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THEME:

RE-THINKING THE FUTURE THROUGH STEM AND TVET FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

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SCIENCE STUDENTS' MOTIVATION AND ATTITUDE AS PREDICTORS OF THEIR ACADEMIC ACHIEVEMENT IN MALUMFASHI LOCAL GOVERNMENT, KATSINA STATE, NIGERIA

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Abstract
This study investigated whether or not students' motivation and attitude towards science can serve as predictors of their academic achievement. Two research questions and two hypotheses were raised and tested at 0.05 levels of significance. The study adopted correlational survey design. The population of the study consisted of one thousand and ninety-nine (1,099) SSII science students from which a total of two hundred and eighty-five (285) students were sampled using simple random sampling technique. A fifty (50) items multiple-choice "Science Achievement Test" (SAT), a 20 items "Science Students Attitude Scale Questionnaire" (SSASQ) and a 30 items "Science Students Motivation Questionnaire" (SSMQ) were used for data collection. The SAT, SSASQ and SSMQ were validated by specialist in science education and psychology. The reliability of SAT was established using Spearman Brown formula and yielded reliability index of 0.858 and the reliability of SSASQ and SSMQ were established using Cronbach' Alpha and yielded reliability index of 0.83 and 0.88 respectively. The collected data was analyzed using SPSS Version 26 using Scattered Plot and Linear Regression Analysis. The findings of the study revealed that motivation and attitude of the students had significant positive relationship with their academic achievement in science. The researchers therefore concluded that motivation and attitude are major predictors of students' academic achievement in science and therefore recommended that science teachers should use instructional strategies that will motivate and bring positive attitude of learners during science subject's instruction to enhance students' achievement.

Keywords: Motivation, Attitude, Academic Achievement and Science Students

Background to the Study

The world has become a global village as a result of innovation due to science and technology. So to say, science is a verified body of knowledge which is arranged in an orderly manner. Science comprises the basic discipline such as physics, chemistry, biology and Mathematics. In addition, National Academy of Science (2008) view science as the use of evidence to construct testable explanation and prediction of natural phenomena, as well as knowledge generated through this process. Science is an integral part of everyone's life. It is a systematic investigation of nature with a view to understanding and harnessing to serve human needs.

Science education can be defined as the study of physics, chemistry, biology and Mathematics with teaching method in order to impart scientific knowledge to individuals or community. It is a field of specialization concerning with two basic aims, which are the production of scientifically interactive society and technological manpower. Science education in the area of academic and industrial activity is the backbone of industrialization and development of any nation. The science related disciplines that will enable the learner to have true knowledge of science and to be able to use it in solving problem are Physics, Chemistry, Biology and Mathematics. Science education are school subject that play an important role in life, they are important because they are the basic subject for the development of many study fields such as mechanical engineering, electronics, nuclear sciences, medicine and surgery, medical laboratory sciences, pharmacy and digital information system. Science education presents various problems, from the simplest to the complex ones, as well as from the macro to the micro ones. Science education contributes to the technological infrastructure and provides trained personnel needed to take advantage of scientific advances and discoveries (Saifullahi, 2021). It plays a major role in the area of health, economic development, energy and environment. It generates fundamental knowledge needed for future technological advances that will continue to drive the economic engine of the world.

Motivation is an internal drive that spurs one into action (Tus, 2020). It is an important psychological construct that drives a person action. Motivation is a strong desire or passion in a person that encourages the person to try and do something in order to succeed. Motivation affects student learning and plays an important role in directing behavior towards a certain goal, increasing the effort and energy towards a goal, increasing the initiative and perseverance of an activity, and improves individual performance. Teaching science in a fun and effective manner will increase students' motivation to learn science (Dan'inna & Bagiwa, 2020),). They believe that, if teachers give suitable feedback to the students on their level, initiate students' interest, makes them understand the importance of the content, and have students share their idea in classroom discussion, then the student's motivation increases as well as their achievement. Student effort toward academic achievement is controlled by motivational factors such as interest, competence and autonomy.

