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STRATEGIES FOR DEVELOPING SCIENTIFIC SKILLS AND ATTITUDES IN PHYSICS EDUCATION AMONG SECONDARY SCHOOL STUDENTS IN EBONYI STATE, SOUTHEAST NIGERIA

Ali, Peter A.
Department of Physics, Ebonyi State College of Education, Ikwo

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Abstract
This study was carried out to identify the strategies for the development of scientific skills and attitudes in physics education among secondary students in Ebonyi state, southeast Nigeria. One research question was developed in line with the purpose of the study. One null hypothesis was formulated and tested at 0.05 level of significance. The study adopted descriptive survey design. The population of the study is 2370 students and 87 teachers, and the sample comprised 600 students and 25 teachers of physics from the area of study. This sample was drawn using multi-stage sampling technique. An–11 item instrument termed "Science Skills and Attitudes in Physics Questionnaire" (SSAPQ) was used by the researcher for data collection. The instrument was first validated by experts and reliability was determined using Cronbach Alpha Statistics and the reliability got was 0.82. The administration and retrieval of instrument were through direct contact and use of research assistants with the respondents. Data collected were analysed using mean and standard deviation for the research question while t-test statistics were used for testing the null hypothesis. The findings of the study revealed that 9 out of 11 items presented are the strategies for the development of scientific skills and attitudes in physics education among secondary students in Ebonyi state, southeast Nigeria. Findings on the hypothesis tested revealed that there was no significant difference in the mean responses of students and teachers of physics from Ebonyi state on the items presented.
Holistic reformation of the physics curriculum to incorporate the strategies, appropriate training of teachers to ensure quality transmission of scientific knowledge, skills and attitudes and provision of needed laboratory facilities, books and other learning materials by the relevant stakeholders were recommended.

Introduction

Background to the study
Over the years, it has been observed that research in physics education both in secondary and tertiary levels has focused more on the concepts of learning and understanding. Arobo, [1] noted that the curriculum of physics as practised in Nigeria has not placed any emphasis on skills development. Again, Arobo, [1] observed the inadequacies of teaching and learning of physics in Nigeria, in that the methods used do not ensure skills and value acquisition. This implies that the teaching of physics is based on stressing concepts and their relationships, while physics laboratory practices emphasizes acquisition of laboratory skills. The development of values has therefore received least emphasis. Accordingly, Aribios, [2] noted that the basic concepts of skills and values development are most of the time neglected in the study of physics and science in general.

In the work place, according to Ripin, [3] the employability of physics graduates appears to hinge more on generic skills and values that are transferable to many areas of research, work and life itself. For the generality of the people and the great majority of students who will pursue a physics career, the teaching of physics for scientific literacy and science culture in a given society should be a priority thrust in physics education. UNESCO has led international efforts towards scientific literacy, particularly in developing countries, cognizant of the crucial role of science and technology in national development. Lately, international emphasis has been on education for sustainable development, 2005-2014 declared as the United Nations Decades for Sustainable Development. Like scientific literacy, sustainable development is laden not only with concepts but also skills and values such as the development of human potential, moral, cultural and gender sensitivity, participatory democracy, collaboration, unity and peace. Skills needed to learn physics are categorized as thinking skills, including science process skills, ICT skills, communication skills and interpersonal skills. The values development section focuses on attitude towards science and its image to students.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Statement of the problem

Now in the general opinion, the measure of teaching is not the amount of knowledge the students learn from teachers but the learning skills which the students master and the values impacted.

Thus, physics teaching requires more attention to the teaching and learning process of moving students from their initial state of knowledge and understanding to the desired level, rather than to the content of the course. In fact, studies show that students learn best if they are engaged in active learning. Student-centred teaching is a teaching style more effective than others because it is more likely to motivate students by engaging their interest. It is important that in order to help students learn better and develop the necessary scientific skills and attitudes, the teacher not only manages change, assessment for the future, curriculum design, training the students learning skills needed, but also developing the teaching techniques needed in the classroom.

In this article, based on the pedagogical teaching strategies (such as e-learning, independent study tasks, project work, mixed workshop, problem-based learning, case study and so on) efforts were made to determine suitable strategies for the development of scientific skills and attitudes in physics education among secondary students in Ebonyi state, southeast Nigeria.

