



## Factors Affecting The Attitude Of Teachers Towards Teaching Biological Sciences In Secondary Schools

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### ABSTRACT

Science is an intellectual activity encompassing systematic understanding of the structure and behavior of the physical and natural world through observation and experimentation. It aims at developing scientific literacy, enabling individuals to understand and apply scientific knowledge and principles in everyday life. Science education involves the teaching and learning of science concepts. It aims at developing students' understanding of scientific principles, processes and applications in their day-to-day life. It develops in the students the skills of creativity, logical thinking and reasoning. Teaching Biological Sciences is the process of educating students about living organisms – including plants, animals and micro-organisms – covering their structure, function, growth, evolution and interactions with the environment. It aims to foster scientific temper, critical thinking and a better understanding of life processes, health and agriculture. The teachers of Biological Sciences should possess a positive attitude and right perceptions towards teaching Biological Sciences. The present study is an attempt to explore the factors affecting the attitude of teachers towards teaching Biological Sciences in secondary schools. The researchers used a well-developed questionnaire as the tool for collection of data from a sample of 160 teachers (80 Headmasters and 80 School Assistants in Biological Sciences) from 80 selected secondary schools located in the rural as well as urban areas in West Godavari district of Andhra Pradesh using Stratified Random Sampling method. The data were analyzed using descriptive and inferential statistics. The findings of the study revealed that the demographic variables – 'Gender' and 'Professional qualification' of teachers have no influence on their attitude towards teaching Biological Sciences at secondary level. However, 'Teaching Experience' has a significant positive influence on their attitude, with senior teachers experienced 10 years and above exhibiting better attitude towards teaching Biological Sciences in secondary schools. The study suggested that the teachers should use digital tools in teaching Biological Sciences to improve student learning.

**Key words:** Attitude, Secondary school teachers, Biological Sciences, Scientific inquiry

### INTRODUCTION

Science is an activity by means of which a person seeks to relate his current sense experience to his total structure of understanding in a manner that is in agreement with all his pertinent observations of properties and behavior. Understanding the nature of science is crucial for scientific literacy. It is essential for preparing individuals to understand and address global challenges, participate in technological advancements and make informed decisions in a scientifically driven world. Science is influenced by the

social, cultural and historical contexts in which it operates. Scientific knowledge is not absolute; it is subject to change as new evidence emerges or existing data is reinterpreted. This flexibility allows science to evolve and adapt over time, reflecting a deeper understanding of the natural world. It seeks to explain natural phenomena through evidence gathered from the environment, making empirical data a cornerstone of scientific inquiry.

### **THE CONCEPT OF 'SCIENCE EDUCATION'**

Science education aims to develop scientific literacy, enabling individuals to understand and apply scientific knowledge in everyday life. It is a cornerstone for fostering innovation, critical thinking and problem-solving skills among students. The science teachers are expected to update their knowledge and use innovative methods and approaches of teaching science in secondary schools. The science curriculum should be designed in such a manner that it should provide a strong foundation in scientific concepts and processes. The goal of science education is to produce scientifically literate individuals who can understand scientific issues and contribute to society's technological and scientific advancements. It should help students apply scientific knowledge to real-world situations, fostering a deeper understanding of occurrences in everyday life. This will make people understand the world around them, face the challenges and improve the quality of their own lives. Science education encourages students towards inquiry-based learning; and trains them to think critically and creatively. It provides tools and knowledge to address challenges in various fields, including healthcare, agriculture and environmental sustainability. Science education, in a broader view, equips individuals in building a society, which is free from poverty, hunger, disease etc. It makes the life of people on the earth happy and comfortable.

### **TEACHING OF BIOLOGICAL SCIENCES IN SECONDARY SCHOOLS**

Science provides a systematic way of understanding the world, improving our living standards, and offering solutions to practical problems. At the secondary stage, students learn basic science, which forms the foundation for their future studies. If students find science interesting and enjoyable at this stage, they can choose a branch of science of their own interest in higher education.

The curriculum of science education should be designed in such a manner that it helps the students have a thorough understanding of scientific concepts and processes. It should aim at producing scientifically literate individuals who can understand scientific issues and contribute to society's scientific and technological advancements. Science covers various disciplines such as biology, physics, chemistry, environmental science, earth science and so on.

'Biological Sciences' or 'Biology' is a branch of science related to the living organisms – plants, animals and micro-organisms – covering their structure, function, growth, evolution and interactions with the environment. It is the overarching field dedicated to studying life on the Earth in all its forms. It can be understood as a field of study that provides an understanding of living organisms of various levels, including molecules, cells, individuals and populations. It encompasses areas such as molecular biology and computational molecular biology, which utilize models and tools from computing science. The teachers of Biological Sciences should take every care in relating curriculum to real-life experiences.