Academic achievement is a measure of what a person has accomplished after exposure to an educational program. It is a means of accomplishment or proficiency of performance in a given skills or body of knowledge. Students' academic achievement corresponds to their performance in school subjects as symbolized by a score on achievement test. It is commonly measured by means of examination or continuous assessments, it represents the level of success of the teaching and learning process, it indicates the extent to which the established goal has been achieved, it also provides feedback to the teacher and student. Academic achievement of students in secondary schools has been a subject of concern by many people including parents, administrators, educators, psychologists and counselors. According to Saifullahi, (2021) student's academic achievement depends on teaching method and learning environment. Using good teaching strategy by the teachers will make students have higher understanding, gain reasonable academic achievement and positive attitude.

Students' attitudes towards learning science play an important role in the teaching and learning process of science subjects. In fact, it affects their achievement in the subject to the extent that their success or failure in physics, chemistry, biology and mathematics depends on their attitudes towards the subject. Attitudes also influence the learner' rate of participation in the class during lessons, and it was found that positive attitudes towards mathematics lead students towards success in mathematics achievement (Dan'inna, 2016). Healthy attitude towards science on the part of students may result from the teacher' attitudes toward the subjects, if the (science) teachers dislike science subjects they would transmit these feelings to the students. As a result of this, no matter what amount of effort, the students are not likely to make or develop interest in it.

West African Examination Council (WAEC, 2015-2019) has shown that students' academic achievement in physics, chemistry, biology and mathematics is very poor. This consistent poor performance of students in physics, chemistry and mathematics at Senior Secondary School Certificate Examination leaves one in doubt about the effectiveness of teaching methods popularly used by teachers for teaching the subjects. Some researchers have discouraged the use of traditional method of teaching which leads to memorization of fact and concept and there is need to find out the effectiveness of other teaching strategies relative to the traditional (Mankilik & Ofodile, 2015).

Objectives of the Study

The specific objectives of the study are set to:

i. Determine whether there is significant relationship between science student's motivation and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria.
ii. Find out whether there is significant relationship between science student's attitude and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria.

Research Questions

In line with the objectives of the study, the following research questions were raised to guide the study:

i. What is the relationship between science student's motivation and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?
ii. What is the relationship between science student's attitude and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

Research Hypotheses

Based on the stated research questions, the following null hypotheses were formulated and tested at 5%level of significance to guide this study:

H_{01} There is no significant relationship between science student's motivation and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

H_{01} There is no significant relationship between science student's attitude and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

Theoretical Framework

The theories that underpinned this study are Maslow's Pyramid Hierarchy of Need (1954) and Walberg Theory of Academic Achievement (1981). Psychologist Abraham Maslow (1954) first introduced the concept of hierarchy of needs in a paper titled "A Theory of Human Motivation" This hierarchy suggests that people are motivated to fulfill basic needs before moving on to other needs. Maslow's hierarchy of needs is most often displayed as a pyramid, with lowest levels of the pyramid made up of the most basic needs and more complex needs are at the top of the pyramid. Needs at the bottom of the pyramid are basic physical requirements including the need for food, water, sleep and warmth. Once these lower-level needs have been met, people can move on to the next level of needs, which are for safety and security. As people progress up the pyramid, needs become increasingly psychological and social. Soon, the need for love, friendship and intimacy become important. Further up the pyramid, the need for personal esteem and feelings of accomplishment become important. Hence, Maslow emphasized the importance of self-actualization, which is a process of growing and developing as a person to achieve individual potential.

The hierarchy of needs theory is relevant to this study as the theory is applicable to teaching and learning as well as students' performance. The theory is able to suggest how teachers can lead their students to become self-actualized. The idea implies the dual role of the theory first to teachers and second to administrators on the basis that both the teachers and the administrators must decide on the performance of their students. The cultural framework of the teachers should reflect the fact that students' physiological and security needs are paramount; therefore, when such needs became culturally focused, students' performance will be improved tremendously in that school (Maslow, 1954). This argument implies a reversed effect that if the need is not culturally focused on, the performance standard of students will not be met.

The second theory which underpinned this study is Walberg theory of academic achievement. This theory is also called Walberg theory of educational productivity. Walberg (1981) identified nine factors which affect the learner's cognitive, as well as affective outcomes. These nine factors include: Learner ability, age, motivation, quantity of instruction, quality of the instructional experience, the home environment, the classroom or school environment, the peer group environment, the mass media. The first three variables in Walberg's model (ability, age, and motivation) can each be seen as internal traits to the learners' or student talent. Ability includes factors that can be measured by the usual standardized test. To Walberg, the age includes chronological age, development and stage of maturation. In his research, Walberg has attempted to keep the age variable as a constant. Motivation or self-concept, in the Walberg model, is practically measured as scores on personality tests of the student's willingness to persist steadfastly on learning tasks. The relevance of Walberg theory of academic achievement as a guide in this study is that it identified important variable that could influence student's academic achievement. These variables include: age, learners' ability, peer group, mass media, quantity and quantity of instruction, classroom environment, and motivation.