Purpose of the study

The main purpose of this study is to determine innovative strategies for the development of scientific skills and attitudes in physics education among secondary students in Ebonyi state, southeast Nigeria.

Specifically this study sought to;

(i) Analyse the skills needed to learn physics as categorized as thinking skills, including science process skills, ICT skills, communication skills and interpersonal skills.

(ii) Analyse the value development section which focuses on attitude towards science and its image to students.

Significance/Justification of the Study

The findings of this study would reveal the possible things to do to improve the teaching and learning of physics in Ebonyi state and other states of the country. This will be achieved through the application of recommendations of this study. Achieving this feat through this study will make students' achievement in physics to improve for better especially as regards the development of the needed scientific skills and attitudes. This would go a long way in improving the science and technology status of the country.

The result of the study will be beneficial to the teachers and curriculum planners. This is in the area of helping them to develop a realizable educational goal in the subject.

Scope of the Study

This study will be conducted in secondary schools in Ebonyi state, southeast of Nigeria. Both teachers and students of physics in the various secondary schools in the state will be studied. The content scope includes determination of the most appropriate strategies to be adopted in the development of scientific skills and attitudes for physics learning among the secondary school students.

The Research Question

The following research question guided the study:

What are the strategies for the development scientific skills and attitudes for learning physics among secondary school students in Ebonyi state?

Hypothesis

The following hypothesis was tested at 0.05 level of significance:

There will be no significant difference in the mean ratings of students and teachers on the strategies for the development of scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria.

Literature review

Concept of Scientific Skills

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Science is one of the top fields of today that has continually gained recognition due to discoveries and inventions. Science is one of the most interesting subjects anyone can ever take in his entire school life. It enables one to let one's curiosity loose and be able to discover many things in this world one never knew existed. Curiosity and desire for improvement of life has led many people to incline towards science and eventually become experts in this field, [4]. Science study involves the development of important skills, including life skills, [5]. Tagliagambe, [6] defined science skill as the ability to use scientific knowledge to identify questions that can be answered through a scientific process and draw conclusions based on facts to understand the natural world and the changes made to it by human activities and to help to make decisions about it. The following scientific skills are identified by researchers;

i. Observation – This is the most fundamental and most important science skill. This is because almost every person is born with the five senses which inform how the person experiences the world. Scientists observe everything that happens around them and question why it is so. Using their senses they gather information about certain mundane phenomena and discover something more exciting and worth noting, [4].
ii. Classification – This skill builds upon observation. Scientists learn to separate and sort objects based on observed properties.
iii. Quantification – One of the most valuable skills needed for science study is the ability to measure accurately and assign values.
iv. Predicting – This skill derives from students being able to spot patterns in past experiments or existing evidence (i.e., from the natural world). Predicting is an educated guess about what's likely to happen when you introduce changes.
v. Controlling variables – Many different factors can affect the outcome of an experiment. Students should understand this by discussing potential factors before starting any experiment.
vi. Interpreting – This skill is closely related to inferring, which means coming to a conclusion after analysing information. Interpreting, is inferring, from a point of view. Two students may interpret an experiment's results differently.
vii. Communicating – This skill touches every other one. Students must be able to transmit information through words, charts, diagrams, and other mediums.
viii. Forming conclusions – This skill is connected to interpreting. Students cannot make conclusions hastily; they must be reached through careful reasoning. [5]

Ogwo, [7] said that physics is about the observation, understanding and prediction of natural systems. In promoting physics to the public and encouraging students to have a career in it, the development of problem solving ability is usually emphasized. Ogwo, [7] also observed that studying physics helps to develop a range of skills that can be applied in many areas; scientific and non-technical. Accordingly, the following skills were identified;

