Relationship Between Self-Concept and Mathematics Achievement of Senior Secondary Students in Port Harcourt Metropolis

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Abstract *This study explored the extent to which the self-concept of students in Port Harcourt relates to their Mathematics, and General Academic Achievement. The population consisted of 6,478 senior secondary 3 (SS3) students from 13 state financed senior secondary schools in Port Harcourt. Stratified random sampling was conducted to select 3 schools (one school each from 2 mixed schools, 5 boys' schools and 6 girls' schools). The sample for study was 300 SS3 students from the 3 randomly selected schools. The instrument used for data collection was the Self-Description Questionnaire 111 (SDQ 111) developed by Marsh (1992) which contains 13 self-concept facets out of which 2 facets (Mathematics, and General Academic) where adopted for this study. The subjects were tested in Mathematics and scores obtained. The general average scores of the students on their promotion examination from SS2 to SS3 were extracted from their school records. The Person's Product Moment Correlation analysis was used to answer the research questions, while the transformed t-test was used to test all the 3 hypotheses formulated for this study. The results of the tests indicated that Mathematics Self-concept is significantly related to Mathematics Achievement, General Academic Achievement and General Academic Self-concept. The main implication of the findings of this study is that self-concept and Mathematics, and General Academic achievement of students are so strongly related that a change in self-concept facilitates a change in achievement. It was therefore, recommended that educational programme designers and developers, teachers, parents and students should make self-concept development of students an educational aim as important as academic achievement.*

Keywords: Self-concept, Mathematics Achievement, General Academic Achievement.

Introduction

Students' performance in Secondary School Certificate Examinations (SSCE) administered by the West African Examination Council (WAEC), and the National Examination Council (NECO), continued to deteriorate from year to year, particularly in the areas of Science and Mathematics (Akubuiro and Joshua, 2004). For Nigeria, a developing country that needs Science and Technology for its development, the poor performance of students in Science and Mathematics and worse still, the very insignificant proportion of students who choose Mathematics as a course of study after secondary education have turned the concern of the government and people of Nigeria into anxiety. This situation does not favour Nigerian's move towards developing a science and technology culture.

However, this problem is not peculiar to Nigeria. Even the developed nations have similar worry and concern. A Gallup Survey commissioned by Bayer Corporation (2003) found nine in every ten Americans concerned about the lack of Mathematics skills of today's students to cope with a changing world that is progressively more difficult to understand, analyze, or explain. Futurists predict continual change emerging from the effects of increasing world population, advancing technologies, environmental degradation, migration and immigration, and challenges to world security (Marsh and Yeung, 1996). In coping with these emerging challenges, students have a competitive advantage when they are able to draw upon meaningful scientific knowledge and functional mathematical skills. According to Cech (2003), a progressively complex world calls for increasingly skilled people who understand Science and Mathematics.

The unresolved riddles therefore are: Why the poor performance of students in Mathematics despite the lofty uses to which Mathematics has been put (Euclid in Principles of Geometry, Einstein in Quantum and Relativity Theories, Newton in Laws of Gravitation and Motion, etc) and is yet to be put? What can be done to check the deteriorating performance of students in Mathematics, and make way for the acquisition of the

requisite Mathematical skills for the understanding of today's complex world and the demands of tomorrow?

Some investigations revealed that the questions above, and even many more others, owe their answers to the complexity of self-beliefs (e.g. self-concept) that act on the students (Purkey & Schmidt, 1987; Chapman & Turner, 1997; Yeung & Lee, 1999). The above researches have shown close relationship between self-concept and academic achievement.

Statement of the Problem

The Nigeria nation and other nations of the world have shown tremendous concern about the poor performance of students in Science and Mathematics (Akubiro & Joshua, 2004; Bayer Corporation, 2003). This poor performance of students in Mathematics in Nigeria – a country that needs Mathematics for its development – deserves the total attention of educational planners, teachers and researchers in Nigeria for a possible turnaround of the poor performance of students in Science and Mathematics.

According to Marsh (1986), self-concept has been shown to be a very important educational achievement indicator as well as a desirable mediating variable leading to other positive outcomes, such that educational policy statements throughout the world list self-concept enhancement as a central goal of education. Whether or not educational policies in Nigeria list self-concept as a central goal of education is a topic for another study.

Suffice it to say that in Nigeria, few researches have been carried out which confirm the significant relationship between self-concept and Mathematics Achievement (Bassey, 2002; Jamabo, 1996; Osang, 1990). A lot more studies need to be done to replicate the above findings in Rivers State and other parts of Nigeria to answer the question: "Why poor students' performance in Mathematics", and possibly suggest ways to check the negative trend.

