

Research Article

# Causes, Effects and Management of Science Anxiety among Senior High School Students in Old Tafo Municipality of Ghana

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**Abstract:** The purpose of the study was to investigate the causes, effects, and management of science anxiety among Senior High School (SHS) students in the Old Tafo Metropolis of the Ashanti Region of Ghana. The descriptive survey research design was adopted for the study. A sample of 337 students were selected from Osei Kyeretwie Senior High School and Al Azhariya Islamic Senior High School using the stratified random sampling procedure. Data were collected by using the Science Anxiety Scale and analysed using descriptive and inferential statistics. The study revealed that the respondents had some level of science anxiety in relation to doing science homework, having a negative attitude toward the science teacher, having fearful when entering the science classroom as well as solving science problems. The study also revealed that the causes of science anxiety involve the content, lack of infrastructure, and inadequate teaching and learning materials to make the subject easy to understand. The study revealed that science anxiety affected students' academic performance negatively, reduced their interest in science, prevent them from pursuing science programmes in the future, and also affected school attendance. The study recommended that school heads should provide the necessary infrastructure and teaching materials that will make the teaching and learning of science practical and easy to understand.

**Keywords:** Causes, Effects, Management, Science, Anxiety**How to cite this paper:**

Fia, S. D., Fosu-Ayarkwah, C., & Obuobi-Ayim, T. (2022). Causes, Effects and Management of Science Anxiety among Senior High School Students in Old Tafo Municipality of Ghana. *Open Journal of Psychology*, 2(1), 46–57. Retrieved from <https://www.scipublications.com/journal/index.php/ojp/article/view/384>

Received: May 10, 2022

Accepted: August 01, 2022

Published: August 02, 2022



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## 1. Introduction

Schools in general can be stressful for children due to increased academic demand and additional obligations [1]. Science classes have been found to be especially demanding for some students [2, 3]. The intensity and difficulty of science-related materials is a significant source of anxiety among students [4, 5]. The experience of science anxiety is able to affect the overall performance of students [6]. Science Education provided at the Senior High School is very important since it prepares the individual student for higher education in order to become a valuable person who will contribute his quota towards national development and also fit well into the Society. Teaching science therefore provides students with science experiences that give them enough opportunities for precise and rightful observation and draw logical conclusions from adequate evidence. It is therefore important to develop concepts that are in line with the aims of teaching science curriculum, skills and habit that are vital in dealing with everyday problems of life [7]. However, it seems that students at the Senior High School level experience anxiety in science subjects whenever lessons are going on, when doing

class exercises, writing class test, and also writing their final West African Secondary School Certificate Examination (WASSCE). Science anxiety appears to be a substantial barrier for students in science education [4].

Many students perceive science to be a difficult topic to master, which hinders their performance in science. Science is recognized as an important course that enhances students' cognitive growth and increases their inventiveness [4]. Due to the voluminous nature of content of science, it puts students off from developing interest in the subject and sometimes leads them to develop negative attitudes towards it. In addition, it demands practical or experimental work which makes students not to like or have interest in the subject. Science anxiety is one major element which affects the accomplishments of students in Science [6]. Science anxiety is a disruptive scenario that occurs as a result of a person's reaction to events that threaten their self-esteem, such as scientific investigations [8]. Some studies, students with scientific anxiety are scared of pursuing science courses and fields connected to science [9, 10].

Moreover, science courses are very competitive and can create "chilly," even "hostile" situations, which can lead to increased anxiety among students [11]. In some situations, most students after being admitted to pursue science programmes opt not to pursue it again because of science anxiety. Science anxiety is described as emotions of tension and stress that obstruct the interest and generation of scientific knowledge, the advancement of scientific skills and capabilities, and the application of scientific information and abilities in a wide range of everyday and academic settings and can negatively impact cognitive processing [10, 12]. In fact, science anxiety can decrease one's interest, zeal and commitment towards science subjects, and possibly have negative impact on the individual student.

In the field of science, both male and female students experience science anxiety and sometimes even when lessons are in progress. However, some studies have proven that gender differences in science anxiety varies on the basis of science subjects or courses and science self-efficacy. Therefore, science courses such as "Life Science", "Earth Science" and Physics could be studied independently [12, 13]. Some studies have revealed that female students generally experience higher level of science anxiety than male students [5, 14].

