



A STUDY ON THE INNOVATIVE PRACTICES FOR QUALITY IMPROVEMENT IN TEACHING PHYSICAL SCIENCE AT SECONDARY LEVEL

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Abstract

Science Education has been recognized as a pre-requisite for scientific and technological advancement across the globe. Science has attained a significant role in different aspects of human life. Science has revolutionized our way of living. It is now essential for everyone not only to understand science but also to manage day-to-day affairs. It provides opportunities for students to acquire relevant functional knowledge and skills that are associated with scientific thinking. Science education is concerned with finding solutions to problems in a bid to understand and interpret natural phenomena. Teachers' knowledge of subject matter, skills of questioning, formulation of learning objectives, selection of teaching methods, effective planning of experiments and classroom management play a significant role in quality improvement of teaching Physical Science. The present study is an attempt to explore the attitude of secondary school teachers towards quality improvement in teaching Physical Science. The researchers used a well prepared and standardized questionnaire as the tool for collection of data from a sample of 100 teachers (100 School Assistants in Physical Science) selected from 100 secondary schools located in Srikakulam, Vizianagaram and Parvathipuram Manyam Districts of Andhra Pradesh using Stratified Random Sampling technique. Mean score values, Standard Deviations, independent t-tests and one-way Analysis of Variance (ANOVA) were used for analysis of data. The findings of the study revealed that the demographic variables –Gender, Location of the institution and Type of School management have no influence on the attitude of teachers towards quality improvement in teaching Physical Science. However, designation and teaching experience have significant positive influence on their attitude towards quality improvement in teaching Physical Science.

3238

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Introduction

At the secondary stage, the students should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary and primary stages. Systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving science and technology are to be

important parts of the curriculum at this stage. Science is taught to the students with a view to develop in them scientific attitude and technological skills necessary for them in solving their day-to-day problems. Further, it should make them think critically and creatively.

The following are the objectives of teaching Physical Science at secondary school level.



Teaching of Science at secondary level aims at making the students:

1. Understand the nature of science and technology
2. Understand the basic principles, concepts and laws of science
3. Apply basic scientific principles in finding solutions to problems related to agriculture, energy, health, nutrition etc.
4. Develop problem-solving and decision-making skills
5. Include values underlying science and technology
6. Develop rich and satisfying views of the universe
7. Develop an understanding of various processes of environment and concern for its preservation and conservation
8. Understand and appreciates the joint enterprise of science, technology and society
9. Develop an attitude that would equip them to continue science and technology education throughout their life
10. Acquire process skills, which form part of the attitude for developing a scientific temper
11. Develop certain manipulative skills which are required in their day-to-day life situations

QUALITY CONCERNS IN TEACHING PHYSICAL SCIENCE

The quality of education and the excellence of its function would depend upon the perception of the persons concerned about the educational goals, aims and objectives. Hence, the understanding of quality in general and quality of education in particular is related to the persons or community to whom it matters. The teachers should be well aware of the educational goals and objectives in the teaching-learning process. Teachers play a significant role in teaching the subject effectively and efficiently to the students. The teachers should be committed and dedicated for the noble cause of teaching. Every subject has its quality indicators, which guide the teachers to maintain quality in teaching that particular subject. Teaching of Physical Science in Secondary Schools is not an

exception in this regard.

The following are some of the quality indicators in teaching Physical Science at secondary level.

- (i) **Organizing quality science classes**
Providing good reference materials as well as lab equipment is essential to a quality science class for a secondary school. The students may not perform many experiments, but they will need to see concepts to grasp what is being taught. Theoretical concepts and practical orientation should go hand-in-hand in teaching physical science.
- (ii) **Developing problem-solving skills among the students**
The teachers should develop mathematical skills as well as problem-solving skills among their students in order to make them solve the problems in Physics and Chemistry easily.
- (iii) **Engaging students in asking questions**
The teachers are required to engage their students in asking questions. The students may be given enough training to develop the skills of questioning on issues pertaining to scientific enquiry.
- (iv) **Building confidence among students through experimentation**
The teachers should teach the students the necessary safety protocol with all science equipment in order to make the students feel comfortable and confident in using the apparatus. The students may be allowed to conduct experiments independently or in a small group.
- (v) **Making Science teaching challenging**
In addition to their regular attendance to theory classes in science, the students may be encouraged to take up hands-on experiments, field trips, science fairs, educational tours etc. Their interaction with others will also help the students discover for themselves the areas of science that interest them. This develops in them scientific attitude and scientific temper.
- (vi) **Engaging the students in different activities**
Student engagement in different



activities leads to experiential learning. When the students are involved in different activities while learning the concepts in science, they get a feeling that they have discovered something for themselves. This helps in greater retention of subject matter in their minds for a longer time. Further, the learning is said to be more concrete in experiential learning.

