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# Combating the Menace of Students' Difficulties in Physics for Developmental Goals in Nigeria

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**Abstract**
The study surveyed the difficulties encountered by Senior Secondary School Students in Physics as well as factors responsible for such difficulties and solutions to combat them. The study is a descriptive one using 300 physics students randomly selected from ten different public senior secondary schools out of the 20 senior secondary schools inAjeromi Ifelodun Local Government Area of Lagos state.Three research questions guided the study using a structured questionnaire which consisted of three parts Part A focused on the bio-data information of the students, Part B consisted of 25 lists of senior secondary school physics topics and Part C consisted of 20 questions to identify factors responsible for such difficulties.The instrument was validated and its reliability coefficient (r) value =0.617 using chronbach alpha.Data collected were analyzed descriptively and the results showed that students identified 13 topics to be difficult out of the 25 topics listed.Also, the 4 factors tested were identified as responsible for these difficulties and solutions were proffers to combat such difficulties based on the factors identified. The researchers' recommended that policy makers should pay close attention to these factors in achieving developmental goals in Nigeria.

**Key words**: Students, Difficulties, Menace and Physics.

## Background to the Study

Science Education has been globally recognized as instrument per excellence for any form of development(Ogunleye&Babajide,2011;Akani&Aboyin,2011;Holbroook,2011;Mwangi,Georg e&Thinguri,2013 ).Physics the bedrock of scientific development is bedeviled with diverse problems such as misconceptions about its nature, poor teaching and learning environment, teachers and students factors, government and parents' factors and many others. These factors may probably be traceable to sources of students difficulties on the subject thereby resulting in poor performance on the parts of the students and hinders all forms of development. The knowledge of physics develops safety skills to avoid dangers. For instance, if one is aware of the fact that at high altitude, there is less oxygen, then appropriate safety measures can be adopted while traveling in an aircraft at high altitude. These skills are valuable for practical application in all sectors. Hence, the need for the employment of physics graduates by employers of labor in industrial sectors is a necessity for all forms of developmental goals .But physics students with difficulties are not employable to such industries.

It is worth mentioning that technology depends on the principles and theories of physics. For example, through the understanding of electromagnetism, electrically driven devices (such as television and computers) were utilized in the development of motorized used in transportation (such as cars).Also, Carnot engine emerge from the understanding of thermodynamics. Physics therefore plays an important role technology and economic development. These days, one travels far, communicates easily and quickly, also transacts businesses around the world effortlessly through the use of equipment produced from the application of the knowledge obtained from physics. In addition, electricity and air conditioners will not be produced without the knowledge of physics. In fact, there will be increase in diseases in the absence of the discoveries and inventions made in physics since most equipment's used in treatment of diseases have principles in physics.

The following are few examples of physicists and their contributions: Galileo Galilei- formulated the laws that govern the motion of objects in a free fall, Isaac Newton- formulated the basic concepts of mechanics and he discovered the universal gravitation, Archimedes invented the Archimedes screw, an inclined, rotating, coiled tube used originally to lift water from the holds of ships; Boltzmann contributed to the development of the kinetic theory of gases, electromagnetism and thermodynamics, Kelvin was the first to propose the use of an absolute scale of temperature and Michael Faraday contributed to the study of electricity and the invention of the electric motor, electric generator and transformer. Also, Wilhelm Roentgen discovered x-rays while William Henry Bragg and William Lawrence Bragg studied the diffraction of x-rays in crystals and Albert Einstein explained the photoelectric effect (Raymond&Jewette, 2004). These discoveries and inventions have greatly contributed to the material well-being of the human race.

**Literature Review**

There are some limitations against such contributions in Nigeria. One of which is difficulties encountered by students in the subject. Secondary school level is the first level at which students are exposed to the study of physics and difficulties at this level will lead to shortage of future physicist, engineers, and scientists to work in technological field (Angell, Guttersrud, Heinrikson & Isnes, 2004).

In addition, Lyons (2006), Owen, Dickson, Stanis Street and Boyes (2008) submitted that the decrease in the enrolment rate of students in Physics affects scientific literacy of societies. While Osborne, Simon and Collins (2003) reported that there is a clear correlation between economic success and the number of trained engineers and scientists within a society, and that an increase in mathematical and scientifically literate population boosts the economy. Also, a report from the Department of Education in the United States of America (2000) asserted that "the future well-being of our nation and people depends not just on how well children are educated generally, but on how well they are are exposed to mathematics and science specifically".

