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# SCIENCE TEACHERS ASSESSMENT OF FACTORS THAT INFLUNCES SCIENCE STUDENTS' PRIOR KNOWLEDGE, SELF- MOTIVATION AND SELF- EFFICACY FOR ENHANCED ACADEMIC ACHIEVEMENT

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## ABSTRACT

*Helping science student's to assess their prior knowledge and develop their self-motivation and self-efficacy has been identified to be among the factors that influences science student's academic achievement. The study investigated the factors that influence science student's prior knowledge, self-motivation and self-efficacy in secondary schools in Anambra state. Six research questions guided the study. The design for the study was a descriptive survey. The sample comprised of 250 science teachers in 50 secondary schools randomly selected from all the government secondary schools in Awka and Onitsha education zones of Anambra state. A validated questionnaire was used for the collection of data and it has a reliability coefficient of 0.82 using Cronbach Alpha technique. Data collected were analyzed using mean, frequency and percentages. The findings of the study revealed that most of the science teachers in Anambra state used for the study do not assess their student's prior knowledge during teaching and learning. They agreed that factors such as learning environment, teaching methods, family issues and instability, peer relationship, assessment techniques among others were among the factors that influences science student's self-motivation. They also agreed that students past experiences, vicarious experiences and emotional state among others were factors that influence science student's self-efficacy. The researchers recommended among others that science teachers should endeavor to assess their students' prior knowledge and help them develop self-motivation and self-efficacy to enhance their academic achievement. Conclusion was also made.*

**Keywords**: Prior knowledge, Self-motivation, Self-efficacy, Academic Achievement, Science students, Science teachers

## Introduction

Education is the totality of the process of training and developing knowledge, skills, minds and characters. It is the preparation for life and its ultimate goal is to achieve social, moral and economic well-being of the possessor. Science education provides individuals with knowledge, skills, competences and freedom of performing noble tasks that are useful for improving the socio- economic standard of the individual (Muhammad,2017). The scientific development of any nation is determined by the quality of science education in its schools.

The desire to improve science achievement through effective instructional mode has led to the increasing awareness in recent years of the learners' centeredness in teaching (Egolum & Ekwonu, 2014).There has been agitators on how best to bring about meaningful learning of science that could lead to attainment of science education objectives. Meaningful learning takes place only when the learner's prior knowledge is related to the new material to be taught (Castillo & Conklin, 2021).

Prior knowledge is a key ingredient to passing new information with the knowledge that we already possess (Castillo & Conklin, 2021). Prior knowledge is a multidimensional and hierarchical entity that is dynamic in nature and consists of different types of knowledge and skills (Okeke & Mogbo, 2019). Prior knowledge is the experience and knowledge a person brings to a new learning situation which greatly influences how the learning material is comprehended (Driscol, 2020). According to Halikar and Lindblion (2008), prior knowledge is the source of information that a person possesses about a topic. It can be based on previous learning, personal experiences on specific research conducted on a topic. It is helpful to determine prior knowledge when studying an issue or learning something new. One's prior knowledge is a fundamental determinant for their achievement in further knowledge and learning especially in a field of science. Having a sound foundation of knowledge on a topic helps the students for ease of understanding and comprehension of that topic.

Prior knowledge can help a student understand new knowledge, makes it easier for them to remember what they have learned, it goes into their long term memory and when they remember what they have learned, they are able to use it in settings outside their classroom. Prior knowledge has long been considered the most important factor influencing learning and student's academic achievement. Eliciting student's prior knowledge may help them to better relate or compare their ideas with the scientific explanations and to enhance their own understanding of science concepts. Trying to learn something without having adequate prior knowledge or worse having misconceptions may result in rote memorization. This type of surface learning may occur if students cannot relate the new knowledge to the existing knowledge framework. The amount and quality of prior knowledge positively influences both knowledge acquisition and capacity to apply higher order cognitive problem-solving skills depending if the students are motivated in learning their tasks