Several personal factors such as motivation determine whether a student will like science subjects or courses. If both intrinsic and extrinsic motivation is not there, the student will not have the urge to have the interest in the science subject. Motivation is widely used word that encompasses several categories such as goal-directed acts, intrinsic and extrinsic satisfaction, and self-efficacy beliefs, and it defines people's objectives, wishes, and the reasons that guide their behaviours and emotions [15, 16]. Thus, the absence of motivation makes the study of science a difficult task for students. There have been several other causes of science anxiety including being taught by a teacher who does not have enough confidence, lack of positive role models, uncomfortable past experience with Science and negative stereotypes associated with people in Science [17]. Globally, numerous studies have shown that anxiety and poor attitudes often inhibit students' engagement in the teaching and learning process, lowering their performance and success levels in Science [18-20]. In Africa, similar reports have been made that science anxiety is prevalent among students and affects the performance of students in science in a very negative sense [21]. It is evident that science anxiety can cause students not to take part in science lessons, cause students to be truants and even drop out of school. As a researcher, I see the need to research into what actually causes students at the Senior High School level to be anxious about science subject.

In dealing with science anxiety among students, several measures have been found to be effective. For instance, a study revealed that psychological interventions can help reduce the extent of science anxiety among students [23]. Such interventions could include "cognitive restructuring" "relaxation techniques" and "social skills training". Other interventions include "assertiveness training" and "problem-solving skills"; "systematic

desensitization”; and “reinforcement”, “modeling” and “role–plays” [24–29]. A study also revealed that creating more active science classes by implementing active learning strategies can help minimize students’ anxiety [30].

Overall, it is clear that Science is an important subject for several career paths. Despite this, the disinterest of students in science which is mainly due to the level of science anxiety has been seen to be very common among students in senior high schools [22]. All the anxiety issues can affect performance negatively and having a dent on the academic lives of students and their future career paths [31]. It is therefore essential that all stakeholders of education do their best to ensure that students do not continue to avoid the study of science [18].

Several authors, both local and international have noted that science anxiety tends to be a persistent problem for students in the contemporary learning institutions [32, 33]. This is affecting students’ academic pursuit in science negatively. In most instances, students enter into the examination hall with fear and anxiety for science paper, resulting in poor performance in the subject [34]. Science anxiety is a disturbing blend of worry and stress that occurs while studying science [35]. Panic, anxiety, helplessness, dread, anguish, embarrassment, difficulty coping, sweaty palms, difficulty with breath and a loss of capacity to focus have all been demonstrated to impede science accomplishment [36].

Science anxiety is still a severe canker for many students, affecting their academic performance negatively [37]. Several second cycle students lost interest in science education and are unable to further their education to a higher level because of the inability to overcome their anxiety in the subject. This problem has long been in existence and this needs to be addressed [38]. Most of the students who pursue science courses in one way or the other, drop out of the course and this has been reported to be partly due to their anxiety of the subject. In most communities, science–related programmes are left for students who are perceived to be brilliant, and as such, most students pursue General Arts, Business, Visual Arts and Home Economics programmes more than Science programmes [39]. There have been several studies which have found science anxiety to be common among senior high school students. Similar results were found by [40]. Anxiety, in particular, has been demonstrated to have a deleterious impact on both cognitive and emotional results [41].

In Ghana, review of existing literature showed that there seem to be few studies on Science anxiety among senior high school students. In spite of this, it is a common knowledge that students have a sense of fear of science programmes in senior high schools. In senior high schools in the Old Tafo Metropolis, there have been struggles of students in science. In spite of this, there seems to be no study exploring the level of anxiety of students in science. It is against this backdrop that this study is carried out to identify issues relating to science anxiety. The purpose of the study was to examine the causes, effects and ways of reducing science anxiety among Senior High School (SHS) students in the Old Tafo Metropolis in the Ashanti Region of Ghana. The study was guided by these research questions – (1) What is the extent of science anxiety among SHS students in the Old Tafo Metropolis in the Ashanti Region of Ghana? (2) What are the causes of science anxiety among SHS students in the Old Tafo Metropolis in the Ashanti Region of Ghana? (3) What are the effects of science anxiety among SHS students in the Old Tafo Metropolis in the Ashanti Region of Ghana? (4) Which strategies could be used to deal with science anxiety among SHS students in the Old Tafo Metropolis in the Ashanti Region of Ghana?