Purpose of the Study

The purpose of this study is to determine whether or not (and to what extent) significant relationships exist between Students' Mathematics Self-concept and Students' Mathematics Achievement, Students' General Academic Achievements and Students' General Academic Self-concept. The following research questions directed the study:
1. To what extent does students' Mathematics self-concept relate to students' Mathematics Achievement?
2. What is the extent to which students' Mathematics Self-concept relate to students' General Academic Achievement?
3. To what extent does the Mathematics Self-concept of students relate to students' General Academic Self-concept?

Statement of Hypotheses

The study was guided by the following three null hypotheses:
1. There is no significant relationship between Students' Mathematics Self-concept and Students' Mathematics Achievement.
2. There is no significant relationship between Students' Mathematics Self-concept and Students' General Academic Achievement.
3. There is no significant relationship between Students' Mathematics Self-concept and Students' General Academic Self-concept.

Significance of the Study

Based on the results of this study, the poor performance of Nigerian students in Science and Mathematics could be hinged, totally or in part, on low Mathematics Self-concept. Thus educators, curriculum developers, teachers and parents would see the need to list self-concept enhancement as a central goal of education in Nigeria.

Review of Related Literature

The overriding theoretical orientation of this study is grounded in the perceptual psychology tradition. Perceptual psychologists postulate that all persons create their own reality through their perceptions of what they belief to be real. And that a person's behaviour is contingent on how an individual perceives and interprets his/her experiences (Combs and Gonzales, 1994). Thus from the perspective of the perceptual psychology, it is clear that to understand an individual's behaviour, we need to know how that individual perceives and interprets his/her experiences. In other words, to appreciate students' academic performance, we need to understand how students perceive and interpret school and school subjects.

The most influential and eloquent voice in self-concept theory was that of Carl Rogers who introduced an entire system built around the importance of the self (Hattie, 1992). In Rogers' view, the self is the central ingredient in human personality and personal adjustment. Rogers described the self as a social product, developing out of interpersonal relationships and striving for consistency. He maintained that there is a basic human need for positive regard both from others and from oneself. He also believed that in every person there is a tendency towards self-actualization and development so long as this is permitted and encouraged by an inviting environment.

Self generally means the conscious reflection of one's own being or identity, as an object separate from others or from the environment. There are a variety of ways to think about the self. Two of the most widely used terms are self-concept and self-esteem. Self-concept is the cognitive or thinking aspect of self (related to one's self-image) and generally means the totality of a complex, organized, and dynamic system of learned beliefs, attitudes and opinions that each person holds to be true about his or her personal existence (Purkey & Schmidt, 1987). Self-concept can also means the general idea we have of ourselves.

The idea of self-concept includes attitudes, feelings and knowledge about ability, skills, and social acceptance capability of the self. Self-concept covers all aspects of our cognitive, perceptional, and affective evaluation. Therefore, self-concept is simply a collection of personal attitudes towards oneself (Gross, 1992).

Psychologists have paid a lot of attention to factors related to the formation and development of self-concept. This issue is very important to the field of mental health, as an individual's conception of his or her person, which is linked to the personality, to a certain extent determines the attitude of that person to his or her environment, and to a larger extent the person's academic performance. It may then be suggested that if self-concept is positive and normal, the individual will possess normal mental health. Adversely, if self-concept is negative and abnormal, the individual may behave abnormally in his or her environment. The implication is that good mental health (resulting from positive self-concept) makes for positive academic achievement.

The consensus appears to be that self-concept is largely acquired. This point is very pertinent for students and for those who are involved in their upbringing, particularly their parents and teachers. Other factors affecting self-concept are the behaviour of others around the individuals, and social stimulation.

Marsh (1992) showed that the relationship of self-concept to school achievement was very specific. According to Marsh, general self-concept and non-academic aspects of self-concept are not related to academic work, but general academic achievement measures were found to relate positively to general academic self-concepts and are highly related to success in that content area.

Many students are not confident about their mathematical ability to solve problems. A poor attitude

towards the discipline is thought to plague learners at every level of schooling. The fear of both answering mathematical questions in class and/or taking mathematical tests has been studied by Marsh, and Hocever (1985) and Stodolsky (1985), and both studies found consistence results that fears of Mathematics often escalates to a level termed mathematics anxiety with the effect of poor achievement in Mathematics. They concluded that individuals with poor attitudes towards mathematics are often reported to have a low self-concept and feelings of incompetence. These attitudes are manifested as self depreciating remarks and a perpetual lack of success in Mathematics.