Motivation is the state that can maintain student's attention and behavior as well as provides them with more energy needed to lead tasks to completion (Silva, 2021). It can help students sustain activities over a long period of time. It encourages and urges students to perform an action. Without it, completing the action may be hard or even impossible. To Caroll (2021), motivation is the process of embracing challenging circumstances to face them with intention, persistence, direction, quality and intensity of behavior. Motivation is inner state uncovering individuals' behavior and

directing them to that behavior (Ertem, 2006). Motivation is an intrinsic desire which is already present in the individual or which is reflected in the individual acquiring new information (Lin, 2012). Motivation plays a major role in student's academic work and in their achievement. It reflects in students' choices of learner's task, the time and effort they denote to them in their persistence on learning task, in their coping with the obstacles they encounter in the learning task. Motivation can be extrinsic or intrinsic. Extrinsic motivation involves doing something because you want to earn a reward or avoid punishment (Bernazzani, 2017). It comes from external forces for example when a student is reading a book to prepare for a test. Intrinsic motivation is also known as personal or self- motivation. Self-motivation (intrinsic motivation) is when one is motivated to do or achieve something because of one's own enthusiasm or interest, without needing pressure from others

Eatough (2022) defined self-motivation as the internal that leads us to take action towards a goal. It keeps us moving forward even when we do not want to. Self-motivation works through you internally, it does not depend on others. According to Insights Newsletter (2014), self- motivation is the motivation arising from an individual's needs. It is an internal, unobservable force that generates a person's effort, drive and persistence towards the achievement of a pre-determined, worthwhile goal. The degree and strength of individual's self- motivation is the single most factor in determining the extent to which he or she will commit what needs to be done to achieve a desired results. It is important to encourage self- motivation in education because it helps to expose students to new skills and challenge them to learn new things. They take pride in their accomplishments not because they will receive a reward but because they feel pleased with their achievement. Without self-motivation, little or no significant achievement will be achieved in spite of the existence of the necessary knowledge, skills and resources and when students are highly motivated, it improves their self-efficacy which in turn improves their self-efficacy which in turn improves their self-motivation. It's a win-win.

Self-efficacy is an individual's belief in his or her own ability to organize and implement action to produce the desired achievement and result. Chemers and Garcia (2001) defined self-efficacy as the perceived capability to perform a given behavior. Self-efficacy trusts one's abilities and powers for learning and performance. This is a key trait for the academic successes of students. To Eatough (2022), self-efficacy refers to our belief in us to meet our goals or a certain standard. If we believe in ourselves and abilities, we are more likely to succeed. Self-efficacy beliefs lead to the individual's excellent performance through increasing commitment, endeavor and perseverance. It can influence the choice of tasks and perseverance while doing them. Therefore students with low self-efficacy are more likely to be afraid of doing their task, avoiding, postponing and given them up soon. In contrast, those with high levels of self-efficacy are more likely to rely on themselves when faced with complexities to find a solution to the problem as well as being patient during the process, making more

efforts and persisting longer to overcome the challenges. Therefore self-efficacy seems to be one of the most important factors in student's academic successes and achievement

Academic achievement is a measure of the degree of success in performing specific tasks in a subject area of study by students after a learning experience. It is the outcome of education that indicates how well a student or class of student is doing academically. Academic achievement represents performance outcome that indicate the extent to which a person has accomplished specific goal especially in a school, college or university (Steinmayr, Meibner, Welidinyer & Wirthwein, 2014). A high academic achievement for any class of students is an indication of teaching/learning effectiveness while poor academic achievement is an indication that the teaching/learning process is is not effective (Igberadja, 2016).

Student's self-motivation and academic self-efficacy has been recognized in literature as established predictors of academic achievement but they have not been sufficiently explored. Also there is lack of enough data on whether student's prior knowledge of subject matter facilitates achievement of science students in secondary schools in Anambra state. Therefore the researchers investigated the assessment of factors that influences science student's prior knowledge, self-motivation and self-efficacy for enhanced academic achievement in secondary schools in Anambra state.

**Research Questions**

The following research questions guided this study

1. What are the percentage of science teachers in secondary schools that usually assesses their student's prior knowledge during teaching and learning?
2. What are the factors that influence secondary school science student's self- motivation for improved academic achievement?
3. What are the factors that influences secondary school science students self- efficacy for improved academic achievement?
4. What are the strategies that will help science teachers in secondary schools assess their student's prior knowledge for improved academic achievement?
5. How will science teachers in secondary schools improve their students' self- motivation for improved academic achievement?
6. What are the strategies that will help science teachers in secondary schools assess their student's self- efficacy for improved academic achievement?

