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Effect of Self- Monitoring Strategy on Students' Test Anxiety and Achievement in Basic Science

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Abstract

The study sought to determine the effect of self-monitoring strategy on basic science students' test anxiety and achievement on selected Basic Science concepts. The study is a quasi- experimental design guided by two research questions and two hypotheses. Treatment and control groups received pretest and posttest independently. The sample for the study consisted of 200 students randomly drawn from four (4) co-educational schools in Oshimili south Local Government Area of Delta-State, Nigeria. Test- anxiety scale and Basic Science Achievement Test (BSAT) were the research instruments used for the study. Cronbach alpha was used to determine the internal consistency of BSAT and was found to be reliable with a coefficient of 0.98. The instruments validation were carried out by lecturers in the department of Science Education, Delta State University Abraka, Delta State. The instruments clearity, appropriateness and relevance were asserted by the experts. Mean and standard deviation were used in answering the research questions while T-test was used in testing the hypotheses at 0,05 level of significance. Result revealed that the experimental group that were subjected to treatment had a lower test anxiety with a higher mean achievement score. Hence, it was recommended among others that teachers should encourage student to monitor their learning during basic science teaching in other to remove all forms of test anxiety and build a stronger foundation for the learning of science.

Key words: Self- monitoring, Test anxiety and Basic science

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Introduction

In recognition of the role of scientific literacy to national development, the Nigerian government has emphasized as a major objective the building of a sound science and technological base as a condition for national development in the National Policy on education (Federal Government of Nigeria, FGN, 2004). The 21st century is characterized by advancement in science and technology. For Nigeria to realize accelerated development in the 21st century, she needs qualitative science education in her schools especially in the junior secondary schools. Over the last two decades, there have been repeated calls for reforms and innovations aimed at improving science education in Nigeria. This suggests that there are issues in science education in Nigeria that need to be improved upon.

Science could be defined as an organized body of knowledge in form of concepts, laws, theories and generalization. Iyama (2010) defined science as a study of nature and natural phenomena in order to discover their principles and laws. Science has three interrelated aspects: content, process and attitude. Content can be separated into physical, life and earth science. Process involves the fifteen inquiry skills proposed by the American Association for the Advancement of Science (AAAS) which includes observing, classifying, experimenting, measuring, inferring, quantification, predicting, relationship, communication, organizing data, controlling variable, questioning, hypothesizing, operational definitions and interpreting data. Attitude concerns openness and objectives (Egara, 2010). Science underpins almost every aspect of our lives. The major science subjects that lead to the study of science courses are Physics, Chemistry, Mathematics and Biology. At the Junior Secondary level of secondary education in Nigeria, all the above named subjects except mathematics are integrated into the subject integrated science now known as basic science at the junior secondary school level. Basic science is the bedrock of all sciences, engineering and technology courses. This underscores the need for basic science in schools. Basic science is a course which stresses the fundamental unity of science and lays adequate foundation of subsequent specialist studies like Medicine, Pharmacy, Dentistry, Chemistry, Biology, Agriculture, Home Economics, Food Science, Biotechnology, Engineering, woodwork, metalwork, to mention but a few. It stresses the fundamental unity of Science, adds a cultural dimension to Science Education and is relevant to student-needs and experiences. The number of students who will enroll for science subjects at the higher level depends on the number

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that are favourably disposed on academic achievement in basic science at the junior secondary school level.

The objective of Basic Science curriculum at the junior secondary school level is to show its link with industry, everyday life benefits, hazards, interact with natural environment and students' eye opening on proceeding to senior secondary school level. The subject is required to meet up with increase in demand for science and technology by private and government establishments, without which, our nation will likely remain impoverished. This is because the natural resources which abound in Delta State needs to be harnessed, processed and converted to needed products for optimum use. Our solid minerals such as coal, columbite, tin, iron, ore, kaolin, limestone, coal, uranium among others and agricultural produce like animal hides and skins, rubber, palm produce, groundnut, cassava to mention but a few are underutilized (Okujagu, 2016). A basic knowledge of science by the students would be very essential for more effective utilization of these resources. The subject must further help the learner to gain the commonality of approach to problems of scientific nature and have an understanding of the role and function of science in everyday life and the world in which he lives (Federal ministry of Education, 2013). The economic crises in Nigeria has impacted heavily on the citizens as it has given rise to high inflation, collapse of oil price, shortage of electricity, humanitarian crises, laying off of workers and shutting down of many industries resulting in high unemployment rate. Yet, for a long time progress in science and technology has been considered a goal on its own. Science has sometimes developed in an ivory tower separated from society and societal needs. However, as important as Basic Science is, science educators have been lamenting over the poor achievement of students in the subject in our junior secondary schools for the past decades (Akor, 2016; Emaikwu, 2017 & Eriba, 2018).