(vii) Developing science skills through the science notebook

'Science note book' is a term associated with the recording of the student observations in the science record while conducting an experiment. The science notebook is especially valuable to a student who is experimenting independently or designing a specific object or studying a certain subject in-depth.

(viii) Encouraging students for independent investigation

The teachers may promote scientific thinking through independent study of a specific topic that interests the students. Products that encourage young scientists to discover new and interesting things on their own are an invaluable investment. For example, a student of Physics can improvise a simple pendulum and a student of Chemistry can devise a high quality distillation kit.

Science can justify its place in the curriculum only when it produces important changes in young people - changes in their ways of thinking, in their habits of action and in the values they assign to the work they do. This is possible only when the teachers are committed and dedicated for the teaching of science with a view to realize its objectives and goals.

Need for the Present Investigation

The existing methods and techniques of teaching Physical Science provide alacuna in the teaching learning process in secondary schools. Even today, majority of teachers are following the traditional methods of teaching

Physical Science in the classroom. There is a big gap between theory and practice in science teaching in schools. Most of the schools do not have science laboratories. There are some schools which have laboratories; but they do not have necessary equipment to conduct experiments. The current trend in science education world-wide focuses on inquiry-based instruction. The students should be encouraged to develop certain skills such as observing, inferring, classifying, predicting, measuring, questioning, interpreting and analyzing data. It is the responsibility of the science teachers working in secondary schools to develop these skills among their students. The teachers are the torch bearers to develop in the students the skills of scientific thinking and problem solving.

The Physical Science teachers working in secondary schools should have a positive attitude to bring about quality improvement in teaching physical science. It would certainly help them in the transaction of Physical Science curriculum in the schools effectively and efficiently. It is felt by the researchers to conduct a study on the factors affecting the attitude of secondary school teachers towards quality improvement in teaching Physical Science. The present investigation is an attempt in this direction.

Findings

On the basis of the analysis and interpretation of data, the researchers have arrived at the following findings and drawn the conclusions.

1. There is no significant difference in the attitude of male and female teachers working in secondary schools towards quality improvement in teaching Physical Science.
2. There is significant difference in the attitude of School Assistants in Physical Science working in secondary schools towards quality improvement in teaching Physical Science.

Objectives of the Study

The main objective of the present study is to find out the factors affecting the attitude of secondary school teachers towards

quality improvement in teaching Physical Science.

The study also aims at finding out the influence of certain demographic variables - gender, designation, teaching experience, location of the institution and school management on the attitude of secondary school teachers towards quality improvement in teaching Physical Science.

Hypotheses

The following hypotheses have been formulated for the present investigation keeping in view the objectives of the study.

- (i) There is no significant difference in the attitude of male and female teachers working in secondary schools towards quality improvement in teaching Physical Science.
- (ii) There is no significant difference in the attitude of Headmasters and School Assistants in Physical Science towards quality improvement in teaching Physical Science.
- (iii) There is no significant difference in the attitude of teachers with an experience of less than 10 years and those with 10 years and above towards quality improvement in teaching Physical Science.
- (iv) There is no significant difference in the attitude of teachers working in rural and urban secondary schools towards quality improvement in teaching Physical Science.
- (v) There is no significant difference in the attitude of teachers working in Government, Local Body and Private schools towards quality improvement in teaching Physical Science.

Limitations of the Study

The study is limited to find out the influence of five demographic variables, viz., gender, designation, teaching experience, location of the institution and type of school management on the attitude of teachers working in secondary schools towards quality improvement in teaching Physical Science. Further, the study is confined to 100 teachers (100 School Assistants in Physical Science)

selected from 100 secondary schools located in the rural as well as urban areas in Srikakulam, Vizianagaram and Parvathipuram Manyam Districts of Andhra Pradesh.

METHODOLOGY

Method of Research

Since the present study involves collecting data with the help of survey, the investigators used Descriptive survey method for the present investigation.

Sample

The sample of the study consisting of 100 teachers (100 School Assistants in Physical Science) has been selected from 100 secondary schools located in Srikakulam, Vizianagaram and Parvathipuram Manyam districts of Andhra Pradesh using Stratified Random Sampling technique.

Research Tool

The researchers used a well-prepared questionnaire consisting of 40 items as the tool of research for the present investigation.

Administration of the Tool

The tool was initially administered to 20 teachers (10 Headmasters and 10 School Assistants in Physical Science) under Pilot study. The measures of reliability, validity and objectivity of the tool have been calculated. Further, the researchers conducted item analysis for the items included in the tool. Out of 40 items selected for the tool, the discriminating power of 36 items has been found positive and is found negative in respect of 4 items.