(i) Problem solving skills; studying physics gives one a pragmatic and analytical approach to problem solving. Tasks are broken down to their basic elements and imagination and creativity are used to try new approaches to solving challenging problems.
(ii) Reasoning skills; studying physics enables one develop reasoning skills to construct logical arguments, apply analytical skills and grasp complex problems. This involves ability to logically and systematically pursue a line of thought. It also involves precise thinking and clarity of thought.
(iii) Numeracy skills; studying physics enables one to use mathematics to find solutions to scientific problems, create mathematical models, interpret same and present information graphically. This also includes gathering data, making and testing models and predictions which create logical data-based decision making.
(iv) Practical skills; this involves experimental, computational, theoretical skills-applicable to a broad spectrum of problems. The study of physics enables one develops practical skills by planning, executing and reporting experiments, using technical equipment and paying attention to details. Under this also, there is the independent learning skills and time management.
(v) Communication skills; studying physics gives one skills to communicate complex ideas and use complex ideas and use technical language correctly. These skills involve writing, speaking and thinking in a logical, predictable and consistent way appreciated in work. Others include how to learn, define problems, strategically plan, implement and communicate solutions.
(vi) Information and communication technology skills; physics is the basis of all advances in information and communication technology. Studying physics enables one to invariably acquire ICT skills more effectively, including software packages and some programming.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

The school physics curriculum lists the following goals for skills development as contained in FGN, [8];

(i) Develop skills for scientific inquiry,
(ii) Develop ability to think scientifically, critically and creatively, and solve physics-related problems individually and collaboratively,
(iii) Understand language of science and communicate ideas and views on physics related issues,
(iv) Make informed decisions and judgements on physics related issues.

According to Solanuel, [9] strategies for scientific skills development are varied. Firstly, students should be made to be able to interpret some pictorial diagrams and apply knowledge of simple physical concepts to practical situations. On this, Ogwo [7] remarked that one should lay the foundation of careful observation which is a hallmark of scientific method. Again, there is the application and brief communication of knowledge. The learner should extract tabular information; extrapolate from data in simple linear graph.

There should be a demonstration of scientific inquiry skills. Students should be able to ask questions about things happening in the environment, and so doing will combine information to draw conclusion, interpret information and to solve problems.

The major tool used in studying and doing physics is mathematics. Much time should be dedicated to the study of mathematics, especially those areas applied to physics. One major role of mathematical skill is that it develops critical thinking ability, and this is exactly what among others is needed for scientific skills development, [7]. As the world moves on in the 21st century, the increasing demand for ICT skills in the work place and schools has necessitated technology integration. Ripin, [3] noted that on average there is the highest number of students using ICT skills at homes and schools. ICT skills are therefore very necessary in the development of scientific knowledge. Intel Teach and Microsoft partners in learning are examples of international programs that have helped teachers and students enhance their ICT skills for teaching and learning physics concepts and doing laboratory works, [3]. Computer interfacing experiments and robotics have enhanced students' laboratory experience in physics. Developing ICT skills involves firstly acquiring the basic knowledge of the use of computer for different operations, then the basic programming, [3].
Communication skills involve listening, speaking, writing and reading which are further developed in a course like physics. Students' reading comprehension of physics texts is often assumed but the technical writing style and presence of equations, graphs and tables lower the readability of the text. If students come to a physics class ill-equipped to understand physics texts, development of reading comprehension skills needs to be the concern of the physics teachers. Such skills can be developed in consultation with the communication arts teachers and with the physics teachers drawing from their experience and strategies of understanding physics, [7].

Interpersonal skills most developed in a physics class are those needed for a group to accomplish its tasks, be it an activity, experiment or project, [7]. Such skills, together with thinking skills and comprehension skills are among self-learning and lifelong learning skills applicable to many areas of life. For physics teaching to be better appreciated by students, skills development can be equally emphasized and their uses to life pointed out.

Concept Scientific Attitudes

The scientific attitude is one that harnesses and directs the power of the human brain, turning it to the investigation of the observable world. Scientists learn to think in specific ways, deducing patterns and principles from observations of the way things work. Over time, the collective effort of scientists in a given field produces a body of reliable knowledge that can be used as a stepping stone to new discoveries. This progress begins with a few simple attitudes and behaviours, [10]. Attitudes can be described as postures or positions adopted or expressions of views or thoughts that have an effect on behaviour, ideas or emotions, [11]. Gardner, [12] and Johnston, [13] noted that in science and science education, the major division has been in terms of scientific attitudes that are cognitive and behavioural attitudes necessary to undertake scientific inquiry, to be scientific, and attitudes towards science or affective attitudes. In another view, scientific attitude is an attitude which will tend to foster scientific achievement. The scientific attitude is indeed closely related to the scientific method, for the attitude gives rise to the method, and the method gives evidence of the attitude, [14].

