Region of Cameroon and all 355 SS 1 students in six sampled public schools in Nsukka Education Zone of Nigeria in 2010. In Nigeria, the researchers used the sample random sampling technique to sample six public schools in Nsukka Education Zone. There was no sampling in Cameroon since the researchers could handle all form four students in the four secondary schools in the region. The instrument for data collection was a 16 item mathematics attitude scale (MAS) developed by the researchers. The items were structured to describe the attitude of the respondent towards mathematics as a school subject. They covered knowledge components of students' attitude towards mathematics, students' emotional reactions towards mathematics and action or students' behaviour towards mathematics.

The scale has response options of strongly agree (SA), agree (A), Disagree (D) and strongly disagree (SA) weighed 4, 3, 2, and 1 respectively. A mean score of 2.5 and above on the scale was adjudged positive while a mean score of below 2.5 was adjudged negative. The internal consistency estimate obtained for MAS using Cronbach alpha was .98. Data obtained were presented using means, standard deviation while the student t-test statistics was used to test the null hypotheses.

2. Results

The result of the study was presented in line with the research questions and corresponding hypothesis.

Research Question one, three and hypothesis one

Table 1: Mean scores and standard deviations of male and female secondary school physics students on MAS

S.No	Item Statement	nM (males)=256; nF (Females)=305; N=561					
		XM	XF	SDM	SDF	XN	SDN
1.	I usually enjoy mathematics lessons.	3.29	3.27	.80.	.80	3.28	.80
2.	All topics in mathematics are difficult to understand.	3.17	3.30	.96	.80	3.25	.88
3.	I usually enjoy physics lessons involving mathematical calculations.	2.78	2.82	.99	.97	2.80	.98
4.	If mathematics is necessary for success in physics most students will drop physics.	2.59	2.46	1.11	1.10	2.52	1.11
5.	Success in final examination in physics depends on knowledge in mathematics.	2.96	3.04	.96	.89	3.00	.92
6.	I hate mathematics so I also hate physics.	3.19	3.23	1.04	1.0	3.21	1.02
7.	I do well in projects requiring construction and production of objects of spectacular shapes.	2.28	2.44	1.18	1.13	2.37	1.15
8.	I do not see how mathematical calculations are related to physics.	2.57	2.67	1.25	1.18	2.62	1.21
9.	In bookstands my attention is always caught by mathematical books	2.31	2.53	1.07	1.11	2.43	1.10
10.	I am happy when mathematics teacher is absent.	.18	3.29	.86	.98	3.24	1.00
11.	Solving mathematics everyday can improve one's knowledge in it.	3.63	3.67	.72	.68	3.65	.70
12.	I do not see how mathematics help physics to solve practical problems in life.	3.06	2.92	.99	1.09	2.98	1.05
13.	I spend my free time solving mathematics.	2.64	2.43	.91	.91	2.55	1.03
14.	I will do physics if there is no mathematics involved.	2.62	2.75	1.09	1.16	2.69	1.13
15.	I spend my past time checking how mathematics relates to some life experiences.	2.68	2.68	1.01	.93	2.68	.97
16.	Sometimes physics teacher has problems explaining the calculations in physics.	2.70	2.43	1.13	1.16	2.55	1.15
Grand mean and standard deviation		2.84	2.87	1.00	.99	2.86	1.01
t cal.=.375 t crit.=1.96 df=559							

The mean score of students on MAS is positive. Their mean score is 2.86 which is above the decision mean score of 2.50. This indicates that most physics students have a positive attitude to mathematics, although most physics students do not agree on items 7 and 9 on the questionnaire.

The mean scores of male and female students on MAS were 2.84 and 2.87 respectively. The result indicates a positive attitude. Female students had a higher mean score than the males. The mean scores of both males and females were negative only on item 7 on the questionnaire. The females have negative scores on items 4, 13 and 16 while their male

counterparts have negative scores only on item 9.

The calculated τ value of .375 is far less than the table value of 1.96. Thus the null hypothesis is not rejected. That is the mean score of secondary school physics students on the MAS is not significantly influenced by gender. Male and female physics students have positive attitude to mathematics.