**Research Method**

The study adopted a descriptive survey design. The population of the study was all the science teachers in Awka and Onitsha Education Zones of Anambra State. The sample for the study consisted of two hundred and fifty (250) science teachers from fifty secondary (Awka Zone= 30, Onitsha Zone= 20) selected using simple random sampling technique. The two education zones were selected by purposive sampling because most of the schools in the two zones are in urban centers with enough science teachers. Also thirty schools were selected

from Awka zone that have a total of 50 schools while 20 schools was selected from Onitsha education zone that has a total number of 31 schools. A validated questionnaire which had a reliability index of 0.82 using Cronbach Alpha technique was used as an instrument for data collection. The questionnaire consisted of two parts (1 and 2). Part 1 contained the bio data of the respondents while part 2 has six sections on the factors that influences and the strategies that will help science teachers assess the prior knowledge and improves their students' self-motivation and self- efficacy for improved academic performance. Sections 1—6 had a total of 51 items. Section 1 for research question 1 had 8 items based on frequency and percentages while other sections were based on a 4-point Likert type scale of Strongly Agree (SD) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point. The researchers with the help of three research assistants administered the questionnaire to five science teachers in each of the fifty schools used for the study. All the questionnaires distributed were collected back and that ensured 100% return. Weighted mean, frequency and percentages were used to answer the research questions. The criterion mean value was 2.50 and any item that had the mean of 2.50 and above was regarded as accepted while those that had mean value of less than 2.50 were rejected

**Presentation of Results**

The results of this study were presented in tables according to the research questions

**Research Question 1:** What are the percentage of science teachers in secondary schools that usually assesses their student's prior knowledge during teaching and learning?

**Table 1**: Percentage of science teachers that always assess the prior knowledge of their students

| S/N | Items | Frequency (f) | Percentage (%) |
|---|---|---|---|
| 1. | Concept test | 168 | 67.2 |
| 2. | Concept map | 35 | 14.0 |
| 3. | Performance-based prior knowledge assessment | 68 | 27.2 |
| 4. | Classroom assessment technique | 110 | 44.0 |
| 5. | Portfolio | 50 | 20.0 |
| 6. | Prior knowledge self- assessment | 88 | 35.2 |
| 7. | Self-report | 71 | 28.4 |
| 8. | Auditions | 25 | 10.0 |

Analysis from table 1 showed that science teachers used for the study agreed that they mostly use concept tests and classroom assessment to assess the prior knowledge of their students hence their percentage use was 67.2 and 44.0 respectively. Other methods of assessment of prior knowledge had less than 40%

**Research Question 2:** What are the factors that influence secondary school science student's self- motivation for improved academic achievement?

**Table 2**: Mean scores of science teachers on the factors that influence science students self-motivation

| S/N | Items | SA | A | D | SD | X | Decision |
|---|---|---|---|---|---|---|---|
| 1. | Class and curriculum structure | 78 | 82 | 54 | 31 | 2.78 | Agreed |
| 2. | Teaching methods | 110 | 112 | 16 | 12 | 3.28 | Agreed |
| 3. | Learning environment | 134 | 42 | 60 | 04 | 3.18 | Agreed |
| 4. | Teacher behavior & personality | 45 | 53 | 146 | 06 | 2.55 | Agreed |
| 5. | Peer relationship | 60 | 99 | 87 | 04 | 2.86 | Agreed |
| 6. | Parental habits and involvement | 58 | 83 | 69 | 40 | 2.64 | Agreed |
| 7. | Family issues and instability | 79 | 101 | 77 | 01 | 2.97 | Agreed |
| 8. | Assessment technique | 98 | 76 | 71 | 05 | 3.07 | Agreed |
| 9. | Interest and abilities of students | 56 | 58 | 34 | 02 | 2.67 | Agreed |
| | **Grand Mean** | | | | | **2.89** | |

Analysis from table 2 indicated that all the items on the table were among the factors that influences science student's self-motivation during teaching and learning. Their grand mean score was 2.89 indicating agreement

**Researching question 3:** What are the factors that influences science students self-efficacy in secondary schools?

**Table 3**: Mean score of science teachers on the factors that influences science students self-efficacy

| S/N | ITEMS | SA | A | D | SD | MEAN | REMARK |
|---|---|---|---|---|---|---|---|
| 1. | Past performance | 119 | 73 | 45 | 13 | 3.19 | Agreed |
| 2. | Positive mastery experience | 53 | 55 | 137 | 05 | 2.62 | Agreed |
| 3. | Positive vicarious experience (modeling) | 76 | 95 | 72 | 07 | 2.96 | Agreed |
| 4. | Verbal persuasion | 81 | 84 | 54 | 31 | 2.86 | Agreed |
| 5. | Emotional states | 122 | 44 | 56 | 28 | 3.04 | Agreed |
| 6. | Physiological states | 08 | 79 | 126 | 37 | 2.23 | Disagreed |
| | **Grand mean** | | | | | **2.82** | |

Data from 3 indicated that all the items on the table except item 6 were among the factors that influences science students self- efficacy during teaching and learning and their grand mean score was 2.82 indicating agreement.

