# RELATIONSHIP BETWEEN AFFECTIVE CHARACTERISTICS AND STUDENTS' PERFORMANCE IN SCIENCE AND MATHEMATICS IN MAKURDI METROPOLIS OF BENUE STATE

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**Abstract**
*The study was conducted to determine the relationship between affective characteristics of students and their class performance in Science and Mathematics in Makurdi Metropolis of Benue State. The population was made up of Senior Secondary 1 (SS1) science students in Makurdi Metropolis of Benue State. Four hundred and Twenty-one SS1 science students (212 males and 209 females) were randomly selected from 12 schools that offer science subjects and use the government approved report sheets which have provision for assigning values to the affective characteristics of the students. The study was a survey design that collected data on the affective characteristics and class performance of students by using questionnaire. Pearson Product Moment Correlation (PPMC) statistic was used to analysed the data obtained from the affective characteristics scores of the students and their scores in chemistry, physics, biology and mathematics. Two research questions and two hypotheses were used for the study. The findings of the study revealed there was relationship between the affective characteristics scores of male and female science students and their performance in science and mathematics. The study recommends that the teachers should build up good rapport with students to increase attentiveness, class attendance, punctuality and curiosity in the science students.*

**Keywords:** *Affective characteristics, performance, relationship, science, learning*

## Introduction

The study of science and mathematics has been recognized all over the world as major tools for advancement of Science, Technology and Mathematics (STM). Science, Technology and Mathematics have become critical factors for sustainable development worldwide. Nations all over the world today are striving hard to develop their students in Science, Technology and Mathematics (STM). Science, Technology and Mathematics have been instrumental in shaping and improving the life of mankind (Nwachuku, 2009). The acquisition of scientific attitudes as well as science process skills necessary for self-reliance and societal adjustment corroborates the fact. STM education also plays an important role in the development of a nation's economy because it forms the basis for the different emerging technologies that the world's operations are now hinged upon. Despite this importance of STM subjects to both individual and national development, students who are supposed to be the link between the knowledge gained in the classroom and societal development still perform below average in external examinations (Akinsowon & Osisanwo, 2014).

Science has multidimensional fields of study. Science, especially at the secondary school level is divided into three major subjects which are chemistry, biology and physics. While chemistry is primarily concerned with matter and its properties, biology deals with the scientific study of

living things, their relationship with one another and with the natural environment among other things while physics involves the study of matter, energy and their interactions (Adolphus, Alamina & Aderonmu, 2013).

In their attempt to improve secondary school students' performance in science subjects, researchers over the years have worked on several variables which they tried to manipulate and find out the effects they have on the learning outcomes of students. Despite the numerous teaching strategies put forward by researchers over the years a paradigm shift towards the study of the influence of learners' characteristics on their academic performance also became necessary. Stakeholders in education tend to have overlooked the importance of the affective domain in learning (White, 2014).

While the affective dimensions of science learning have long been recognized as important, they have received much less attention by researchers than have the cognitive dimensions. Reasons for this imbalance include the archetypal image of science itself, where reason is separated from feeling, and the long-standing cognitive tradition of science education research. Often mentioned students' characteristics in research are students' attitude, motivation, perception, conception and manipulative skills which can be classified under affective, cognitive and psychomotor domains. It is the affective characteristics of the learner however, that has received little attention from teachers. The affective characteristics includes a host of constructs, such as attentiveness in the class, attendance to class, punctuality, neatness, politeness, self-control, relationship with others, curiosity, honesty, humility, tolerance, leadership and courage. Less attention has been given to these 13 affective constructs which may encourage or discourage the adoption of effective learning behaviours. Few aspects of affective domain have been demonstrated to have a significant influence on students' learning (McConnell & Kraft, 2011). For example, Perry, Hall and Ruthig (2007) showed a profound link between students' feeling of "control" and learning. Robbins, Lauver, Davis and Langely (2004), Covington (2007), Pekrun (2007), Zusho, Pintrich and Cappola (2003), and McConnell et al. (2010) demonstrated that some aspects of student motivation have more significant influences on college student performance (as measured by class scores) than does student ability measured by standardized test results.