At the secondary level, teaching Biological Sciences aims to help students understand life processes, develop scientific thinking, and connect biology to health, environment, and society. The objectives focus on knowledge, skills, attitudes, and values that prepare learners to be responsible citizens in a science-driven world. According to Davis (1997), the design and selection of teaching methods in Biological Sciences should take into account not only the nature of the subject matter; but also the pedagogical aspects on how pupils learn in a learning environment. For this purpose, the teachers should take into account the ability of the average learner, time-frame, context and content.

### **METHODS OF TEACHING BIOLOGICAL SCIENCES AT SECONDARY LEVEL**

Methods of teaching can be understood as the procedures that the teacher follows, steps the teacher takes to present a concept and the outline of activities that the teacher uses in the classroom to foster concrete learning on the part of the students. Teaching Biological Sciences in secondary schools involves a blend of traditional and modern approaches, ranging from teacher-centered lectures to student-centered experiential learning. The most effective strategies combine hands-on activities, technology integration, and inquiry-based methods to make biology engaging and relevant.

The following are some of the important methods of teaching Biological Sciences in secondary schools.

#### **(A) Teacher-centered methods**

Teacher-centered methods are the instructional approaches where the teacher is the primary source of knowledge and the focus of the teaching-learning process. Here, students play a passive role, primarily absorbing information through lectures, and direct instruction. These methods allow large amounts of information to be covered quickly in a shorter duration. Teacher-centered methods include:

##### **(i) Lecture method**

Lecture method is used to convey information to the students by means of a lecture by the teacher to introduce complex concepts quickly. But this method makes the students passive listeners.

##### **(ii) Demonstration Method**

The demonstration method involves the teacher showing a scientific experiment or concept in action while explaining it to students. This method helps in visualizing abstract concepts. It engages students with real-time interactions.

##### **(iii) Heuristic Method**

In Heuristic method, the students are guided to discover facts for themselves. This method develops critical thinking skills among the students.

##### **(iv) Textbook/Chalk and talk method**

This is a traditional method of teaching that encourages note taking skills. It is an effective method for structured explanations.

#### **(B) Learner-centered methods**

Learner-centered methods are the instructional approaches in teaching where the focus of activity shifts from the instructor to the learner. These methods transform the teacher's role from a primary lecturer to an active facilitator. By emphasizing active engagement, collaboration and critical thinking, students take active participation in their educational journey.

Learner-centered methods include:

##### **(i) Inquiry-Based Learning (IBL)**

Inquiry-based learning places students at the center of the learning process, encouraging them to ask questions, conduct experiments, and draw conclusions. This approach mirrors the scientific method, fostering critical thinking and curiosity. It encourages students to investigate and explore. This approach promotes active learning and collaboration; and develops higher order thinking skills among the students.

**(ii) Project-Based Learning (PBL)**

In project-based learning, students work on a project over an extended period, solving real-world problems or answering complex questions. This approach integrates multiple disciplines and emphasizes hands-on learning. It encourages team-work and problem-solving skills.

**(iii) Problem-solving Method**

This method involves presenting students with a scientific problem and guiding them to find solutions through analysis, experimentation and reasoning. This method develops critical thinking and analytical skills. It encourages independent and collaborative learning. It is applicable to real-life situations.

**(iv) Co-operative Learning**

Co-operative learning involves students working in small groups to achieve common learning goals. This method fosters teamwork and communication skills. It promotes peer-to-peer learning. This method encourages collaboration and mutual respect. It helps to build social and interpersonal skills.

Approaches and methods of teaching science play a pivotal role in shaping the future of learners. By adopting diverse strategies such as inquiry-based learning, project-based learning, and experiential learning, educators can create an engaging and impactful learning environment. Effective science teaching not only imparts knowledge but also inspires students to become critical thinkers and problem solvers who contribute meaningfully to society.

**(C) INNOVATIVE METHODS AND APPROACHES OF TEACHING BIOLOGICAL SCIENCES**

The following are some of the innovative methods and approaches of teaching Biological Sciences in secondary schools.