The following scientific attitudes have been identified, [10, 11];

(i) Curiosity

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Curiosity is a fundamental characteristic attitude of a scientist. An urge to know and understand the natural world is part of the makeup of every healthy baby, and it's how humans learn to adapt to the world. Over time, most people come to understand that things act in a specific way, and are satisfied with that. Scientists are not. Their curiosity leads them to study how things in the natural world behave, why, and what factors might affect them. This requires a certain degree of creativity.

(ii) Creativity and Critical Mindedness

Scientists must have fertile mind because creating a plausible reason for things to work as they do is a crucial step in scientific investigation. Scientists generate new and original ideas and base suggestions and conclusions on pieces of evidence, and when in doubt, ask questions on the veracity of a given statement in relation to the evidence provided. Creating a hypothesis that can explain a phenomenon, and then constructing an experiment to test that hypothesis and establish its accuracy, lies at the heart of the scientific method. This creativity, or mental agility and criticality in thinking must also extend to recognizing unanticipated factors when they intrude on the experiment.

(iii) Open Mindedness;

A scientist listens and respects the ideas of others. He accepts criticisms and changes his mind if reliable evidence contradicts his believes.

(iv) Objectivity

A scientist is objective if he does not allow his feelings and bias to influence his recording of observations and interpretation of data, and formulation of conclusions.

(v) Belief

A scientist believes that everything that happens in this world has a cause or reason.

(vi) Intellectual Honesty

A scientist gives a truthful report of observations. He does not withhold important information just to please himself or others.

(vii) Humility

A scientist is humble when he admits that he is not free from committing errors. He recognises that there may be better ideas and recognises that there are individuals whom he may have to consult to arrive at correct observations and conclusions.

(viii) Risk Taking

A scientist expresses his opinions and tries new ideas even at the risk of failure or criticism.

(ix) Responsibility

A scientist actively participates in a task and also dutifully performs tasks assigned to him, which an act of responsibility.

Research method

Research Design

The cross-section descriptive survey research design was adopted for this study. This is used to study a sample of population at a single point in time. This design was adopted because according to Ezeh, [16] it enables the researcher to use reliable techniques to collect data from a well-defined population or systematically selected segments of a population for the purpose of determining the attributes of the population. Ezeh, [16] also explained that in survey research design, the purpose is usually to identify the characteristics of a defined population with respect to specific variables.

Area of the Study

The area of the study is Ebonyi state of Nigeria using all the government and private secondary schools. Ebonyi state is divided into three educational zones of Abakaliki, Onueke and Afikpo. There are thirteen local government area councils in the state. The state has common geopolitical boundaries with Cross River, Abia, Benue and Enugu.

Population of the Study

The population for this study is made up of 2370 students who are second and third year senior secondary school and have chosen physics as one of their subjects of study and 87 teachers of physics in the various secondary schools in the area of the study, EBSEB [17]

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Sample and Sampling Techniques
Purposive sampling technique was adopted in sampling the working population. The sample for the study is made up of 600 students and 25 teachers selected from schools in the three educational zones of the state. This comprises both rural and urban schools. A criterion used in choosing the schools was that the school must have a reasonable number of physics students and teachers. The final list of schools used was arrived at through simple ballot with replacement, of schools that meet the criterion after the purposive sampling.

Instrument for Data Collection
A questionnaire developed by the researcher from the objectives of the research, literature, consultation with stakeholders in education and personal observations based on the research question and hypothesis was used for data collection. The instrument is titled "Science Skills and Attitudes in Physics Questionnaire" (SSAPQ).

Validation of the Instrument
The face and content validity of the instrument was determined. To ascertain this, the researcher presented copies of the questionnaire together with the topic and purpose of the study, research questions and hypotheses to three experts for validation. Their comments and suggestions guided the construction of the instrument.

Reliability of the Instrument
The reliability of the instrument was determined by administering copies of the questionnaire on students and teachers of physics in two selected secondary schools in Enugu state. The scores obtained from the respondents were collated to determine the internal consistency of the instrument in each section. This was done using Cronbach Alpha. The choice of Cronbach Alpha is in line with Howith and Cranner, [18] who recommended Cronbach Alpha as a proper statistical tool for determining the internal consistency of an instrument for a descriptive survey. Internal consistency was measured because the instrument is homogenous in nature.