The perception of a task will be strengthened if the students believe that it has relevance to their life and especially after the class hours. A student who places more value and interest in the task typically shows greater learning, persistence, and effort (Wigfield & Eccles, 2002). Students with high values, motivational drive and expectation, will try harder, persist longer on tasks, and generally perform better on course assignments than do students who have lower expectations (Pintrich & DeGroot, 1990; Pintrich, 2003; Bykerk-Kauffman et al., 2009; McConnell et al., 2010). A student who knows what is needed in order to complete a task will begin with low task (or test) anxiety, whereas a student who perceives the task as difficult or is unclear on the expectations may begin with heightened anxiety that can interfere with the learning process.

The influence of gender on affective characteristics of learners especially on attitude, interest and motivation has been a source of concern to most researchers though no consistent result has been established. For instance, results from Awang, Ahmad, Wahad and Mamat (2013) indicated that there are no significant differences between male and female students with regards to most affective items such as attending classes in a timely manner, interest towards

teaching aids, enjoyable class activities, being active in class, doing revision and making own note except for items of love to attend everyday class and read additional materials. Also, Akinsowon and Osisanwo (2014) asserted that girls are considerably less interested in science subjects than boys. In contrast, Shekhar and Devi (2012) observed that females have a higher achievement motivation compared to males. It is therefore quite obvious that discrepancies still abound between the affective disposition of males and female's students towards science, and for this reason gender and its effect on the affective characteristics of the learners in mathematics, chemistry, physics and biology will be considered in this study.

A contemporary view is that the affective dimension is not just a simple catalyst, but a necessary condition for learning to occur (Pintrich, 2003). Attitude and motivation are indeed the most critically important constructs of the affective domain in science education, and remain mostly unmeasured. This assertion therefore provides the impetus for the present study which is aimed at ascertaining the effect of the affective characteristics on the male and female students' test scores in mathematics, chemistry, physics and biology in Makurdi Metropolis of Benue State.

**Purpose of the Study**

The purposes of the study are:

(i) to find the relationship between the affective characteristics scores of secondary school students and their performance in mathematics, chemistry, physics and biology.

(ii) to find out the relationship between the affective characteristics scores of male and female secondary school students and their performance in mathematics, chemistry, physics and biology.

**Research Questions**

The following research questions were raised to guide the study.

(i) Is there any relationship between the affective scores of secondary school students and their performance in mathematics, chemistry, physics and biology?

(ii) Is there any relationship between the affective scores and the performance of male and female science students in mathematics, chemistry, physics and biology?

**Hypotheses**

The following null hypotheses were formulated to guide the study:

**$Ho_1$:** There is no relationship between the affective scores of secondary school science students and their performance in mathematics, chemistry, physics and biology.

**$Ho_2$:** There is no relationship between the affective scores and the performance of male and female secondary school science students in mathematics, chemistry, physics and biology.

**Methodology**

The study adopted the survey type of research design. Copies of questionnaire were given to the class teachers at the SSI level for data collection on the affective characteristics of the science students. The population of the study consisted of all SSI science students in Makurdi Metropolis of Benue State. The sample consisted of 421 SSI science students (212 males and 209 females) from 12 schools that offer science subjects and use the government approved report sheets which have provision for assigning values to the affective characteristics of the students. This is because it is those values assigned to the affective characteristics of the students in their report sheets that were correlated with the performance scores of students in

each of mathematics, chemistry, physics and biology. The sample for the study was selected through random and purposive sampling techniques across the schools in Makurdi Metropolis of Benue State. The correlation was estimated using the Pearson Product Moment Correlation (PPMC) at 0.05 level of significance.

**Instrument**

The instrument used for the study consisted of sections A and B. Section A was made up of demographic information of the students on gender, school and class. Section B consisted of 13 general characteristics on the affective development of the science students (tables 2 and 3). The class teacher was to tick (√) under the headings, excellent (5), very good (4), good (3), fair (2) and poor (1) the one which reflect his opinions most about the students (table 1). This was how the ratings were made on the government report sheet. The class performance of each science and mathematics students was also collected.