According to Wong (1992), mathematics achievement is closely related to self-concept and attitude towards mathematics. As in the case of the general self-esteem, more mathematically confident students have significantly higher scores on a standardized measure of mathematics computations. Osang (1990), in his study, tested the relationship between students' performance in mathematics and self-concept. He found that students' performance in mathematics depended on their mathematics self-concept. That is, their achievement in mathematics depended on what they thought of or believed about themselves, with reference to mathematics as a subject.

In a study conducted by Byrne (1984), he founded that relationship between students' self-concept in Mathematics and their Mathematics Achievement is logically and inevitably connected. Byrne reported that achievement in Mathematics is highly related to what an individual thinks of Mathematics. That is, ones Mathematics self-concept will influence ones achievement in Mathematics. Also students' self-perceptions of mathematics ability influence their mathematics achievement, and that their attitude towards mathematics during high school has positive effects on their choosing careers in science and mathematics.

Methodology

The study adopted the Correlational Research Design. The population of the study consisted of 6,478 SS3 students of the 13 state government financed post primary schools in Port Harcourt. Only the state schools were chosen (as against unity schools and private schools) to make for homogeneity: that is, to ensure the use of subjects that have similar characteristics.

The sample for this study consisted of three hundred (300) SS3 students that were chosen from 3 randomly selected schools from 13 senior secondary schools in Port Harcourt. The study employed the stratified random sampling technique, each school type (single boys, single girls and mixed schools) was considered a stratum and a senior secondary school selected at random.

All the research questions were answered using the Pearson's Product Moment Correlation Statistic, with Mathematics Self-concept as independent variable and Mathematics Achievement, General Academic Achievement and General Academic Self-concept as dependent variables. To test the null hypotheses formulated for this study, the computed Person's Product Moment Correlation Coefficients (r) were transformed to t-test using the formula,

$$t = r^2. [(n - 2)/(1 - r)]^{\frac{1}{2}}.$$

Results

In the tables that follow, SMS = Students' Mathematics Self-concept, SMA = Students' Mathematics Achievement, GAS = General Academic Self-concept, and GAA = General Academic Achievement.

Hypothesis One: There is no significant relationship between students' Mathematics Self-concept and students' Mathematics Achievement.

Table 1: Transformed t-test on the Relationship between Students' Mathematics Self-concept and Students' Mathematics Achievement

Variables	N	Mean	SD	df	p	Cal (r)	Crit. (r)	Cal. t-test trans.	Crit. t-test trans
SMS (x)	300	31.21	10.65	298	0.05	0.767	0.139	20.55	1.960
SMA (y)		27.13	13.81						

The result in the above table indicates that there is a significant positive relationship between Mathematics Self-concept of students and students' Mathematics Achievement [calculated t = 20.55 > critical t = 1.960 at p < 0.05; df = 298]. This significant positive relationship implies that students with high Mathematics Self-concept will generally achieve higher in Mathematics than those with low Mathematics Self-concept.

Hypothesis Two: There is no significant relationship between students' Mathematics Self-concept and students' General Academic Achievement.

Table 2: Transformed t-test on the Relationship between Students' Mathematics Self-concept and Students' General Academic Achievement

Variables	N	Mean	SD	df	p	Cal (r)	Crit. (r)	Cal. t-test trans.	Crit. t-test trans.
SMS (x)	300	31.21	10.65	298	0.0	0.131	0.139	2.281	1.960
GAA (z)		49.63	14.46						

The data in Table 2 show that the calculated t, though low, is significant at the 5% confidence level [calculated t = 2.281 > critical t = 1.960 at p < 0.05; df = 298]. This implies that students with high Mathematics Self-concept can achieve highly in general school work.

Hypothesis Three: There is no significant relationship between students, Mathematics Self-concept and students' General Academic Self-concept.

Table 3: Transformed t-test on the Relationship between Students' Mathematics Self-concept and Students' General Academic Self-concept

Variables	N	Mean	SD	df	p	Cal (r)	Crit. (r)	Cal. t-test trans.	Crit. t-test trans.
SMS (x)	300	31.21	10.65	298	0.0	0.147	0.139	2.565	1.960
GAS (m)		37.89	7.23						

This result shows a significant positive relationship between Students' Mathematics Self-concept and Students' General Academic Self-concept at the 5% confidence level [calculated t = 2.565 > critical t = 1.960 at p < 0.05; df = 298]. The interpretation is that students with high Mathematics Self-concept have the tendency of viewing school and academics positively.

