A STUDY ON THE ATTITUDE OF STUDENTS TOWARDS THE STUDY OF PHYSICS IN CORPORATION SCHOOLS IN COIMBATORE DISTRICT

RESEARCH PROJECT REPORT

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Content

Tables		
Table Number	Title	Page No.

Chapter – 1

INTRODUCTION

1.1 INTRODUCTION

An important feature of educational development in India during the past several decades has been the sustained effort to evolve a national system of education. It was Sri Aurobindo who first of all, in the year 1910, visualised *A National System of Education*. Its main emphasis was on the nature and power of the human mind, the nature of simultaneous and successive teaching and the training of mental and logical faculty. Gandhiji's *Buniyadi Taleem* (Basic Education) as envisaged in the Wardha Scheme was another powerful indigenous model rooted firmly in the Indian soil. The curriculum developed under this scheme aimed at the total development of the child, reflecting the Gandhian philosophy of education, i.e., the development of Body, Mind and Spirit. The fact that India could not implement it as a national curriculum indicated the magnitude and complexity of the problems involved in changing the established structure of education and the existing pattern of curriculum.

School education in post-independent India has passed through different phases. Soon after independence, the *Secondary Education Commission* (1951-53) was set up by the Government of India and it gave several recommendations for improving the quality of school education. In 1964-66, the *Education Commission* was set up, which brought out a more comprehensive document on education covering all stages and aspects of education as a whole. This was a major landmark in the history of the modern education system in India. Several recommendations of this Commission formed the basis for the National Policy on Education (NPE), 1968. The acceptance of a common school structure, i.e., 10+2 and a common scheme of studies as part of general education for 10 years of school throughout the country were important steps towards improvement in the school system.

The NPE, 1968 envisaged ‘a radical transformation of the education system to relate it more closely to the lives of the people, provide expanded educational opportunities, initiate a sustained intensive effort to raise the quality of education at all stages, emphasise the development of science and technology and cultivate moral and social values.’ Then, the National Policy on Education, 1986, modified in 1992, stressed the need for evolving a national system of education based on a common educational structure (10+2+3), a national curriculum framework and the minimum levels of learning for each stage of education. For the first time, a detailed strategy of implementation accompanied by assignment of specific responsibilities and financial and organisational support was brought out in the form of Programme of Action, 1992. But, quite evidently efforts have fallen far short of these goals set in these documents. Though the country’s achievements in a number of areas have been substantial in quantitative terms, these are not enough to provide a real breakthrough.

Inspite of the constitutional provision for free and compulsory education upto the age of 14, the target of universalising elementary education has not yet been achieved. The major challenges to India’s goal of universal elementary education still remain the same: expanding access, arresting dropouts, raising learning achievements to an acceptable level of quality, and reducing gaps in educational outcomes across states and among groups. The nation has not yet reached the all important threshold of educational attainment where benefits are optimal and the high economic growth rates are sustained.

1.2 SCIENCE AND TECHNOLOGY

Science is the creative response to the curiosity and capacity to wonder present amongst every human being. Learning of science in schools augments the spirit of enquiry, creativity and objectivity along with aesthetic sensibility. It aims to develop well-defined abilities of knowing, doing and being. It also nurtures the ability to explore and seek solution of the problems related to environment and daily life situations and to question the existing beliefs, prejudices and practices in society. Science concerns itself with the fundamental knowledge of universe, world and its environment. Technology deals with numerous ways and means of pressing science into the service of mankind, thus enhancing and improving the quality of human life. Learning of science in general education up to secondary stage, therefore, needs to be replaced by learning of science and technology in view of the strong organic linkages between the two.

Scientific pursuits have primarily attempted to comprehend the physical world, the technological initiatives that have tended to manipulate and control the same. Science is universal and its principles and laws could be verified anywhere. The technology takes appropriate shapes depending upon various factors including economic, geographical, social and political conditions. The twenty-first century citizens will have to acquire the basics of scientific and technological literacy. The learners have to understand how basic scientific principles are applied in finding solutions to problems in the field of agriculture, weather, energy, health and nutrition, industry, defense, information processing and other areas of human concern. It would help them discover the relationship between science and technology in these areas besides acquiring problem-solving and decision-making skills.