**Table 1: Key to rating the students' affective characteristics**

| Heading | Excellent | Very Good | Good | Fair | Poor |
|---|---|---|---|---|---|
| Point | 5 | 4 | 3 | 2 | 1 |

**Decision**

The strength of the relationship was tested using the following statistical decision of coefficient of correlation at p = 0.05 (Daramola, 2006).

If $0.0 \leq r \leq 0.20$, relationship is negligible
If $0.21 \leq r \leq 0.40$, relationship is low
If $0.41 \leq r \leq 0.60$, relationship is moderate
If $0.61 \leq r \leq 0.80$, relationship is substantial
If $0.81 \leq r \leq 1.00$, relationship is high

**Data Analyses**

The points in table 1 was used to score the ratings of the teachers to the items of the questionnaire. Hypotheses 1 and 2 were tested after calculating using Pearson Product Moment Correlation at 0.05 level of significance. SPSS version 21 was used for the analyses.

**Results**

The result of the study is presented below based on the hypotheses of the study.

**$Ho_1$:** There is no relationship between the affective scores of secondary school science students and their performance in mathematics, chemistry, physics and biology.

**Table 2: Correlation coefficients of science students' affective characteristics scores and performance in Mathematics, Chemistry, Physics and Biology**

| | Correlation r for Students Scores | | | |
|---|---|---|---|---|
| **Affective Char** | **Maths** | **Chem** | **Phys** | **Bio** |
| Attentiveness | .68 | .54 | .56 | .50 |
| Attendance | .67 | .46 | .40 | .35 |
| Punctuality | .53 | .60 | .57 | .55 |
| Neatness | .47 | .42 | .35 | .71 |
| Politeness | .42 | .50 | .26 | .62 |
| Self control | .76 | .52 | .51 | .50 |
| Relationship with others | .64 | .56 | .47 | .50 |
| Curiosity | .65 | .40 | .52 | .63 |
| Honesty | .29 | .26 | .48 | .56 |
| Humility | .48 | .54 | .38 | .54 |
| Tolerance | .45 | .46 | .59 | .50 |
| Leadership | .42 | .49 | .50 | .60 |
| Courage | .08 | .18 | .08 | .17 |

Table 2 shows the correlation coefficients between students' affective score and their performance in mathematics, chemistry, physics and biology. The correlation coefficients between attentiveness and score in mathematics (r = .68) showed a substantial relationship. Substantial relationship was also obtained between students' scores in attendance and score in mathematics (.67), self-control and score in mathematics (.76), students neatness and score in biology (.71) among others. The least correlation coefficients are between students scores in courage and mathematics (r = .08), chemistry (r = .18), physics (r = .08) and biology (r = .17) which all gave negligible relationships.

**$Ho_2$:** There is no relationship between the affective scores and the performance of male and female science students in mathematics, chemistry, physics and biology.

**Table 3: Correlation coefficients of male and female students' affective scores and performance in Mathematics, Chemistry, Physics and Biology**

| **Affective** | **r for Male Students Scores in** | | | | **r for Female Students Scores in** | | | |
|---|---|---|---|---|---|---|---|---|
| **Characteristics** | **Maths** | **Chem** | **Phys** | **Bio** | **Maths** | **Chem** | **Phys** | **Bio** |
| Attentiveness | .78 | .48 | .53 | .47 | .55 | .52 | .56 | .59 |
| Attendance | .67 | .32 | .38 | .34 | .62 | .61 | .42 | .42 |
| Punctuality | .45 | .58 | .67 | .33 | .57 | .74 | .92 | .53 |
| Neatness | .43 | .33 | .25 | .56 | .56 | .61 | .52 | .86 |
| Politeness | .34 | .47 | .25 | .65 | .55 | .52 | .31 | .59 |
| Self-control | .56 | .43 | .45 | .37 | .92 | .61 | .58 | .62 |
| Relationship with others | .67 | .47 | .38 | .45 | .57 | .54 | .62 | .63 |
| Curiosity | .54 | .41 | .46 | .47 | .56 | .39 | .59 | .79 |
| Honesty | .37 | .24 | .50 | .56 | .25 | .52 | .46 | .59 |
| Humility | .43 | .30 | .40 | .54 | .52 | .61 | .35 | .62 |
| Tolerance | .34 | .54 | .56 | .37 | .57 | .54 | .62 | .63 |
| Leadership | .28 | .48 | .39 | .53 | .56 | .59 | .59 | .68 |
| Courage | .06 | .21 | .03 | .21 | .10 | .19 | .13 | .13 |