Students' academic achievement is a psychological construct that measures the level of knowledge acquired by marks obtained in tests in a term or annual examination. Students' achievement in secondary schools is evaluated in a number of ways. For regular grading, students demonstrate their knowledge by taking written and oral tests, doing presentations, homework and participating in class activities and discussions. Teachers evaluate in the form of letter or number grades and side notes to describe how well a student has done. Students' academic achievement in Nigeria secondary schools especially in public secondary schools has been a source of concern to all and sundry. There has been a general apprehension about the fallen standard of education in

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Nigerian educational system. This unfortunate trend has become a source of concern considering the great importance of education to national development. Aremu (2010) remarked that academic failure is not only frustrating to the students and the parents, its effect is equally grave on the society in terms of dearth of manpower in all spheres of the economy and politics. Poor academic achievement is adjudged by the examiner as falling below an expected standard (Morakinyo, 2013). Research has attributed low academic achievement at secondary school level to many factors. Morakinyo (2013) attributed the low level of academic achievement in secondary schools to teacher's non-use of verbal reinforcement strategy, attitude of some teachers to their jobs, poor attendance to lessons, lateness to school and poor methods of teaching. On the other hand, Aremu and Sokan (2009) passed the blames of poor achievement of secondary school students on themselves. The authors pointed out that low retention, parental factors, association with wrong peers, low achievement motivation and test anxiety among others have contributed immensely to the low academic achievement being witnessed in the students.

The National Policy on Education (2004) stipulated that secondary school education is an instrument for national development. It fosters the worth and development of the individuals for further education and development of the society. High academic achievement needed to attain the above lofty objective of secondary school education is now becoming a dream too difficult to realize. Adebule (2009) remarked that all over the country, there is a great consensus of opinion about the fallen standard of education at the Secondary School level of education. Asikhia (2010) viewed secondary school education as a transformational tool necessary to achieve a more rapid economic, social, political, technological, scientific and cultural growth and development. However, the achievement index at this level of education he noted has become so low that it is now unacceptable to all stakeholders. More must be done not only to raise public awareness of scientific issues, but also to find ways of actively engaging students in the classroom for better achievement. A research on students' proper integration into self -learning processes and monitoring of their learning is paramount. Thus, there are on-going reforms in the education sector which are very necessary in inculcating new skills and knowledge needed by students mainly who are prone to the learning of science concepts. Among these skills are self -monitoring strategy which is an innovative instructional procedure for teachers and students among others in the learning process to ensure quality learning and hence, achievement.

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Self-monitoring strategies are individualized plans used to increase independent functioning in academic, behavioral, self-help and social areas. Rather than reducing students' undesired behaviour, self-monitoring strategies develop skills that lead to an increase in appropriate behaviour. When self-monitoring skills increase, corresponding reductions in undesired behaviours often occur, even without direct intervention (Stacy, 2015). Self- monitoring is crucial to self -regulation. It functions through self-awareness and focuses on students' ability to monitor their progress towards learning goals. Wilde and Garvin (2007) in Okotcha, Uzoka & Oghenejode (2015) defined the concept as an awareness of symptoms or bodily sensations that is enhanced through periodic measurements, recordings and observations to provide information on improved self -management. Self –monitoring is used as an assessment tool and as an intervention according to Shapiro and Cole (1999) as cited in Starcy (2015). Self- monitoring helps to provide data on a particular behavior such as number of cigarettes smoked, levels of depression and anxiety and obsessive thoughts. As an assessment tool, self-monitoring is commonly used in the area of internalizing disorders such as anxiety and depression (Craske & Tsao, 1999). The goal of self-monitoring as an intervention is to reduce unwanted behaviours and helps empower individuals to gain control over their thoughts and behaviours (Falkenberg & Barbetta, 2013). This is known as reactive effect. An awareness of the discrepancy between the actual self and the ideal self arises, which then leads to behavioural change. Self-monitoring has been shown to have reactive effects in health behaviour. There is need to ascertain its effect on test anxiety.