Method of Data Collection
The researcher together with the help of research three assistants administered the instrument directly to the respondents in the sampled secondary schools in the state. The research assistants were instructed on how to distribute and collect copies of the questionnaire from the respondents.

Method of Data Analysis
Mean scores and standard deviation were used to answer the research questions while t- test statistics were used to test the hypotheses at 0.05 level of significance. In analysing the data, mean ratings of 4 was regarded as Strongly Agree (SA), 3 for Agree (A), 2 for Disagree (D) and 1 for Strongly Disagree (SD). In analysing the data for the hypothesis, the t- test was used to test the hypothesis at the 0.05 level of significance.

Presentation and analysis of data

Research Question
What are the strategies for the development of scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria?

Table 1: Mean responses on the strategies for the development of scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria.

Responses		Students				Teachers			
S/N	Item Statement	ΣFX	Ẍ	SD	Decision	ΣFX	Ẍ	SD	Decision
1	Creating the right scientific values through acculturation to science	1,920	3.2	1.28	Accepted	93	3.7	1.56	Accepted
2	Teaching of scientific values to students	1,740	2.9	1.19	Accepted	78	3.1	1.27	Accepted
3	Compulsory teaching of science from lower levels of education	1,200	2.0	1.22	Rejected	58	2.3	1.14	Rejected

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

4	Making science learning compulsory at all levels of secondary education	1,200	2.1	1.19	Rejected	48	1.9	1.27	Rejected
5	Creating more awareness in the society for science learning through mass and social media	1,680	2.8	1.16	Accepted	65	2.6	1.12	Accepted
6	Encouraging science learning through appropriate incentives for students	2,040	3.4	1.43	Accepted	78	3.1	1.27	Accepted
7	Making science teaching more lucrative to attract the best brains	1,680	2.8	1.16	Accepted	78	3.1	1.27	Accepted
8	Adopting more innovative methods of teaching science	1,980	3.3	1.37	Accepted	85	3.4	1.43	Accepted
9	Regular training and retraining of science teachers to keep abreast of the latest development in science education	1,800	3.0	1.22	Accepted	90	3.6	1.49	Accepted
10	Use of hand-on science method (activities, experiments, projects, etc)	2,160	3.6	1.49	Accepted	95	3.8	1.65	Accepted
11	Provision of necessary textbooks and laboratory facilities for teaching and learning of science	1,920	3.2	1.28	Accepted	88	3.5	1.50	Accepted
Grand mean				2.92			3.10		

Table 1 is used to answer the research question, which sought to find out the strategies for developing scientific skills and attitude for learning physics among secondary school students in Ebonyi state, southeast Nigeria. The results on the table show that items 1,2,5,6,7,8,9, 10 and 11 were all accepted because they all have mean values above 2.50 for both student and teacher respondents. The grand mean values are 2.92 and 3.10 for students and teachers respectively. The values are above 2.50 hence, the respondents agreed that the accepted items are strategies for developing scientific skills and attitudes for learning of physics among secondary school students in Ebonyi state, southeast Nigeria. Items 3 and 4 had mean values of 2.0 and 2.3 respectively for students and 2.1 and 1.9 respectively for teachers. Each of these values is less than the cut of value of 2.5 and hence rejected.

Hypothesis:

HO: There is no significant difference in the mean rating of the responses of students and teachers on the strategies for developing scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria. The data for testing the hypothesis are presented in table 2.

Table 2: T-test analysis of the responses of two groups of respondents (students and teachers of physics from Ebonyi state) on the strategies for developing scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria.

S/N	Item statement	Students N = 600		Teachers N = 25		t-cal	t-tab	Remark
		X_1	S_1^2	X_2	S_2^2	t-cal	t-tab	Remark
1	Creating the right scientific values through acculturation to science	3.2	1.64	3.7	2.43	-5.00	1.96	Not significant
2	Teaching of scientific values to students	2.9	1.42	3.1	1.61	-2.99	1.96	Not significant
3	Compulsory teaching of science from lower levels of education	2.0	1.49	2.3	1.30	-5.51	1.96	Not significant