Methodology

This research adopted a correlational survey research design. This type of research design seeks to establish what relationships exist between two or more variables. Also, this type of research indicates the direction, magnitude and strength of the relationships between the variables (Creswell 2014). The population of the study comprises all senior secondary school science students in all (18) public senior secondary school in Malumfashi Local Government, Katsina State. The target population for this study

consisted of all senior secondary school three (SSIII) science students in public co-educational school with a total number of one thousand and ninety-nine (1099) students. Simple random sampling technique was used to select two hundred and eighty-five (285) senior secondary school three (SSIII) science students from the eighteen schools in the study area.

Science Achievement Test (SAT) was used as an instrument for data collection in this study. It was developed by the researcher; it consisted of forty (50) multiple-choice items with option ranging from A-D from which students are expected to choose the correct responses. The items of the instrument were adapted from the Physics, Chemistry, Biology and Mathematics senior secondary school certificate examination (SSCE) past question (WAEC & NECO, 1998-2020). The adaption of the items of the instrument was employed in order to simplify the wordings to the level of students. The items of instrument were scored two marks for each correct answer and zero for each incorrect answer. Marking guide was prepared in order to guide the marking of the students' script. The maximum score is 100 marks while the minimum score is 0 marks.

Science Students Motivation Questionnaire (SSMQ): The researcher adapted Science Students' Motivation Questionnaire constructed by Mubeen & Reid, (2014). The Questionnaire consists of 20 items. Scoring the questionnaire was done using a "Five- Choice Likert Scale". These are Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree (SD). Each option was carried a weight in the order of priority from five to one in positive motivation responses and from 1-5 in negative motivation responses. The students were asked to freely indicate their motivation to science by simply ticking one of the five options that suit their motivation. From the items, maximum score is (100%), minimum score is (20%).

Science Students Attitude Scale Questionnaire (SSASQ): this instrument was constructed by the researcher. The Questionnaire consists of 25 items. Scoring the questionnaire is done using a "Four-Choice Likert Scale". These are Strongly Agree (SA), Agree (A), Disagree (DA) and Strongly Disagree (SD). Each option was carried a weight in the order of priority from four to one in positive attitude responses and from 1-4 in the negative attitude responses. The students were asked to freely indicate their attitude to science by simply ticking one of the four options that suit their attitude. From the items, maximum score is 100%, minimum score is 25%.

The three instruments were validated by two senior lecturers from Science and Technology Education Departments, Bayero University Kano; one professor from Science and Technology Education Departments, Federal University of Technology Minna and one experience Physics, Chemistry and Biology teachers at secondary school level with 16 years teaching experience. Their corrections were considered in the construction of the final instruments. Two schools apart from those selected for the main study were used for pilot testing of the instrument. The reliability of the Science Achievement Test (SAT) was established using split-half reliability method; the coefficient was calculated using Spearman Brown's formula and it was found to be 0.85. For Science Students Motivation Questionnaire (SSMQ) and Science Students Attitude Scale Questionnaire (SSASQ), the researcher established internal consistency reliability using Cronbach's Alpha method using SPSS, and the reliability index was found to be 0.88 and 0.83 respectively.

The researcher visited the sampled schools and sought for their permission to conduct the study and addressed the principals and science teachers on the duration and nature of the study. The researcher administered the Science Achievement Test, Science Students Motivation Questionnaire and Science Students Attitude Scale Questionnaire to the selected students. The scripts were marked by the researcher and the students' scores were recorded. The data obtained were recorded and subjected to data analysis using (SPSS v. 26) for both descriptive and inferential statistical tool. Scattered Plot was used to answer the research questions while the null hypotheses were tested at 0.05 significance level using Kendal Tau-B statistical tool

Analysis of Result

Research Question One: What is the significant relationship between science student's motivation and their academic achievement in the subjects in Malumfashi Local Government, Katsina State, Nigeria?