Also, Nashon (2003) reported that the low participation in physics among students at varying levels of learning seems to be global. Literature reveals that senior secondary students' decisions about taking physics is based on a number of factors grouped into two categories: external and

internal, 'external' reasons deal with factors that influence from outside, such as family, school and science teachers, peers, mass media and the society and 'internal' reasons are based on students' perceptions and experiences of science. Students who enjoyed their learning experience in junior science and achieved good results in science were found to be more confident in their abilities and more likely to enroll in physics (George & Taylor, 2001).

Behar and Polat (2007) opined that students' difficulties in physics are due to misconceptions while Johnson (1991) attributed the cause to complexity due to ideas and concepts existing at three different levels namely; macro and tangible, micro, and representational or symbolic. Lack of textbooks, instructional materials, students' attitude and time .This difficulties may lead to poor enrolment of students into physics education department has resulted in the continuous shortage of physics graduates.

Therefore, Behar and Polat (2007) suggested that scientific concepts should be introduced at the macroscopic level to students to eradicate student 'difficulties.

Research reports also show that students who find a subject interesting tend to choose it for further study. Hence, physics must be relevant to the students through the eradication of their difficulties. Researches have established that availability of required textbooks and materials reduce students' difficulties and contribute positively to their academic achievement (Adebitan, 2004; Ogunleye, 2000). Textbook is one of the common and easy tools that students can consult for understanding and clarification of concepts.Textbooks written by foreign authors with foreign examples lead to student's difficulties.

Furthermore, the need for relevant instructional materials should not be underestimated. There is an adage which says, "What I see I know, what I hear I forget, what I do, I remember; implying that students' understanding of physical concepts will be greatly improved if instructional materials and laboratory equipment's are effectively used in teaching and learning physics (Boyes,2008; Ogunkola & Fayombo,2009). Physics is a physical science hence its teaching should involve more of practical demonstration to students than theoretical presentation of facts. More often than not, most schools have laboratories that are ill-equipped. In this case, the teaching strategy may include "rote-learning method" and "lecture method" (that is, the talking and chalking method). This will not improve the performance in physics but rather create more difficulties to students (Olagunju, 2002; Ogunleye 2009).

Various researchers have indicated positive relationships between students' interest and learning. Logan and Skamp, (2005), Trumper, (2006) and Elster, (2007) have shown that students' in-terest for physics declines with time. Also, Williams, Stanis Street, Spall, Boyes and Dominic (2003) and Krapp (2002) identified a significant decline in students' interest in physics due to difficulties they encounter in it.

It is against this background that this study investigated the topics that students found difficult to comprehend, factors responsible for such difficulties and proffer adequate solutions to eliminate such difficulties for economic development in Nigeria and African countries

**Objectives of the study**

1. To identify the topics in senior secondary school (SSS) 1 and 2 physics curriclum that students find difficult
2. To identify factors responsible for these difficulties.
3. To suggest solutions to combat such menace based on the factors identified

**Statement of the Problem**

The problem of this study is that students are having difficulties in some physics topics and these difficulties prevented them from gaining admission into university in pursuit of physics related courses .This has resulted into economy degradation, poor standard of living and hardship in the country.

**Theoretical Framework**

This study is based on constructivist theory of learning. This theory of learning states that learning is a process in which the learner actively constructs new ideas based upon current and past ideas. That is, "learning involves constructing one's own knowledge from one's own experiences" (Jonassen, 1991; Ormrod, 2003).This study is related to this theory in the sence that, learners will be able to construct their own knowledge (apply the knowledge they has acquired in new situation) only when students' difficulties are combated.

This school of thought views knowledge construction and occurrence of learning in three ways viz: subjective, shared and adapted from one's own experiences. Knowledge is subjective when individual construct knowledge. It is shared when a group of people are involved in knowledge construction and application.