Anxiety is an emotional component of human beings that manifests itself in life endeavours in form of worry and restlessness. When this kind of emotional component manifests with regard to a test or assessment condition, then it is regarded as test anxiety. Test anxiety is an experience which expresses itself in candidate's mind and behaviour in form of fear of failure, negative self -evaluation in relation to one's previously established standard, self- blame for perceived shortcomings, social evaluation in relation to one's estimate of how others are doing and negative prediction of what will be the outcome of a test. According to Hammond, Radin and Radin (2016), test anxiety is the phychological state of a candidate about a test as expressed by the level of worry, fear, uncertainty, concern and helplessness expressed before, during or even after a test. Test anxiety is a combination of perceived physiological over-arousal, feeling of worry and dread, self-depreciating thoughts, tension and somatic symtoms that occur during test situation. Students with

high level of test anxiety are unable to focus their full attention on learning situation (Okotcha, Uzoka & Oghenejode, 2015). The goal of most testing situation is to measure a person's level of knowledge or skill in a particular area, that is, achievement. In studying science concepts, research has shown that anxiety affects students' achievement. According to Njoku (2003), the persistent poor achievement of students in science is a major source of anxiety for them which needs to be addressed through appropriate learning strategy such as self- monitoring strategy.

Statement of the Problem

Basic science is a subject that presents science as a unified entity and exposes learners to the fundamental principles of science needed for sustainable development. The number of students who enroll for science subjects at the higher level depends on the number that are favourably disposed on academic achievement in basic science at the junior secondary school level. Academic achievement measures the level of knowledge acquired by marks obtained in tests given to the students in a term or annual examination. Where a student exhibits test anxiety during test or examination, then the mark obtained will be low. Low, not necessarily because the student does not know the question that was asked but because the student had test anxiety. Hence, there is need for a learning strategy that will remove such test anxiety in students for a better achievement since test result is an index of academic achievement. It is on this premise that this study sought to investigate the effect of self-monitoring strategy on students' test anxiety and achievement in basic science.

Purpose of the Study

This study sought to ascertain the effect of self-monitoring strategy on students' test anxiety and achievement in basic science. Specifically, the study sought to:

1. Determine the effect of self-monitoring strategy on students' test anxiety in basic science
2. Find out the effect of self-monitoring strategy on students' achievement in basic science

Research questions: The following research questions guided the study

1. What is the effect of self-monitoring on students' test anxiety in basic science?
2. What is the effect of self-monitoring on students' achievement in basic science?

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Hypotheses: The following research hypotheses (H_0) were formulated to guide the study and were tested at 0.05 level of significant

H_{01}: There is no significant difference in the mean test anxiety scores of basic science students exposed to self –monitoring and those not exposed to self –monitoring

H_{02}: There is no significant difference in the mean achievement scores of basic science students exposed to self –monitoring and those not exposed to self –monitoring.

Methodology

The study adopted a quasi-experimental design, the pre-test post-test control group design. The population of study comprised of all the junior secondary school two students in Oshimili south and Oshimili North Local Government Areas of Delta State Nigeria. The sample of the study consisted of two hundred (200) students assigned to the experimental and control groups using simple random sampling by balloting technique. The instruments used for data collection are the test anxiety scale and the Integrated Science Achievement Test (ISAT). Both were developed by the researchers. The test anxiety was a five (5) item scale while the achievement test was a nine (9) item test. The instruments were validated by lecturers in Integrated Science in the department of Science Education Delta state University Abraka and college of Education Agbor. The instruments clearity, appropriateness relevance were asserted by the experts. The Cronbach alpha was used to determine the internal consistency of the instrument and was found to be reliable with a coefficient of 0.98. The basic science students were given the test anxiety scale to rate themselves before treatment. The ISAT was also administered to the students prior to the commencement of the experiment. After the treatment, post-tests were administered. Mean and standard deviation were used inn answering the research questions while T- test was used in testing the hypotheses at 0.05 level of significance.

Results

Research question 1

What is the effect of self-monitoring on basic science students' test anxiety in basic science?

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Table 1: Mean and standard deviation of basic science students test anxiety with reference to those exposed to self- monitoring strategy and those not exposed

Group	N	Pre-Test		Post-Test		Mean Gain
		Mean	SD	Mean	SD	
Exp.	100	21.67	6.80	19.11	6.31	-2.60
Control	100	21.31	7.08	29.63	11.59	8.30

Result on Table 1 shows that the mean response scores of Basic science students Test Anxiety level of the experimental group that were exposed to self-monitoring strategy was less than the group not exposed to self-monitoring strategy (19.11< 29.63).