**(i) STEM (Science, Technology, Engineering and Mathematics) Approach**

STEM approach aims to provide instructional environments for blended learning and is committed to enlighten students how the scientific method can be applied in an every day context. Indeed, STEM is a teaching and learning approach that is a unique combination of Science, Technology, Engineering and Mathematics. It is not the teaching of one subject; but it is the amalgamation of all four subjects as a comprehensive one through an interdisciplinary curriculum. This approach focuses on the practical application of problem-solving in the real-world situations. This approach favors the development of a student profile that is flexible, determined and motivated, which allows students to apply their learning to new situations and relevant contexts.

**(ii) Differentiated Instruction**

Differentiated Instruction is a teaching philosophy that tailors lessons to individual student needs, readiness and learning styles. Instead of a 'one-size-fits-all' approach, teachers proactively adjust how students learn, what they learn and how they demonstrate their knowledge, ensuring all students achieve the same core learning goals.

**(iii) Multi-media Resources**

Videos, animations and interactive apps can effectively be used by teachers of Biological Sciences to visualize processes like cell division or photosynthesis.

**(iv) Virtual labs**

The teachers of Biological Sciences can use online simulations for experiments that require large number of resources and found unsafe in a real science laboratory.

**(v) Flipped Classroom**

In a flipped classroom, students learn basic concepts through pre-class materials such as videos or readings. Class time is then used for interactive discussions, experiments, and problem-solving activities. This method maximizes in-class engagement. It encourages self-paced learning and supports personalized instruction.

**(vi) Experiential Learning**

Experiential learning emphasizes learning through experiences. Students engage in activities such as experiments, field trips, and simulations to deepen their understanding of scientific concepts. This approach involves hands-on activities, wherein the students actively participate. This approach connects classroom learning to real-life experiences. It encourages reflective thinking.

**(vii) Interdisciplinary Teaching**

The subject, 'Biological Sciences' can be linked with technology, ethics or environmental sciences to understand its application to real-life situations.

With the right blend of approaches, methods and tools, teaching of Biological Sciences can empower students to explore, innovate and make a difference in the world. The science teachers are expected to choose the right approaches and methods suitable to the content and context under which the process of teaching-learning takes place in the classroom. However, the choice of an approach or a method depends on various factors such as the needs of the learner, learning objectives, availability of resources, content to be taught and the learning environment under which students are subjected to learn.

## **RATIONALE OF THE STUDY**

Most of the existing methods and approaches of teaching Biological Sciences provide a lacuna in the teaching learning process in secondary schools. Even today, majority of teachers are following the traditional methods of teaching Biological Sciences in the classroom. There is a big gap between theory and practice in science teaching at secondary level. Most of the schools do not have sufficient infrastructural and instructional facilities. There are some schools which have laboratories; but they do not have necessary equipment to conduct experiments. Paucity of human and material resources in secondary schools remains a great constraint in teaching Biological Sciences effectively in the classroom. Majority of the science teachers do not find an opportunity to update their knowledge and improve their pedagogical skills through Faculty Development Programmes (FDPs). The students should be encouraged to develop certain skills such as observing, inferring, classifying, predicting, measuring, questioning, interpreting and analyzing information for purpose of learning Biological Sciences in its true sense. It is the responsibility of the science teachers working in secondary schools to develop these skills among their students.

The researchers felt that science teachers working in secondary schools should have a positive attitude towards teaching science with a view to develop in their students the skills such as critical thinking, creativity and problem-solving. It is felt by the researchers

to conduct a study to examine the factors affecting the attitude of teachers towards teaching Biological Sciences in secondary schools. The study is intended to know the influence of Gender, Professional Qualification and Teaching Experience on the attitude of teachers towards teaching Biological Sciences at secondary level. The present investigation is an attempt in this direction.

### **OBJECTIVES OF THE STUDY**

The main objective of the present study is to explore the attitude of teachers towards teaching Biological Sciences in secondary schools.

The study also aims at finding out the influence of certain factors, viz., Gender, Professional Qualification and Teaching Experience on the attitude of teachers towards teaching Biological Sciences in secondary schools.

### **HYPOTHESES OF THE STUDY**

The following hypotheses have been formulated for the present investigation:

- (i) There is no significant difference in the attitude of male and female teachers towards teaching Biological Sciences in secondary schools.
- (ii) There is no significant difference in the attitude of teachers with B.Ed. qualification and those with M.Ed. and above qualifications towards teaching Biological Sciences in secondary schools.
- (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 teaching Biological Sciences in secondary schools.

### **LIMITATIONS OF THE STUDY**

The study is limited to find out the influence of three demographic variables, viz., Gender, Professional Qualification and Teaching Experience on the attitude of teachers towards teaching Biological Sciences in secondary schools.