Specifically, the study is based on Bruner constructive theory. Bruner's theory states that learning is a process of discovery. In discovery, the learner is confronted with problems (difficulties) .The first step is for learner to develop a sense disparity with what one has already known so as to bring some order out of any confusion through "cognitive restructuring" of previously known ideas in order to accommodate the new experience through the assimilation of new relations and the creation and manipulation of learning materials. He contends that a child moves through three successive stages of mental development: the inactive, the ikonic and the symbolic. At the inactive stage, the learner manipulates the learning material directly. At the ikonic stage, the learner deals with mental images of objects but does not manipulate the objects directly. Lastly at the symbolic stage, he is able to manipulate symbols and no longer is mental images of objects.

**Research Questions**

1. What are the topics in SSS curriculum in physics that students found difficult?
2. What are the factors responsible for these difficulties?
3. How can these difficulties be overcome?

**Methodology**

The study is a descriptive survey type withsample of Ten (10) Senior Secondary Schools randomly selected from the 20 senior secondary schools in Ajeromi Ifelodun LGA of Lagos

state selected by means of simple random sampling. A total of three hundred (300) Senior Secondary two (SS2) physics students were randomly selected from the ten (10) schools, thirty (30) senior secondary schools (SSS) two.

The instrument used for this study was students' questionnaire structured to obtain students' opinions.It consisted of three sections (A, B and C). Section A focused on students' personal data. Section B consisted of 25 topics in senior secondary schools 1 and 2 curriculum and students were to make a tick ( ) on the topics they perceived difficult to understand. The instrument was developed on a 5 point Scale include; Very difficult (VD) Difficulty (D) Fair (F) Simple (S) and Very simple (VS) The options indicated the magnitude of difficulty which students experienced and perceived when learning each of the Twenty-five (25) topics, while section C sought information on the factors responsible for the difficulties in physics.Four different factors were presented, (textbooks, students attitude, instructional materials and time to study physics) students are expected to respond to these items based on their level of agreement using a three point scale of Agree,(A) Disagree (D) and Undecided (UD) .The instrument was scored as follows: Very difficult (VD) =1 Difficulty =2 (D) Fairly Difficult= 3 (F) Simple (S) =4 and Very simple (VS)=5 . Agree (A) =2 Disagree (D) =1 and undecided =0.For positive responses and negative responses were scored the other way round.

The face, content and construct validity of the instrument was carried out by the researchers to ascertain the internal consistency of the instrument, a pilot test was conducted using 20 physics students in St Fin Barr's Senior Secondary School Akoka, Lagos and the reliability coefficient (r) was calculated to be 0.617 using Chronbach Alpha. Data collected were analysed descriptively using frequency count mean, simple percentage, standard deviation and regression analysis. The frequency vs. difficult topics graph was plotted to show relationship.

## Data Analysis and Results

### Research Questions

1. What are the topics in SSS curriculum in physics tht students found difficult?
   Table1 1&Figure1 provide answer to this research question
   Table 1 shows the descriptive statistics of the students' difficulties area in physics