Table 3 shows the correlation coefficients of male and female students' affective scores and their performances in mathematics, chemistry, physics and biology. The highest correlation coefficient of r = .86 was obtained between female science students' scores in punctuality and physics, and showed substantial relationship. For the male students, the correlation between affective score of students in attentiveness and scores in mathematics, r = .78 also showed a substantial relationship. Negligible relationships were obtained between scores of male and female students in courage and mathematics, chemistry, physics and biology.

**Discussion and Conclusion**

The findings of this study can be obtained from tables 2 and 3. Table 2 shows relationship between students' affective scores and performance in Mathematics, Chemistry, Physics and Biology. The correlation coefficients between attentiveness and score in mathematics (r = .68) showed a substantial relationship. Substantial relationship was also obtained between attendance and score in mathematics (.67), self-control and score in mathematics (.76), students' neatness and score in biology (.71) among other showed substantial relationship.

These showed that the affective characteristics terms of attentiveness, class attendance, punctuality, relationship with others and curiosity among others play important roles in the performance of the students. These agree with the findings of Michelli (2013) that found significantly positive correlation between students' attitudes and their performance in Mathematics. Also Olusola and Rotimi (2012) found out that students do well in physics when they adopt a positive attitude to the subject. On a general basis, Narmadha and Chamundeswari (2013) found out in their study that positive disposition of students at the secondary school level towards the learning of science leads to a subsequent improvement in their academic achievement.

Data in table 3 show the correlation coefficients between male and female students' affective scores and their performances in mathematics, chemistry, physics and biology. The correlation coefficient between male science students' scores in attentiveness and mathematics was the highest (r = .78) and showed a substantial relationship. The relationship between female students scores in punctuality and physics (r = .92) also showed a substantial relationship. These findings corroborated that of Fatoba and Aladejana (2014) in a study in which they examined the effects of gender on secondary school students' attitude in Physics. There was slight difference in attitude of the students in favour of females which led to better performance. In another related study, Adebule and Aborisade (2014) observed no significant difference in gender and the correlation between affective characteristics and performance of secondary school students in Mathematics and therefore recommended that sex should not be considered as a factor influencing the affective characteristics of students towards Mathematics and thus teachers should teach the subject freely among students of different genders. Oluwatelure (2015) revealed that there was a significant gender difference in the performance of students in science. A significant difference was also observed in the attitude of male and female students. A positive relationship was observed in the attitude and performance of students in science. A positive relationship was also observed between students' attitude towards science and scientific attitudes of the respondents. Conclusively, gender of learners is an important factor that must be considered in the teaching and learning of science. Both male and female developmental inputs are required for the development of science and technology in the society.

**Recommendations**

From the findings, the following recommendations were made.

(i) Students should be exposed to a friendly and interesting classroom environment. Comfortable learning environment will create a good positive attitude and discourage bad attitudes. As students' achievements are associated with their attitudes, values, interest, motivation and participation in class activities, organizing learning environment in an attractive manner is vital.

(ii) There should be change in learning attitude from boredom, sheer drudgery, apathy and indifference to enthusiasm and excitement, to allow students develop appropriate affective characteristics.

(iii) The current study also recommends that the teachers should build up good rapport with students to increase attentiveness, class attendance, punctuality and curiosity in the science students.

(iv) There is a pressing need to look more closely at the nature of the teaching and learning processes in classes and to note the affective factors that contribute to consistent improvements to students' performance.

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