### **DELIMITATIONS OF THE STUDY**

The study is confined to explore the attitude of 160 teachers (80 Headmasters and 80 School Assistants in Biological Sciences) working in 80 selected secondary schools located in the rural as well as urban areas in West Godavari District of Andhra Pradesh.

### **METHODOLOGY**

#### **(a) Method of Research**

Since the present study involves collecting data from the individuals with the help of a survey, the investigators preferred 'Descriptive survey' method of research for the present investigation.

#### **(b) Sample**

The sample of the study consisting of 160 teachers (80 Headmasters and 80 School Assistants in Biological Sciences) working in 80 selected secondary schools located in the rural as well as urban areas in West Godavari District of Andhra Pradesh using 'Stratified Random Sampling method'. In this method, in addition to randomness, stratification introduces a secondary element of control as a means of increasing precision and representativeness.

#### **(c) .Research Tool**

The researchers used a well-developed questionnaire consisting of 34 items as the tool of research for the present investigation under pilot study. The researchers have verified whether the tool prepared is in conformity with the conditions required by a standard tool. The researchers have conducted item analysis as a process of standardization of the research tool.

#### **(d) Administration of the Tool**

The tool was initially administered to 20 teachers (10 Headmasters and 10 School Assistants in Biological Sciences) working in 10 (ten) secondary schools from West Godavari district 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 34 items selected for the tool, the discriminating power of 30 items has been found positive and is negative in respect of 4 items. The items whose discriminating power is negative have been removed; and the final tool consists of 30 items, which are pool proof in all respects. The final tool has been administered to 160 teachers (80 Headmasters and 80 School Assistants in Biological Sciences) working in 80 selected secondary schools located in the rural as well as urban areas in West Godavari District of Andhra Pradesh.

#### **STATISTICAL INTERPRETATION OF DATA**

The duly filled-in questionnaires have been collected from 160 respondents for purpose of tabulation of data.

The data collected has been analyzed and interpreted using different statistical techniques such as Mean scores, Standard Deviations and t-ratios; and are presented in the following table.

**Table showing t-values of different variables relating to the attitude of teachers towards teaching Biological Sciences in secondary schools**

S. No.	Variable		N	Mean	S.D.	t-ratio	Result
1	Gender	Male	70	101.93	26.04	0.53*	*Not Significant at 0.05 and 0.01 levels
		Female	90	99.61	29.19		
2	Professional qualification	B.Ed.	140	101.79	25.88	0.28*	*Not Significant at 0.05 and 0.01 levels
		M.Ed. & above	20	103.50	25.51		
3	Teaching Experience	Less than 10 yrs	120	88.17	27.23	2.86*	*Significant at 0.05 and 0.01 levels
		10 yrs. & above	40	102.50	27.49		

## **FINDINGS OF THE STUDY**

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 towards teaching Biological Sciences in secondary schools.
2. There is no significant difference in the attitude of teachers with B.Ed. qualification and those with M.Ed. & above qualifications towards teaching Biological Sciences in secondary schools.
3. There is significant difference in the attitude of teachers with an experience of less than 10 years and those with 10 years and above towards teaching Biological Sciences in secondary schools.

Senior Teachers with an experience of 10 years and above exhibited better attitude towards teaching Biological Sciences in secondary schools as compared to their junior counterparts with an experience of less than 10 years.

## **CONCLUSION**

From the above findings, it is concluded that 'Gender' and 'Professional qualification' have no influence on the attitude of teachers towards teaching Biological Sciences in secondary schools. However, 'Teaching Experience' has a significant positive influence on the attitude of teachers towards teaching Biological Sciences in secondary schools, with senior teachers exhibiting more favorable attitude towards teaching Biological Sciences as compared to their junior counterparts.

## **EDUCATIONAL IMPLICATIONS**

- (i) The study helps teachers of Biological Sciences identify the innovative methods and approaches of teaching Biological Sciences in secondary schools basing on the felt needs of the students.
- (ii) The study helps teachers of Biological Sciences use different strategies in order to develop scientific attitude among their students.
- (iii) The present study helps the teachers of Biological Sciences to bring about necessary changes in their Pedagogy in secondary schools to equip the students with the necessary skills of 21<sup>st</sup> century.
- (iv) The study would help the teachers to take necessary steps for improving quality in teaching Biological Sciences in secondary schools.
- (v) The study would help the Academic Organizations like SCERTs, IASEs and the State Departments of Education to take necessary steps to organize Faculty Development Programmes (FDPs) periodically for the benefit of teachers in enhancing their skills in teaching Biological Sciences.

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