**Table1: Descr**

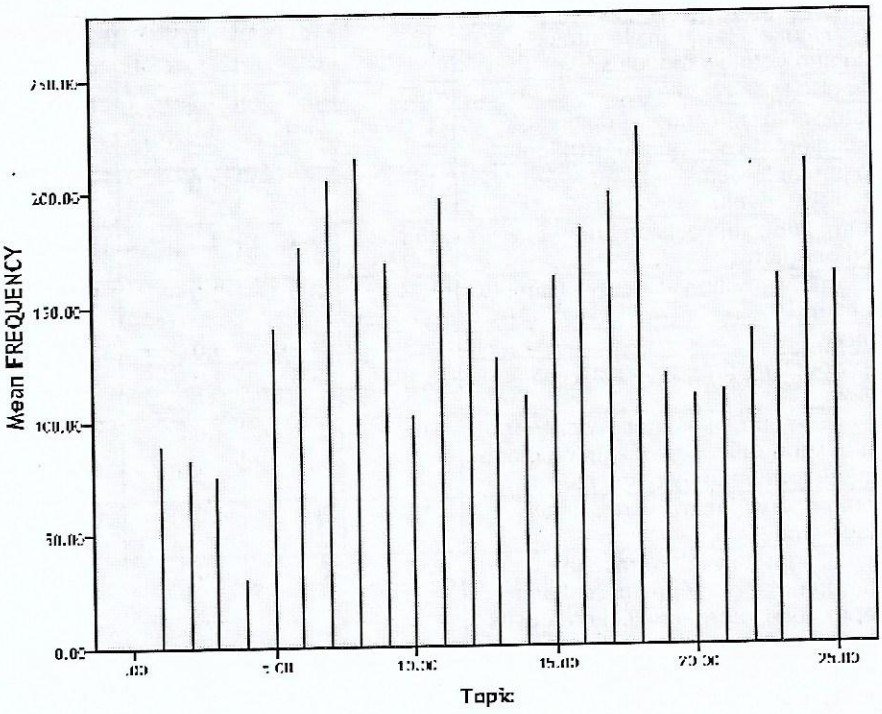
| TOPIC |
|---|
| 1 Measureme quantities. Dir |
| Motion, Force |
| 3 Heat energy convention, ar |
| 4 Work,energ |
| 5 Heat capaci latent heat. |
| 6 Expansivity and volume |
| 7 Electric char distribution an |
| 8 Fields -cor Gravitational a force, properti |
| 9 Current elec difference, Ele Resistors in s |
| 10 Particle na states of matt Brownian mot |
| 11 Capillarity - application. Vi |
| 12 Elasticity - tensile strain a |
| 13 Projectile a |
| 14 Scalar and vectors, resolu |
| 15 Equilibriu moment, stabi |
| 16 Momentum conservation o |
| 17 Simple har harmonic moti |
| 18 Resonance |
| 19 Waves -pro wave equation |
| 20 Light wave propagation o surfaces, ima |
| 21 Reflection through lense |
| 22 Reflection refraction thro apparent dept application. |
| 23 Sound wa speed, charac application. |
| 24 Pressure, principle. |
| 25 Physics lal |

**Table1: Descriptive statistics of the students' difficulties in physics topics**

| TOPIC | FREQU-ENCY | MEAN | MEDIAN | STANDARD DEVIATION | RANGE |
|---|---|---|---|---|---|
| 1 Measurement. Fundamental and derived quantities. Dimensional analysis. | 89 | 3.88 | 4.0 | 1.0 | 4 |
| Motion, Forces; centripetal centrifugal forces. | 83 | 3.80 | 4.0 | 0.85 | 4 |
| 3 Heat energy and heat transfer: conduction, convention, and radiation and temperature | 76 | 4.0 | 4.0 | 0.93 | 8 |
| 4 Work,energy and power. | 30 | 4.4 | 5.0 | 0.75 | 3 |
| 5 Heat capacity, specific heat capacity and latent heat. | 141 | 3.4 | 4.0 | 1.12 | 4 |
| 6 Expansivity and its application - linear, area and volume | 176 | 3.3 | 3.0 | 1.07 | 5 |
| 7 Electric charges - types, production, distribution and storage. | 206 | 3.0 | 3.0 | 1.04 | 4 |
| 8 Fields -concept and types of field, Gravitational and magnetic field. Lines of force, properties of force and force field. | 215 | 2.9 | 3.0 | 1.10 | 4 |
| 9 Current electricity -electric current, Potential difference, Electromotive force; Ohm's law, Resistors in series and parallel. | 169 | 3.3 | 4.0 | 1.08 | 6 |
| 10 Particle nature of matter; Atomic structure; states of matter, Diffusion, Osmosis and Brownian motion. | 102 | 3.8 | 3.0 | 1.05 | 4 |
| 11 Capillarity - Adhesion, cohesion and application. Viscosity, Density. | 197 | 3.1 | 3.0 | 1.06 | 4 |
| 12 Elasticity -Hooke's law; tensile stress, tensile strain and young's modulus. | 157 | 3.3 | 3.0 | 1.16 | 4 |
| 13 Projectile and falling bodies. | 127 | 3.6 | 4.0 | 1.11 | 4 |
| 14 Scalar and vector quantities-Addition of vectors, resolution of vectors and resultant. | 110 | 3.8 | 4.0 | 2.51 | 4 |
| 15 Equilibrium of forces –Principles of moment, stability, couple. | 163 | 3.3 | 4.0 | 1.13 | 4 |
| 16 Momentum, impulse, collision and conservation of energy. | 183 | 3.2 | 3.0 | 1.10 | 4 |
| 17 Simple harmonic motion -Energy of simple harmonic motion | 199 | 3.0 | 3.0 | 1.20 | 4 |
| 18 Resonances. | 228 | 2.7 | 3.0 | 1.11 | 4 |
| 19 Waves -production, propagation, types and wave equation. | 120 | 3.6 | 4.0 | 1.17 | 4 |
| 20 Light waves -sources of light, rectilinear propagation of light, reflection of light on plane surfaces, image formation by plane mirror. | 110 | 3.7 | 4.0 | 1.11 | 4 |
| 21 Reflection on curved mirrors, refraction through lenses-types | 112 | 3.7 | 4.0 | 1.12 | 4 |
| 22 Reflection of light -laws of refraction, refraction through triangular prism, real and apparent depth, total internal reflection and its application. | 138 | 3.5 | 4.0 | 1.12 | 4 |
| 23 Sound wave -production, transmission, speed, characteristics, Echo and its application. | 163 | 3.3 | 4.0 | 1,12 | 4 |
| 24 Pressure, law of floatation, Archimedes' principle. | 213 | 2.9 | 3.0 | 1.21 | 4 |
| 25 Physics laboratory practical. | 164 | 3.1 | 3.0 | 1.35 | 4 |