Research Question Two And Hypothesis Two:

Mean scores and standard deviation of Nigeria and Cameroon secondary school physics students on MAS

S.No	Item Statement.	nn(Nigeria)=355;	nc(Cameroon)=206	Xn	SDn	Xc	SDc
1.	I usually enjoy mathematics lessons.			3.31	.79	3.22	.81
2.	All topics in mathematics are difficult to understand.			3.37	.74	3.05	1.03
3.	I usually enjoy physics lessons involving mathematical calculations.			2.87	.93	2.61	1.09
4.	If mathematics is necessary for success in physics most students will drop physics.			2.43	1.12	2.64	1.07
5.	Success in final examination in physics depends on knowledge in mathematics.			3.10	.87	2.87	.99
6.	I hate mathematics so I also hate physics.			3.30	.97	3.07	1.09
7.	I do well in projects requiring construction and production of objects of spectacular shapes.			2.97	.93	1.49	.86
8.	I do not see how mathematical calculations are related to physics.			3.18	.95	1.72	1.02
9.	In bookstands my attention is always caught by mathematical books.			2.81	1.00	1.91	1.01
10.	I am happy when mathematics teacher is absent.			3.29	.96	3.17	1.07
11.	Solving mathematics everyday can improve one's knowledge in it.			3.62	.70	3.69	.70
12.	I do not see how mathematics help physics to solve practical problems in life.			2.92	1.06	3.09	1.01
13.	I spend my free time solving mathematics.			2.95	.86	1.99	.90
14.	I will do physics if there is no mathematics involved.			2.59	1.13	2.80	1.11
15.	I spend my past time checking how mathematics relates to some life experiences.			2.76	.96	2.60	.89
16.	Sometimes physics teacher has problems explaining the calculations in physics.			2.30	1.11	2.90	1.06
	Grand mean and grand standard deviation			2.99	.94	2.68	.92

$t_{cal}=3.92$ $t_{crit}=1.96$ $df=559$

The mean scores of Cameroonian and Nigerian physics students on the MAS are both positive. But the mean score of Cameroonian physics students of 2.68 is lower than that of Nigerian physics students with 2.99. The Nigerian physics students have a more positive attitude to mathematics than their Cameroonian counterparts. This is seen from the low negative mean on items 7, 8, 9 and 13 for the Cameroonians' response on the questionnaire items as against items 4 and 16 of students in Nigeria.

The τ calculated value of 3.92 is greater than the table value of 1.96. The null hypothesis is rejected. Therefore the mean score of secondary school physics students on the MAS significantly depends on nationality.

2.1a Discussion

The findings show that male and female physics students in both Nigeria and Cameroon have positive attitude to mathematics. Therefore they reported low enrolment and poor achievement in physics is not due to the attitude of students to mathematics or mathematics phobia. These findings do not agree with that of Lawrence (1998), who reported that mathematics was a constraint in teaching Advanced Level physics because physics students had cultivated a negative attitude to mathematics at ordinary level physics. Again, the positive attitude indicator of physics students to mathematics did not support Akem (1993), that many students find mathematics itself difficult and are put off in physics.

This finding disagrees with the findings of Nkpa (1999) who revealed that mathematics phobia contributes to gender inequities in science and technology education. The assertion of Ogunleye (2001) that the heavy dependence on mathe-

tics makes most girls at the senior secondary school level to dread physics is not supported by the findings.

Though the enrolment and poor achievement in physics has been reported in both countries (Ali, 1998; Johnson, 2002 and Jacks, 2004) the attitude of students to mathematics could not be a major factor. This survey is carried out in Anglo-Saxon secondary schools in the Francophone zone in Cameroon. From the authors experience most students in these schools come from Francophone background and they usually have language problem in secondary schools. So, the lower mean score on their attitude to mathematics as against that of Nigerian students could be as a result of language barrier to understanding some mathematical concepts.

Since attitude of students to mathematics is positive, then internal cognitive variables such as interest, aptitude do not explain low enrolment of secondary school students in physics in Nigeria and the Cameroons. It may well be that other external factors such as job market opportunities and job prestige for mathematics and physics based occupations make beginning science students shy away from physics.

Another explanation of the difference in attitude of Cameroon and Nigerian physics students to mathematics is that in Nigeria, the students start up with physics in SS1 with the knowledge that mathematics and physics are complementary subjects. Since they have to take physics, they have to cultivate a positive attitude to mathematics. But in Cameroon, the students are made in their junior classes to take mathematics and physics as two separate subjects with little or no relationship for avoidance of their being scared of the mathematics content of physics at the junior level. The students in

Cameroon start the mathematics content of physics in form three when most of them already have a negative attitude to mathematics and this then throws them off physics by form four.

2.1b Conclusion

Most students taking physics have a positive attitude to mathematics. This finding contradicts most findings in the sense that the mathematics content of physics is a negative factor which scares students from physics. Also, the findings have also not supported many findings which have always attributed greater negative attitude to mathematics to female than to male students. In the case of nationality, it can rightly be concluded that a nations' system of education could have an impact on students' academic pursuit.

The conclusion that students' attitude to mathematics is positive, may then mean that low enrolment in physics is not attributable to mathematics phobia. Therefore educators and researchers may have to seek other external factors to explain low enrolment in physics. Such other external factors may include job values (such as pay, cultural prestige, social influence and even job market opportunities) for mathematics/physical based careers and occupations.

It is recommended that teachers of physics and mathematics infuse extensive job analysis in various occupations and the value of mathematics and physics in such occupations in normal classes for beginning science students.

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