Hypothesis 1

H_{01}: There is no significant difference in the mean test anxiety scores of basic science students exposed to self –monitoring and those not exposed to self –monitoring

Table 2.1: A T-test comparison of Basic Science students pre-test test anxiety mean score

Group	N	Mean	SD	DF	T	PValue	Decision
Control	100	21.31	7.076	198	0.367	0.714	NS
Exp.	100	21.67	6.796	198			

Table 2.2: A T-test comparison of Basic Science students post-test test anxiety mean score

Group	N	Mean	SD	DF	T	PValue	Decision
Control	100	29.63	11.59	198	7.97	0.000	S
Exp.	100	19.11	6.31	198			

Table 2.1 shows that the pre-test anxiety mean scores of the students expose monitoring and those not exposed to self-monitoring, a t-value of 0.367 was obtain associated probability value of 0.714. This means both group had equal test an before the treatment. But after the treatment, Table 2.2 reveals that the mean te scores of students exposed to self-monitoring became statistically significant value=0.000). Inference drawn is that there is a significant difference in the mean t score of students exposed to self-monitoring in basic science and those not expos hypothesis one was rejected.

Research question 2

What is the effect of self-monitoring on students' achievement in basic science?

Table 3: Mean and standard deviation of basic science students' achievement scores with reference to those exposed to self- monitoring strategy and those not exposed

Group	N	Pre-Test		Post-Test		Mean Gain
		Mean	SD	Mean	SD	
Exp.	100	30.75	10.90	44.04	12.19	13.28
Control	100	34.45	9.21	37.90	9.50	3.45

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Result on Table 3 shows that the Basic science students in the experimental group that were exposed to self-monitoring strategy had a higher achievement mean gain (13.28 > 3.45). This is an indication that self- monitoring strategy on students test anxiety improved students' achievement in Basic science.

Hypothesis 2

H_{02}: There is no significant difference in the mean achievement scores of basic science students exposed to self –monitoring and those not exposed to self –monitoring.

Table 4.1: A T-test comparison of Basic Science students' pre-test achievement mean score

Group	N	Mean	SD	DF	T	PValue	Decision
Control	100	34.45	9.217	198	2.59	0.010	S
Exp.	100	30.76	10.902	198			

Table 4.2: A T-test comparison of Basic Science students' post-test achievement mean score

Group	N	Mean	SD	DF	T	PValue	Decision
Control	100	37.90	9.496	198	-3.973	0.000	
Exp.	100	44.04	12.194	198			S

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Table 4.1 shows that the pre-test achievement mean scores of the students exposed to self - monitoring and those not exposed to self-monitoring, a t-value of 2.59 was obtained with an associated probability value of 0.010 before the treatment. But after the treatment, Table 4.2 reveals that the mean achievement scores of students exposed to self-monitoring became statistically significant (t=-3.973, p value=0.000). Inference drawn is that there is a significant difference in the mean achievement score of students exposed to self-monitoring in basic science and those not exposed. Hence, hypothesis two was rejected.

Discussion of Findings

The findings of the study as presented in Table 2.2 shows that the basic science students that were exposed to self- monitoring had a significantly reduced test anxiety compared to the control group that were not exposed to self- monitoring. Table 2.1 revealed that both groups did not have a significant different test anxiety before the treatment, but after the treatment, the experimental group that had a higher mean test anxiety level reduced. This suggests a reduced level of worry, fear, uncertainty and concern after the treatment. The basic science students were able to self-monitor their academics which reduced the fear that accompanies test. This result agrees with the findings of Starcy (2015). The author noted the effectiveness of self-monitoring on one of his participants. The author noted that the percentage of non-overlapping data points (PND) for the participant yielded 60% suggesting that the self-monitoring intervention may have decreased the test anxiety.

The study revealed that the basic science students that were exposed to self-monitoring in test anxiety performed significantly better than the basic science students that were in the control group that had better mean achievement score at the pretest stage. The higher performance exhibited by the experimental group could be as a result of a reduced test anxiety brought about by the intervention in self-monitoring. This result agrees with the findings of Okotcha (2018) who noted that the level of perceived preparedness (by students) significantly predicted students' achievement in a science course.

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Conclusion

On the basis of the findings of this study, the following conclusions were made:

1. Self- monitoring strategy has significant effect on students' test anxiety
2. Self-monitoring strategy on students' test anxiety leads to better achievement by students

Recommendation

In view of the findings of this study, the following recommendations were made:

1. Since self-monitoring strategy reduced students' test anxiety and consequently increasing overall achievement, that teachers should encourage student to monitor their learning during basic science teaching in other to remove all forms of test anxiety and build a stronger foundation for the learning of science.
2. Science teachers should be trained on the use of this strategy so that they can teach their students accordingly.
3. Curriculum planners should include this strategy as one of the students' activities in the curriculum.
4. Similar research work could be carried out in other subject areas in order to verify the effect of this strategy.

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