Table 1 shows that greater number of the students responded that 13 topics out of the 25 topics are difficult (topics whose frequency is greater than 150).Frequency shows students responses on difficulties alone.89students out of 300 students responded that topic 1 is difficult while 211 students admitted that it is simple therefore topic 1 is not difficult. On the contrary, 228students responded that topic 18 is difficult while 72 responded that it is simple therefore topic 18 (Resonance) is difficult. In fact it is the most difficult topic in SS2 topics in the curriculum.

Next to this is Fields-concept and types of field, Gravitational and magnetic field. Lines of force, properties of force and force field with frequency of 215, Pressure, law of floatation, Archimedes' principle has frequency of 213,followed by Electric charges- types, production, distribution and storage,with a frequency of 206, next is Simple harmonic motion-Energy of simple harmonic motion,with a frequency of 199,followed by Capillarity- Adhesion, cohesion and application. Viscosity, Density with a frequency of 197. Next is Momentum, impulse, collision and conservation of energy., with a frequency of 183 followed by Current electricity- electric current, Potential difference, Electromotive force; Ohm's law, Resistors in series and parallel with a frequency of 169, next is Equilibrium of forces Principles of moment, stability, couple,and Sound wave- production, transmission, speed, characteristics, Echo and its applicationwith frequency of 163,next is Elasticity- Hooke's law; tensile stress, tensile strain and young's modulus with a frequency of




1. **Research Question 2: What are the factors responsible for these difficulties? Tables 2, 3&4 provides answers to research question 2.**

student's responses. ANOVA[a]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 7224.330 | 4 | 1806.083 | 3518.741 | .000[b] |
| | Residual | 151.416 | 295 | .513 | | |
| | Total | 7375.747 | 299 | | | |

a. Dependent Variable: total responses

b. Predictors: (Constant), Time, Textbook, Instructional mat, Students attitude

Table 2 shows that all the predictors significant contributed to students difficulties. All the four factors are significant at .05 levels

**Table 3: Contributions of the predicators to students' difficulties in physics**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .604 | .273 | | 2.216 | .027 |
| | Textbook | .976 | .026 | .338 | 37.502 | .000 |
| | Studentattitude | .962 | .031 | .293 | 31.110 | .000 |
| | Instrutionalmat | .995 | .021 | .438 | 47.520 | .000 |
| | Time | .992 | .026 | .356 | 38.476 | .000 |

Table 3 shows the contribution of each of the factors to student difficulties, instructional materials made a contribution of .995; the highest contribution, followed by time available for students to study, .992 next is textbooks, .976 and finally, students' attitude with a contribution of.967.