## 2. Research Methods

The descriptive survey research design was adopted for the study. In the view of Best and Kahn (2009), a descriptive survey design examines the relationships that exist, the practices that are prevalent, the beliefs and attitudes that are held, the issues that are occurring, and the effects or trends that are developing in relation to a specific

phenomenon. A sample of 337 students were selected from a target population of 2,700. Stratified and simple random sampling techniques were used to select schools (Osei Kyeretwie Senior High School and Al Azhariya Islamic Senior High School) and students for the study. Data was collected by using the Science Anxiety Scale developed [42]. Data was analysed using means and standard deviations.

### 3. Results

The data obtained from the questionnaires were analysed using means and standard deviations. Since the questionnaire was scored on a 5-point Likert-type scale, mean scores above 3.0 were deemed to be high while mean scores below 3.0 were deemed to be low. Higher means imply that the respondents agreed to the specific statements.

**Research Question 1:** What is the extent of science anxiety among SHS students in the Tafo Metropolis in the Ashanti Region of Ghana?

This research question sought to find out the extent of science anxiety among the respondents. The results are presented in [Table 1](#).

**Table 1. Extent of Science Anxiety among Students**

Statement	Mean	Std. Dev.
I cannot learn science no matter how much I study	1.99	1.33
I get stressed just when entering the class if it is science	3.09	1.38
I do not have the self-confidence for learning science	1.98	1.29
I feel uncomfortable when I enter the laboratory	1.94	1.29
I feel desperate when tackling science problems	2.53	1.39
Everybody but me understands science	2.18	1.38
I am afraid of not passing because of the science course	2.36	1.42
I do not feel that I have the competence to solve the questions related to science	2.24	1.42
I am not anxious about problems related to science because I do not like science	2.15	1.35
I become nervous when I have to do science homework	3.13	1.44
I do not answer in science class even if I know the answer in case my friends make fun of me	3.01	1.54
I become nervous when solving science problems	3.08	1.24
I am afraid of being in low position in science courses	3.11	1.65
I am not afraid of anything as much as science examinations	2.76	1.53
I am not interested in scientific activities	2.05	1.33
I have to study science when watching TV or even when there are people talking in the room	2.52	1.56
The attitude of the teacher in the science classes makes me anxious	3.10	1.48
It always makes me anxious that science is a compulsory course in the curriculum	2.36	1.39
I usually sleep in the science class when I go to bed late or cannot sleep well	2.20	1.44
I am worried in case the teacher asks me questions in the science class	3.03	1.41

Source: Field survey (2021)

[Table 1](#) shows that respondents become nervous when they have to do science homework ( $M=3.13$ ,  $SD=1.44$ ). Also, the respondents indicated that they were afraid of being in low position in science courses ( $M=3.11$ ,  $SD=1.65$ ). The respondents revealed that the attitude of the teacher in the science classes makes them anxious ( $M=3.10$ ,  $SD=1.48$ ). In addition, the respondents indicated that they get stressed just when entering the class if it

is science ( $M=3.09$ ,  $SD=1.38$ ) and become nervous when solving problems related to science ( $M=3.08$ ,  $SD=1.24$ ). In the classroom, the respondents were of the view that they are worried in case the teacher asks them questions in the science class ( $M=3.03$ ,  $SD=1.41$ ) and they do not answer in science class because they may be mocked by friends ( $M=3.01$ ,  $SD=1.54$ ).

From the results in [Table 1](#), it is clear that the respondents had some level of science anxiety in relation to doing science homework, getting low position in class, the attitude of the science teacher, entering science class and solving problems related to science. Science anxiety was also shown in the respondents being worried of being asked questions in science class and being scared of answering questions because they may be mocked.

**Research Question 2:** What are the causes of science anxiety among SHS students in the Tafo Metropolis in the Ashanti Region of Ghana?

This research question aimed at finding out the causes of science anxiety among the respondents. The results are shown in [Table 2](#).