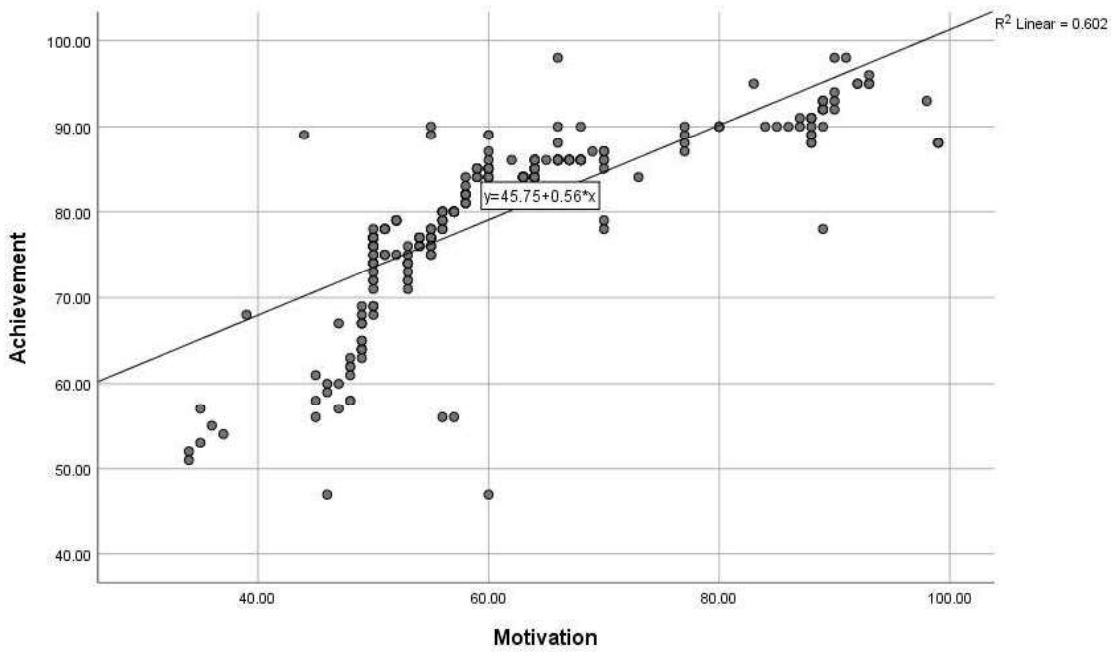

Figure 1: Simple Scattered Plot of Science Student Academic Achievement and Motivation

Figure 1 shows the graph of simple scattered plot of science student academic achievement and motivation. It was revealed from the graph that there was strong positive relationship between science students' motivation and their academic achievement with a coefficient of determination of 0.602 indicating 60.2% of variation in students' academic achievement in science is predicted by their motivation. This means that there was a positive relationship between motivation and students' academic achievement in Science. Hence, the more students are motivated, the better they will perform in science subjects.

Research Question Two: What is the significant relationship between science student's attitude and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