**Table4: Summary of Regression Analysis of the independent variables on dependent**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .990[a] | .979 | .979 | .71643 | .979 | 3518.741 | 4 | 295 | .000 |

Predictors: (Constant), Time, Textbook, Instructional mat, Student attitude

**Table 4 shows that the four factors investigated made a total contribution of 97.9% to the difficulties of students in physics.**

## 1. How can these difficulties be overcome?

These difficulties can be overcome by taking cognizant of the following factors since they are sorely the causes of students' difficulties. Therefore, to overcome students' difficulties, instructional materials must be provided to teach difficult topics, is must be clear, relevant to the topic for which it is prepared for. It could be real object or improvised, or it could be diagrams; the diagrams must be and big enough, attractive and simple.It must be visible to the students.Nevertheless, real objects are better but where it is not possible it could be improvised.

Secondary school authorities must make provision for enough time for physics lessons on the time table. Time for assembly and other curricular activities must not overlap with time for

physics lessons, students must devote a greater percentage of available time to practicing and solving physics problems.They should also devote greater time to read and discussing physics contents and its related factors.

Adequate textbook should be made available for students, because textbook is the heart of any educational enterprise; teacher rely on them to set the parameters of instruction and to impact basic educational content(Akani&Aboyi,2011).These text must be made readily available for the students. It must be standard, easy to understand, the language use must not be difficult for students to comprehend. It must contain familiar examples .The diagrams must be attractive and the text must contain enough worked examples and exercises for students to practice physics.

Improved students' positive attitude through close attention to classroom activities, punctuality and regular attendance at lesson is necessity.Others include correct notes taking and prompt submission of assignment. Constant studying of notes before and after lessons and participate effectively in physics lessons through asking questions. They must participate actively in the lesson and make positive contribution.

**Discussion of Findings**

Students admitted that their difficulties in physics are caused by lack of adequate instructional materials for physics lessons and practical's. The available materials are few in number and do not give opportunity for individual to carry out practical activity. This prevented them from acquiring necessary practical skills for innovative minds and creativity. Also, the few available materials for practical are not functioning properly. Therefore, most of the topics in physics are taught in abstraction. This situation cannot bring any form of developmental goals to Nigeria.

Time allocated to physics lessons are too short for the contents and that most of time for physics lessons are spent on the assembly ground for other co-curricular activities and sometimes time for physics lessons fall on public holidays. The domestic activities of some students prevented them from study physics and doing their physics assignment. This is another source of students'difficulties.

Other sources includes textbooks, they admitted that they don't have textbook to study physics. The physics textbook in circulation are complex and difficult in terms of language and the cover page is to attractive and fascinating, hence, they don't read and solve questions.

Students' attitude toward physics has been generally poor as an evidence of the combined effects of the above factors. Students don't normally read physics notes before and after lessons. They don't attend lessons punctually and regularly and so they have difficulties in physics. These difficulties cannot make them to be employable and be productive rather leading to unemployment and low standard of living and diseases.

**Conclusion**

Students' difficulties in physics have successfully been investigated, 13 factors were identified to be responsible, and solution to this problem is to take proper cognizance of these factors so as to achieve developmental goals in Nigeria.

## Recommendations

1. The Department of science and technology unit should make adequate provision for the supply of instructional materials and material for practical in schools or create a Centre in every local government where science equipment and materials could be kept, employ workers to monitor the collection and return of materials by schools in the local government.

2 All principals of schools should ensure that the school time table committee is functioning and ensure that enough time is allocated to science subjects. Specifically physics; based on its nature and it should come up in the morning when students are not yet tired.

3. Teachers should be trained on the usage and improvisation of science materials. The Science Teacher Association of Nigeria has initiated this in the time past. Government should include the retraining of science teachers on improvisation and uses of science materials. Also, there is a strong need for the training of teachers on entrepreneurship skills in schools.Government should make necessary provision for this in its annual budget

4. Indigenous physics authors should be encouraged and patronized through the inclusion of their text in the curriculum. There should be good synergy among curriculum planners and physics authors so that the content of the curriculum and textbooks will align and the standard of each text must not be compromised. There should be quality control assurance on textbooks standards and production.

5. All physics teachers should use strategies that will make students develop positive attitude towards physics; such as the use of instructional materials, correct textbooks, sufficient time allocation etc.

Parents must buy textbooks for their children and give them enough time to concentrate on their academic work.

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