**Research Question 4:** What are the strategies that will help science teachers in secondary schools assess their students' prior knowledge?

**Table 4:** Mean scores of science teachers on the strategies that will help science teachers in secondary schools assess their students' prior knowledge

| S/N | ITEMS | SA | A | D | SD | MEAN | DECISION |
|---|---|---|---|---|---|---|---|
| 1. | Find out what the students already know and what they want to know (KWLChart) | 88 | 136 | 20 | 06 | 3.22 | Agreed |
| 2. | Ask students to draw concept map on the topic you want to teach | 70 | 104 | 65 | 11 | 2.93 | Agreed |
| 3. | Use silent group remedial practice | 50 | 82 | 76 | 42 | 2.56 | Agreed |
| 4. | Use diagnostic multiple choice qualities | 130 | 62 | 47 | 11 | 3.24 | Agreed |
| 5. | Ask students to draw a picture | 75 | 79 | 57 | 39 | 2.76 | Agreed |
| 6. | Get students to ask questions | 173 | 50 | 61 | 16 | 3.12 | Agreed |
| 7. | Use brainstorming | 48 | 55 | 146 | 01 | 2.60 | Agreed |
| 8. | Use finding out tables | 36 | 84 | 71 | 59 | 2.39 | Disagreed |
| 9. | Use graphic organizers | 41 | 62 | 95 | 52 | 2.37 | Disagreed |
| 10. | Use anticipatory quizzes | 45 | 52 | 148 | 05 | 2.55 | Agreed |
| | **Grand mean** | | | | | **2.77** | |

Data from table 4 indicated that all the items on the table except items 8 and 9 (2.39 and 2.37 respectively) were the strategies that will help science teachers activate students prior knowledge during teaching and learning

**Research Question 5**

What are the strategies that will help science teachers in secondary schools improve their student's self-motivation?

**Table 5**: Mean scores of science teachers on the strategies that will improve students self-motivation

| S/N | ITEMS | SA | A | D | SD | MEAN | DECISION |
|---|---|---|---|---|---|---|---|
| 1. | Make students understand the learning process | 83 | 87 | 49 | 31 | 2.89 | Agreed |
| 2. | Be the role model to your students or acquaint with people that can aspire them | 65 | 106 | 26 | 03 | 2.93 | Agreed |
| 3. | Give students opportunity for how they want to learn something | 18 | 50 | 129 | 53 | 2.13 | Disagreed |
| 4. | Offer them incentives and rewards to motivate them | 120 | 75 | 43 | 12 | 3.21 | Agreed |
| 5. | Associate their school work with their interest | 133 | 67 | 40 | 10 | 3.29 | Agreed |
| 6. | Focus on their strength before resolving their weaknesses | 118 | 71 | 41 | 20 | 3.15 | Agreed |
| 7. | Publicize goals to help students to study accountable | 99 | 51 | 84 | 16 | 2.93 | Agreed |
| 8. | Emphasize proper expression of behavior | 48 | 54 | 142 | 06 | 2.58 | Agreed |
| 9. | Give timely feedback | 115 | 70 | 42 | 23 | 3.11 | Agreed |
| 10. | Work towards the same goals & achieve it collaboratively | 62 | 80 | 68 | 40 | 2.66 | Agreed |
| | **Grand mean** | | | | | **2.88** | |

Data from table 5 showed that all the items on the table except 3 were among the strategies that can be used to improve the self-motivation of science students for better academic achievement

**Research Question 6:** What are the strategies that will help science teachers in secondary schools assess their student's self-efficacy for improved academic achievement?