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

4	Making science learning compulsory at all levels of secondary education	1.9	1.61	2.1	1.42	-3.36	1.96	Not significant
5	Creating more awareness in the society for science learning through mass and social media	2.6	1.25	2.8	1.35	-3.83	1.96	Not significant
6	Encouraging science learning through appropriate incentives for students	3.1	1.61	3.4	2.04	-3.56	1.96	Not significant
7	Making science teaching more lucrative to attract the best brains	2.8	1.35	3.1	1.61	-4.51	1.96	Not significant
8	Adopting more innovative methods of teaching science	3.3	1.88	3.4	2.04	-1.18	1.96	Not significant
9	Regular training and retraining of science teachers to keep abreast of the latest development in science education	3.0	1.49	3.6	2.22	-6.57	1.96	Not significant
10	Use of hand-on science method (activities, experiments, projects, etc)	3.6	2.22	3.8	2.72	-1.78	1.96	Not significant
11	Provision of necessary textbooks and laboratory facilities for teaching and learning of science	3.2	1.64	3.5	2.25	-3.23	1.96	Not significant

df = 624

The data presented in table 2 revealed that each of the 11 items in the table had calculated t-values less than the table value of 1.96 (two tailed test) at 0.05 significance and 624 degrees of freedom. This indicates that there was no significant difference in the mean ratings of the responses of the two groups of respondents (students and teachers of physics from secondary schools in Ebonyi state, southeast Nigeria) on the strategies for developing scientific skills and attitude for learning physics among secondary school students in Ebonyi state, southeast Nigeria.

With this result the null hypothesis of no significant difference was upheld for the 11 items.

Conclusion

Physics is a fundamental science that forms the basis for the development of technology, engineering and other allied areas. The level of overall development of any nation hinges on its scientific and technological advancement, hence accordingly, FGN, [8] noted that secondary school physics curriculum has been developed to be relevant, appropriate and current in the rapidly changing world moderated by information and communication technology. As a subject, the objective of senior secondary school physics is to ensure that students develop interest in it and choose it as a profession or choose others professions which require physics, [8]. This objective has not been achieved because most students shy away from the subject because it has been made too abstract ant the appropriate scientific skills and attitude have not been inculcated in them.

To make students choose and progress in this subject and put the nation on a path of sustainable scientific and technological development there is the need to develop in them these scientific skills and attitudes. Making contribution to this direction the study identified strategies for developing scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria. This if addressed by the relevant stakeholders could enhance a better teaching and learning of the subject. The study therefore made the following contributions to knowledge;

a) It has provided information to the various stakeholders in science education on the strategies for developing scientific skills and attitudes for learning physics among secondary school students in Ebonyi state, southeast Nigeria. This will enhance the teaching and learning of the subject and project the area to the part of scientific and technological development.

b) The study has provided information that could be used to enrich the participation and enrolment of students into physics and physics related courses.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Educational Implications of the Study

The findings of the study have the implication that if the following strategies are adopted in the teaching and learning of physics in secondary schools in Ebonyi state, southeast Nigeria, the students shall improve in their scientific skills and values;

(i) Creating the right scientific values through acculturation to science
(ii) Teaching of scientific values to students
(iii) Creating more awareness in the society for science learning through mass and social media
(iv) Encouraging science learning through appropriate incentives for students
(v) Making science teaching more lucrative to attract the best brains
(vi) Adopting more innovative methods of teaching science
(vii) Regular training and retraining of science teachers to keep abreast of the latest development in science education.
(viii) Use of hand-on science method (activities, experiments, projects, etc
(ix) Provision of necessary textbooks and laboratory facilities for teaching and learning of science

Limitations of the Study

Limitation in this context means any area not covered by the study but still considered important for the development of the scientific skills and attitudes among secondary school students for the teaching and learning of physics. They are:

1) Identification of material resources required by students and teachers of physics at the secondary school level for the development of the needed scientific skills and attitudes.
2) Skill improvement needs of teachers of physics at secondary school level for the development of the needed scientific skills and attitudes in the learning of physics.

Recommendations

Based on the findings of the study, the following recommendations are made.

1) That the Nigeria Federal Ministry of Education in collaboration with other relevant agencies should address the physics curriculum to take care of the strategies to ensure the development of scientific skills and attitudes among the learners.
2) Teachers should be given the appropriate training to ensure quality transmission of scientific knowledge, skills and attitudes.
3) Needed laboratory facilities, books and other learning materials should be provided by the relevant stakeholders

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