**Table 2. Causes of Science Anxiety**

Statement	Mean	Std. Dev.
Science content is too much	3.62	1.46
There are a lot of demands in science subject	3.89	1.26
There are a lot of difficult calculations and abstract concepts in science subject	3.54	1.36
There are not enough facilities and infrastructure (laboratory) to help in the study of science	3.84	1.29
The practical aspect of science makes science difficult	3.87	1.56
Science teachers make the study of science too complex and difficult	2.62	1.43
There are not enough materials for teaching science	2.71	1.40
There are no excursions, fieldtrips and exposure to study science	3.63	1.48

Source: Field survey (2021)

In [Table 2](#), it could be seen from the respondents that there are a lot of demands in science subject ( $M=3.89$ ,  $SD=1.26$ ) and that the practical aspect of science makes science difficult ( $M=3.87$ ,  $SD=1.56$ ). The respondents were also of the view that there are not enough facilities and infrastructure (laboratory) to help in the study of science ( $M=3.84$ ,  $SD=1.29$ ). The respondents also made known that there are no excursions, fieldtrips and exposure to study science ( $M=3.63$ ,  $SD=1.48$ ). Regarding the content of science, the respondents indicated that the content is too much ( $M=3.62$ ,  $SD=1.46$ ) and that there are a lot of difficult calculations and abstract concepts in science subject ( $M=3.54$ ,  $SD=1.36$ ).

The results in [Table 2](#), clearly shows that the causes of science anxiety revolve around the content, infrastructure and other issues. Specifically, the content and demands are deemed to be too much in science, the practical aspects, the calculations and the abstract concepts in science together cause science anxiety. The inadequacy of infrastructure and lack of exposure to fieldtrips connected to science also lead to science anxiety.

**Research Question 3:** What are the effects of science anxiety among SHS students in the Tafo Metropolis in the Ashanti Region of Ghana?

This research question sought to bring to bear the effects of science anxiety among the respondents. The results are presented in [Table 3](#).

In [Table 3](#), it was shown that the effects of science anxiety include affecting performance negatively ( $M=3.79$ ,  $SD=1.27$ ) and reducing interest of students in science ( $M=3.75$ ,  $SD=1.32$ ). Also, science anxiety prevents students from pursuing science subjects in future ( $M=3.69$ ,  $SD=1.39$ ) and affects school attendance and overall performance negatively ( $M=3.50$ ,  $SD=1.39$ ).

**Table 3. Effects of Science Anxiety**

Statement	Mean	Std. Dev.
Anxiety in science affects performance in science	3.79	1.27
Anxiety in science prevents students from pursuing science subjects in future	3.69	1.34
Science anxiety can reduce interest of students in science	3.75	1.32
Science anxiety can affect school attendance and overall performance	3.50	1.39
Science anxiety can make students drop out of school	2.97	1.54

Source: Field survey (2021)

**Research Question 4:** Which strategies can be used to deal with science anxiety among SHS students in the Tafo Metropolis in the Ashanti Region of Ghana?

This research question focused on the strategies that can be used to deal with science anxiety among SHS students.

It was shown in [Table 4](#) that providing more facilities and infrastructure (laboratories) to help in the study of science ( $M=4.54$ ,  $SD=0.89$ ), providing more teaching materials to assist teachers ( $M=4.53$ ,  $SD=1.00$ ) and teachers making the study of science easier and interesting ( $M=4.49$ ,  $SD=1.02$ ) can help deal with science anxiety. Also, it is shown that making the science syllabus easier to cover ( $M=4.42$ ,  $SD=1.16$ ) and providing training to improve the expertise of science teachers ( $M=4.39$ ,  $SD=1.02$ ) can help students overcome science anxiety.

**Table 4. Strategies to Deal with Science Anxiety**

Statement	Mean	Std. Dev.
Making the science syllabus easier to cover	4.42	1.16
Providing training to improve the expertise of science teachers	4.39	1.02
Providing more teaching materials to assist teachers	4.53	1.00
Providing more facilities and infrastructure (laboratories) to help in the study of science	4.54	0.89
Teachers making the study of science easier and interesting	4.49	1.02
Organising excursions and fieldtrips to make science more practical	4.38	0.97
Making students aware of all the future prospects of studying science	4.31	1.01
Engaging in relaxation technique whenever there is anxiety	4.31	0.95
Learning special skills in studying science	4.24	1.08
Changing mentality about science as a subject of study	4.06	1.24
Gradually training yourself to deal with science anxiety	4.16	1.20

Source: Field Survey (2021)

Further, it was shown in [Table 4](#) that organising excursions and fieldtrips to make science more practical ( $M=4.38$ ,  $SD=0.97$ ), making students aware of all the future prospects of studying science ( $M=4.31$ ,  $SD=1.01$ ) and engaging in relaxation technique whenever there is anxiety ( $M=4.31$ ,  $SD=0.95$ ) can help students overcome science anxiety. These were the main strategies identified by the respondents to be helpful in dealing with science anxiety.