**Table 6**: Mean scores of science teachers on the strategies that will help them improve their students self -efficacy

| S/N | ITEMS | SA | A | D | SD | MEAN | DECISION |
|---|---|---|---|---|---|---|---|
| 1. | Help students accomplish small tasks | 99 | 78 | 51 | 27 | 3.02 | Accepted |
| 2. | Use moderately difficult tasks | 111 | 52 | 72 | 15 | 3.04 | Accepted |
| 3. | Use peer models | 63 | 100 | 82 | 05 | 2.87 | Accepted |
| 4. | Allow students to make their choices | 43 | 49 | 151 | 07 | 2.54 | Accepted |
| 5. | Centralize on students interest | 121 | 52 | 62 | 15 | 3.12 | Accepted |
| 6. | Teach specific learning strategies | 80 | 85 | 54 | 31 | 2.86 | Accepted |
| 7. | Encourage students to try a task | 107 | 81 | 43 | 19 | 2.76 | Accepted |
| 8. | Give them frequent focused feedback | 74 | 97 | 70 | 09 | 2.94 | Accepted |
| | Grand mean | | | | | 2.89 | |

Analysis from table 6 showed that all the items on the table were among the strategies that can be used to improve the self-efficiency of science students during teaching and learning for better academic performance

**Discussion**

Analysis from our study revealed that many science teachers do not assess the prior knowledge of their students before teaching them new concepts. Out of the eight methods for assessing students prior knowledge, the science teachers used for the study uses only two to a reasonable percentage while others especially use of concept maps and auditions were either used to a very low percentage or not used at all. This might be because the science teachers used for the study have no knowledge of such methods and so do not use them. And if teachers do not assess their student's prior knowledge before starting a new topic, students may struggle to learn new information even though they have prior knowledge on that concept that could help them learn more effectively. This is in agreement with the study of Ambrose et al (2010) that was of the view that not assessing students' prior knowledge by teachers during teaching can hinder students learning. This is because learning ultimately begins with the known and proceeds to the unknown. Teachers can activate their students prior knowledge through use of multiple choice questions, brainstorming, finding out what the students know, getting them to ask questions, asking them to draw concept maps and so on.

Science teachers used for the study agreed that factors such as learning environment, teaching methods, family issues & instability, peer relationship, assessment technique, class and curriculum

structure and others were among the factors that influences science student's self-motivation. This is in agreement with the study of Meghna and Vandana (2020) who opined that school environment, teacher and peer relationship, students' interest and abilities were among the factors that influences students' self- motivation. The strategies that can help improve the self-motivational level of science students for improved academic performance according to the study includes teachers should offer students incentives & rewards, make them understand the learning process, give then timely feedback, focus on their strengths before resolving their weaknesses and so on. This is in line with opinion of Carol (2021), that offer of incentives, publicizing goals to help students to stay accountable and giving them timely feedback were among the strategies that encourages students' self-motivation. Students who have self-motivation does things they enjoy or value. For example they read for pleasure and reading for pleasure helps students throughout their academic and professional lives.

Student past performance, emotional state, vicarious experience (modeling), positive mastery experience, verbal persuasion and emotional states were the factors that influences students self- efficacy according to this study hence all these factors have mean score above the criterion mean. This is in line with the study of Hasan, Hossain & Islam (2014), who were of the opinion that vi- carious experiences, mastery experiences, verbal & social persuasions were among the factors that influences students' self-efficacy. The study found out that helping students accomplish small tasks, using peer models, using moderately difficult tasks, teaching with specific learning strategies, centralizing on students interests and giving students frequent feedback among others were among the strategies that science teachers can use to improve the self- efficacy of their students. Also Margolis & McCabe (2006) suggested that use of peer models, moderately difficult tasks, giving students frequent, focused feedback and others are tips that can improve self-efficacy for struggling students.

## Conclusion

Student prior knowledge should be taken into consideration in instructional design and curriculum planning. The results of prior knowledge assessments may be used as a tool for students support in addressing areas of deficiency. Prior knowledge lays a base or foundations for learning new ideas, helps to correct students' misconceptions, makes learning meaningful and make learners confident during teaching and learning

The need for self-motivation among students arises from the fact that most of the tasks students are asked to perform by teachers are not inherently enjoyable. It is therefore crucial to integrate motivational strategies into the process of teaching and learning. When students are adequately motivated academically, it will go a long way to solving most of the problems faced in educational system and also increase their academic performance and self-efficacy. Students with high self-efficacy have greater academic expectations and display better

academic performance than those with low self-efficacy.

**Recommendations**

From the results obtained, it was recommended that:

1. Science teachers should endeavor to assess their student's prior knowledge and encourage them to develop their self-motivation and self-efficacy during teaching and learning
2. The state and federal government as well as professional organizations such as STAN should organize seminars, workshops and conferences for teachers to develop skills that will help them develop self-efficacy and self-motivation in their students
3. Institutions of teacher educations should develop skills in teachers to accelerate learning achievement to close prior knowledge gaps that lead to academic achievement disparities

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