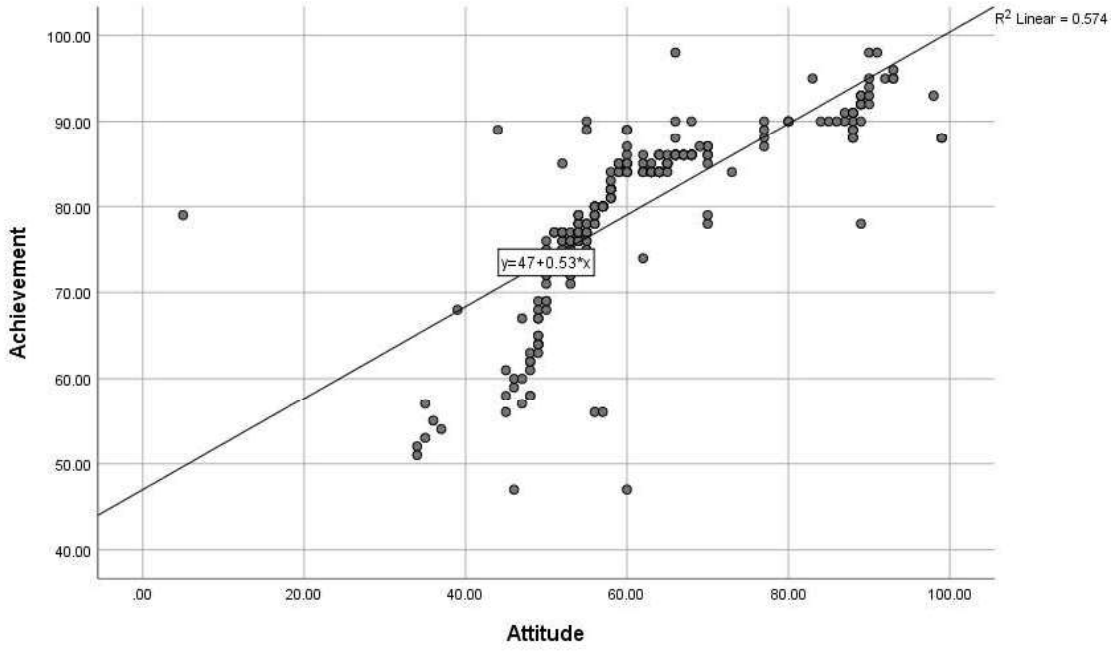

Figure 2: Simple Scattered Plot of Science Student Academic Achievement and Attitude

Figure 2 shows the graph of simple scattered plot of science student academic achievement and their attitude. From the graph above, it was revealed that there was a strong positive relationship between science students' attitude and their academic achievement with a coefficient of determination of 0.574 indicating 57.4% of variation in students' academic achievement in science is predicted by their attitude. This means that there was a positive relationship between science students' attitude and their academic achievement. Hence, the more students developed positive attitude, the better they will perform in science subjects.

Null Hypothesis Testing

Table 1: Linear Regression Analysis of Students' Motivation, Attitude and their Academic Achievement in Science

Model	R	R Square	df	P-value
Motivation	0.776	0.602	283	0.000
Attitude	0.757	0.574	283	0.000

Dependent Variable: Academic Achievement
Predictors: (Constant), Motivation, Attitude

Null Hypothesis One: There is no significant relationship between science student's motivation and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

Table 1 shows Linear Regression Analysis of students' motivation, attitude and their academic achievement in science. The result revealed that there is significant a strong positive relationship between science student academic achievement and their motivation (N=285, R = 0.776, R^2 = 0.602, p<0.05). Thus, null hypothesis 1 is hereby rejected at $p < 0.05$ and concluded that there is significant relationship between science student's motivation and their academic achievement. Hence, motivation is a predictor of science students' academic achievement.

Null Hypothesis Two: There is no significant relationship between science student's attitude and their academic achievement in Malumfashi Local Government, Katsina State, Nigeria?

Table 1 shows Linear Regression Analysis of students' motivation, attitude and their academic achievement in science. The result revealed that there is significant weak positive relationship between science student academic achievement and their attitude (N=285, R = 0.757, R^2 = 0.574, p<0.05). Thus,

null hypothesis 1 is hereby rejected at $p < 0.05$ and concluded that there is significant relationship between science student's attitude and their academic achievement. Hence, attitude is a predictor of science students' academic achievement.

Discussion of the Result

The finding of this study revealed that there was significant positive relationship between science students' motivation and their academic achievement. This means that motivation is a predictor of students' academic achievement in science. This finding is in agreement with the findings of Mubeen and Reid (2014), Mohammed et al (2015), Çetin, (2015), Ugwuanyi et al (2020), Tus (2020) whom found that, high students' motivation might lead to high students' academic achievement.

It was also observed in this study that there was significant positive relationship between science students' attitude and their academic achievement. This means that attitude is a determiner of students' academic achievement in science. The result of this study is in accordance with the findings of Bakara, et al. (2009), Kpolovie et al (2014), Dogan, (2015), Dan'inna, (2017), Dan'inna and Bagiwa, (2020), whom found that, positive students' attitude might lead to high students' academic achievement.

Conclusion

The findings of the study revealed that the motivation and attitude of the students had significant strong positive relationships with their academic achievement in science. Hence, the researchers therefore concluded that motivation and attitude are major predictors of students' academic achievement in science. In other words, high motivation and positive attitude might lead to high students' academic achievement in science. Thus, motivation and attitude of students should not be disregarded in their ability to achieve higher students' achievement in science.

Recommendations

Based on the findings of this study, the researchers made the following recommendations.

1. Science students should be taught in a fun and effective manner that will increase their motivation to learn science subjects adequately thereby improving their academic achievement.
2. Science teachers should use instructional strategies that will motivate and bring positive attitude of learners during science subject's instruction to enhance students' achievement.

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