## 4. Discussion

### 4.1. Prevalence of Science Anxiety among Students

The study revealed that the respondents had some level of science anxiety in relation to doing science homework, getting low position in class, the attitude of the science teacher, entering science class and solving problems related to science. Science anxiety was also shown in the respondents being worried of being asked questions in science class and being scared of answering questions because they may be mocked. All of these connote that the students in the study experienced science anxiety.

The findings of this study support earlier study that the fear of negative evaluation, or the feeling of dread connected with receiving a negative review while participating in class, was the main construct underlying students' high levels of anxiety associated with science [30]. A similar study also sought to determine and overcome undergraduates' science laboratory anxiety. From their results, it was found that students experienced science anxiety usually relating to laboratory anxiety in the form of working with chemicals especially acids, laboratory accidents, using laboratory materials and equipment, and making mistakes. Similarly, another study identified the difference in anxiety levels between pure scientific and social science students in Pakistan and discovered that pure science students have considerably higher levels of anxiety than social science students [44].

Furthermore, previous related study revealed that Students reported scientific anxiety in the form of dread of receiving a poor score and failure, as well as physical reactions to science tests such as sweating, shaking, sadness, sobbing, and feeling their pulse beat faster [38]. These were confirmed in the findings of the current study. Generally, the findings of the studies discussed have all confirmed the findings of the current study. The implication is that science anxiety is a common experience among most students in second cycle institutions in several societies.

### 4.2. Causes of Science Anxiety among Students

The study revealed that the causes of science anxiety revolve around the content, infrastructure and other issues. Specifically, the content and demands are deemed to be too much in science, the practical aspects, the calculations and the abstract concepts in science together cause science anxiety. The inadequacy of infrastructure and lack of exposure to fieldtrips connected to science also lead to science anxiety. From the results, it is clear that there are a variety of causes of science anxiety among the students in the study.

The results are similar earlier study that students' scientific anxiety was caused by unpleasant classroom activities, examination anxiety, chemical perceptions, teachers' attitudes, and parents' attitudes, according to their findings. Some students perceived science courses as boring, disliking, incomprehensible, unreasonable, full of numbers and formula and require a good deal of memorization and reasoning [38]. In a similar vein, another study aimed at finding out the anxiety factors among students of distance learning of Allama Iqbal Open University. Highlighted factors such as course tutorials, books distribution, assignments and student support services as major causes of science anxiety among the students [45]. Another study on students' anxiety towards the learning of Chemistry, indicated the causes of students' anxiety in Chemistry were a broad syllabus, a lack of awareness of job prospects, teachers and their teaching approaches, and a lack of resources for teaching [18].

Another scientific study examined the effects of anxiety on secondary school students' academic performance in science and mathematics disciplines and it was revealed that teachers, parents, boredom and learning difficulties, society, a lack of necessary resources, tests and examinations, and a lack of confidence all contributed to

the students' anxiety [46]. The causes of science anxiety can therefore be seen to be multi-faceted. In essence, strategies to curb science anxiety should be multi-faceted.

#### ***4.3. Effects of Science Anxiety among Students***

The study revealed that the effects of science anxiety include affecting performance negatively, reducing interest of students in science, preventing students from pursuing science subjects in future and affecting school attendance. When students experience science anxiety, they are likely to withdraw from any science-related activity or task. This is likely to affect their performance in school and their overall academic performance. This also sends the signal that they will lose interest in pursuing science at higher levels. In Ghana, this could be what is accounting for the general small number of students pursuing science-related courses at higher levels of education. Most people right from their young ages are scared and anxious about pursuing science. This anxiety is mostly carried into adulthood and thus affecting the number of students pursuing science. From the foregoing, science anxiety generally affects students negatively and therefore needs to be discouraged or overcome. The findings of this study corroborate on secondary school pupils' scientific anxiety levels, and revealed that there is a negative correlation between students' science anxiety levels and their academic accomplishment. They argued that when students have science anxiety, they are less likely to enjoy studying science and thus affect their overall performance in science. In essence, science anxiety reduces the academic performance of students [47].

In a similar vein, a study examined the types of classroom anxiety connected to the academic achievement of students in science. The results revealed that a rise in perceived course struggles from the start to the conclusion of the semester was connected with poorer marks. Higher anxiety at the beginning of the semester was linked to a desire to drop out of the major by the conclusion of the semester [48]. This implies that science anxiety does not only affect performance but can affect the attendance of students and their desire to pursue science.