Conclusion

This study investigated the extent to which students' mathematics self-concept relates to students' mathematics achievement, general academic achievement and general academic self-concept. Significant positive relationships were found in all the three cases at the 0.05 level of significance. These results are supported by Marsh (1990) and Morriss and Smith (1978). This study further found that the strength of relationship between Mathematics Self-concept and Mathematics Achievement decreased as Mathematics Self-concept was compared with General Academic Achievement and General Academic Self-concept. It is clear that self-concept becomes more empirically sensitive to, and more predictive of, achievement outcomes the more specific that it is conceived and assessed.

According to Bandura (1997), self-concept beliefs influence the choices people make and the courses of action they pursue. Individuals tend to engage in tasks about which they feel competent and confident and avoid those which they do not. Self-concept also helps determine how much effort people will expend on an activity, how long they will persevere when confronting obstacles, and how resilient they will be in the face of adverse situations. The higher the self-concept, the greater the effort, persistence, and resilience an individual puts on tasks. As a consequence, self-concept exercises a powerful influence on the level of accomplishment that individuals ultimately realize. Conversely, people who doubt their capabilities may believe that things are tougher than they really are: a belief that fosters stress, depression, and a narrow vision of how best to solve a problem. In other words, many students have difficulty in school not because they are incapable of performing successfully but because they have learned to see themselves as incapable of handling academic work. This study has shown that the more positive the self-concept of students, the higher their motivation, commitment and success in academics and other endeavours.

Thus, given the significance of self-concept in academic achievement of students, the enhancement of self-concept outcomes should be of major concern to educators, program developers, teachers, parents and counselors.

Recommendations

The self-concept beliefs of teachers are themselves related to their instructional practices and to the achievement and psychological well-being of their students. Efficacious teachers create classroom climates in which academic rigor and intellectual challenge are accompanied by the emotional support and encouragement necessary to meet the attendant challenge and achieve academic excellence (Tschannem-Moran and Woolfolk Hoy, 1998). All teachers should, therefore, do well to take seriously the responsibility of nurturing the self-concept of their students, for it is clear that these self-beliefs can have beneficial or destructive influences.

Teachers should pay as much attention to students' perception of competence as to actual competence, for it is the perception that may more accurately predict student's motivation and future academic choices. Assessing students' self-concepts can provide schools with important insights about their students' academic motivation, behaviours, and future choices. For example, unrealistically low self-concept leads to poor academic behaviours, avoidance of challenging courses and careers, and diminishing school interest and achievement.

The ultimate aim of education should be to produce competent, caring, loving, and lovable people. One needs only cast glance at the American landscape to see that attending to the personal, social, and psychological concerns of students is both a noble and necessary enterprise. Teachers can aid their students by helping them to develop the habit of excellence in scholarship, while at the same time nurturing their self-beliefs necessary to maintain that excellence throughout their adult lives.

Parents should develop positive self-concept in their children, at the early stages of their lives. This could be best done at home which is the most important social force in shaping and maintaining the child's

self-concept. The home environment is the strongest agent in shaping the child's self-concept, so the earlier he is exposed to positive self-concept formation the better. Positive attitudes of the parents towards their children will boost their ego, strengthen their feeling of self-worth and act as another form of motivation to work harder. Empathy should be applied in this kind of relationship and no sign of conflict of interest should be experienced in their child's choice of subjects and career.

Counseling services should be provided in schools so that students having problems in academic subjects can be attended to through the combined efforts of the school and the home. Students, because of their sexes, should not be discouraged directly or indirectly from learning certain subjects when they are young. In other words, students should be discouraged from forming stereotyped attitudes towards certain subjects, because of their sexes. This will boost positive competition between males and females, and enhance academic achievement and excellence.

The influence of students' self-beliefs on their achievement does not end with their schooling. Consequently, the aim of education must transcend the development of academic competence. Schools have the added responsibility of preparing self-assured and fully-functioning individuals capable of pursuing their hopes and their ambitions.

Self-concept theory is a relatively new area in the Nigerian educational scene. Thus, more researches on this field should be conducted to delve more into the self-concept patterns and how they affect vocational choices, physical appearance, problem-solving abilities and the up bringing of children by parents. These studies should be done to test the various facets of self-concept in different populations. Perhaps, it will then be hoped that educational policy statements in Nigeria would list and emphasize positive self-concept development as a central goal of education.

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