The items whose discriminating power is negative have been removed; and the final tool consists of 36 items which are pool proof in all respects. The final tool has been administered to 100 teachers (100 Headmasters and 100 School Assistants in Physical Science) working in 100 rural as well as urban Secondary Schools located in Srikakulam, Vizianagaram and Parvathipuram Manyam Districts of Andhra Pradesh.

STATISTICAL INTERPRETATION OF DATA

The data collected has been analyzed and interpreted using different statistical

techniques such as Mean score values, Standard Deviations, t-ratios and one-way

Analysis of Variance (ANOVA); and are presented in the following table.

Table showing t-ratios/F-values of different variables relating to the attitude of Secondary school teacher towards quality improvement in teaching Physical Science

Variable	N	Mean	S.D.	ratio/ value	Result	
Gender	Male Female	30 70	113.54 111.98	30.81 31.74	0.56*	*Not significant at 0.05 and 0.01 levels
Designation	Headmaster School Assistant (Physical Science)	00 00	110.98 120.58	29.93 30.37	3.57*	Significant at 0.05 and 0.01 levels
Teaching Experience	Less than 10yrs. 10 yrs. & above	90 10	110.08 116.37	30.36 32.37	2.19*	Significant At 0.05 levels
Location of the institution	Rural Urban	80 20	112.71 114.95	32.11 30.93	0.79*	*Not significant at 0.05 and 0.01 levels
Type of School management	Government Local Body Private	50 70 80	114.10 114.13 113.28	31.42 33.20 30.31	0.003*	*Not significant at 0.05 and 0.01 levels

3242

Examples of the projects

Environmental problems are discussed all over the world and main environmental questions can be studied in physics. A great feedback has our project about renewable energy resources, "Do you know the Sun". The aim of this "great" project is to study theoretical problems concerning the energy (solar energy, water-power, wind-power). Our most successful project—the project water, and other projects (how to build a house, modern physics—nanotechnology, physics and medicine, world in motion, horror vacui) can be integrated in this main project. The final competences are included in the curricula—

electricity, optics, transformation of energy, photovoltaic, semiconductors and energy flow.

The Sun—our nearest star

Topics

- (1) All about the Sun—our star in the past and the future;
- (2) Physics of the Sun (weight, radius, temperature);
- (3) Thermonuclear reactions;
- (4) Radiation;
- (5) Motion of the Sun;
- (6) What is photovoltaics?
- (7) Some advantages and disadvantages of photovoltaics—discussion (Table 1).



Table 1 Photovoltaics—discussion

Advantages	Disadvantages
No emissions	Expensive production
No noise	Relatively low effectiveness (> requires large areas)
Long life	Depends on illuminance by the Sun (low effectiveness in winter, doesn't work during the night)
Can be manufactured out of common chemical elements	A small amount of toxic substances is used during production
Not use up any natural resources when in use	
Low costs for maintenance and use	

School Assistants in Physical Science have exhibited better attitude towards quality improvement in teaching Physical Science as compared to their counterparts working as Headmasters in secondary schools.

1. There is significant difference in the attitude of secondary school teachers with an experience of less than 10 years and those with 10 years and above towards quality improvement in teaching Physical Science.
2. Teachers with an experience of 10 years and above have exhibited better attitude towards quality improvement in teaching Physical Science as compared to their junior counterparts with an experience of less than 10 years.
3. There is no significant difference in the attitude of teachers working in rural and urban secondary schools towards quality improvement in teaching Physical Science.
4. There is no significant difference in the attitude of teachers working in Government, Local Body and Private secondary schools towards quality improvement in teaching Physical Science.

Educational Implications

- (i) The study would help the teachers identify the difficulties faced by their students in secondary schools in learning Physical Science; and find out remedial measures to overcome the difficulties.
- (ii) The present study helps the teachers to bring about the necessary changes in the Pedagogy with regard to the teaching of Physical Science in secondary schools.

- (iii) The study would help the teachers to take necessary steps for improving quality in teaching Physical Science in secondary schools.

Suggestions

The study suggests the teachers to take up innovative practices in teaching Physical Science in Secondary Schools with a view to develop in their students the skills of scientific thinking. The study also suggests that the academic organizations like SCERTs, IASEs and the State Departments of Education to take necessary steps for planning and implementing different schemes to enhance quality in teaching Physical Science.

Conclusion

From the findings of the study, it is concluded that gender, location of the institution and type of school management have no influence on the attitude of teachers working in secondary schools towards quality improvement in teaching Physical Science. However, the designation and teaching experience of teachers have a significant positive influence on their attitude towards quality improvement in teaching Physical Science.

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