These confirmed the findings of the current study, anxiety affects students' behaviour, physiology, and cognition. High-risk testing might be particularly tough for pupils who suffer from anxiety. Anxious pupils are more likely to develop depression. All of these affect the performance of the student negatively [49]. Again, in Pakistan, a study investigated the influence of anxiety on science success and an in-depth examination of the findings revealed that science anxiety had an influence on students' academic performance. Their findings showed that as anxiety levels rise, students' academic performance suffers, regardless of their gender [50]. The effects of science anxiety are detrimental on students' performance, their attendance, and their willingness to keep studying science at the high level. Generally, all of these effects have been confirmed in the findings of the current study and those of the other studies.

#### ***4.4. Strategies/Measures that Can Be Used to Reduce Science Anxiety***

The study revealed that providing more facilities and infrastructure (laboratories) to help in the study of science, providing more teaching materials to assist teachers and teachers making the study of science easier and interesting can help deal with science anxiety. Also, it was found that making the science syllabus easier to cover and providing training to improve the expertise of science teachers can help students overcome science anxiety. These measures or strategies are essential if students are going to be assisted to overcome science anxiety. Further, it was revealed that organising excursions and fieldtrips to make science more practical, making students aware of all the future prospects of studying science and engaging in relaxation techniques whenever there is anxiety can help students overcome science anxiety.

Since science involves a lot of practical work, it is always essential to have the needed facilities so that the learning of the practical aspect of the course would be easy. Also, any

means to make the covering of syllabus easier could be a major means to overcoming science anxiety. The strategies thus involve the teacher, the school authorities and the agency responsible for curriculum development. Also, some psychological strategies like relaxation techniques can be engaged in by students with science anxiety so as to reduce the anxiety.

The findings support the findings of several previous researchers that explored the causes of science anxiety and how to reduce it among Indian higher education students. Various non-clinical and clinical preventive treatments are available for students with significant academic anxiety [51]. The findings also revealed the need to make student aware that they can receive timely assistance from specialists. A study done by researchers also aimed to figure a psychological anxiety intervention that reduced a motivation, psychological distress and increased intrinsic and extrinsic motivation in medical students. They came to the conclusion that psychological interventions like relaxation are useful in lowering anxiety levels and related factors which confirmed the findings of the current study.

Furthermore, a similar study investigated the impact of exam anxiety and academic achievement on techniques such as cognitive restructuring and study skill training in Science and revealed that cognitive restructuring and study skills training have a good impact on students' academic performance while having a negative impact on anxiety symptoms in Science [52]. Cognitive restructuring techniques like relaxation can help in reducing science anxiety [53]. These findings are all in line with the findings of the current study.

## 5. Conclusions and Recommendations

The study concluded that senior high school students in the Old Tafo Metropolis experience science anxiety. Their anxiety comes in connection to doing science homework, the attitude of science teachers and generally worrying about their performance in science classes. The study also revealed that Science anxiety among students is caused by content demands, inadequate infrastructure and teaching materials and little or no practical work of science subjects which academic performance negatively, reducing their interest in studying science, preventing them from pursuing science courses in future and affecting their school attendance. It is recommended that Science teachers in senior high schools should adopt positive attitude in the classroom which will encourage students to develop an interest in science. It is recommended that to reduce science anxiety, the infrastructure and materials needed to teach and learn science subjects must be provided and the content taught by experienced teachers as well as using teaching methods for students to easily understand the subject. The study found out that science anxiety reduced the academic performance of students and their desire to further pursue science. It is therefore recommended that teachers encourage students to give extra attention to science so that they can perform better and have the desire to continue in the field of science education.

**Author Contributions:** Conceptualization SDF, CFA, and TOA; methodology, SDF, CFA, and TOA; formal analysis SDF, CFA, and TOA; investigation; SDF, CFA, and TOA; Resources, CFA; data curation SDF, CFA, and TOA; writing-original draft preparation, SDF, and CFA; writing-review and editing, CFA; visualisation, SDF, CFA, and TOA; supervision SDF, and CFA; project administration, CFA. Authors have read and agreed to the published version of the manuscript.

**Funding:** "This research received no external funding"

**Data Availability Statement:** Data is available on request from the corresponding author.

**Acknowledgments:** We acknowledge respondents for their time with us.

**Conflicts of Interest:** "The authors declare no conflict of interest." "No funders had any role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results".

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