Science operates through its processes. Consequently, teaching and learning of science needs to be characterized by focused emphasis on processes, i.e., experimentation, taking observations, collection of data, classification, analysis, making hypothesis, drawing inferences, and arriving at conclusions for the objective truth. The process skills so acquired would help in developing attitudes and values that constitute the spirit of scientific temper. Science has to be learned more in familiar environment and not in alien and contrived situations.

An important purpose of science and technology teaching in general education up to secondary stage is to familiarise the learner with various dimensions of scientific and technological literacy. These would include — understanding the nature of science; ability to properly apply appropriate science concepts and their technological applications; capacity to understand values that underlie science and technology, willingness to understand and appreciate the joint enterprise of science, technology and society, ability to develop rich and satisfying views of the universe and to continue science and technology education throughout life, and development of certain manipulative skills which are required in day-to-day life situations. In addition to the support available to develop these skills within and outside the laboratories it would be imperative to make use of tools of information technology such as computers and multimedia packages.

Science and technology education should have something of value to offer to all students. Particularly, rural and tribal oriented technology will have to be made an important part of the educational package and its connectivity will have to be ensured. Science must cut across traditional subject boundaries and open itself to issues such as gender, culture, language, poverty, impairment, future occupation and environment and observance of small family norm. It is also necessary to familiarize children with Indian traditions of scientific and technological learning and contributions of Indian scientists both in the past and the present. The achievement of India in various fields through scientific and technological enterprises would develop and nurture self-confidence and self-assurance amongst the learners. All these issues should become integral aspects of science curriculum.

1.3 PHILOSOPHY OF SCIENCE

The philosophy of science seeks to understand the nature and justification of scientific knowledge. It has proven difficult to provide a definitive account of scientific method that can decisively serve to distinguish science from non-science. Thus there are legitimate arguments about exactly where the borders are, which is known as the problem of demarcation. There is nonetheless a set of core precepts that have broad consensus among published philosophers of science and within the scientific community at large. For example, it is generally agreed that scientific hypotheses and theories must be capable of being independently tested and verified by other scientists in order to become accepted by the scientific community.

There are different schools of thought in the philosophy of scientific method. The most popular position is empiricism, which claims that knowledge is created by a process involving observation and that hence scientific theories are the result of generalizations from observation. Empiricism generally encompasses inductivism, a position that tries to explain the way general theories can be justified by the finite number of observations humans can make and the hence finite amount of empirical evidence available to confirm scientific theories. This is necessary because the number of predictions those theories make is infinite, which means that they cannot be known from the finite amount of evidence using deductive logic only. It has been a long running matter of philosophical debate whether such positions require metaphysical assumptions about the structure of the world that themselves cannot be justified in a scientific way, and whether that poses a problem for science or not. Biologist Stephen J. Gould, for example, maintained that 1) uniformity of law and 2) uniformity of processes across time and space must first be assumed by anyone who wants to do science as a scientist. Gould summarized this view as follows:

The assumption of spatial and temporal invariance of natural laws is by no means unique to geology since it amounts to a warrant for inductive inference which, as Bacon showed nearly four hundred years ago, is the basic mode of reasoning in empirical science. Without assuming this spatial and temporal invariance, we have no basis for extrapolating from the known to the unknown and, therefore, no way of reaching general conclusions from a finite number of observations. (Since the assumption is itself vindicated by induction, it can in no way "prove" the validity of induction - an endeavor virtually abandoned after Hume demonstrated its futility two centuries ago).(– *Gould, S. J. 1965. Is uniformitarianism necessary? American Journal of Science 263:223–228*).

Empiricism holds that the landmark of scientific theories is their verifiability by induction from evidence. Many versions of empiricism exist, with the predominant ones being bayesianism (using Bayes' rule to compute the inductive probability of theories from evidence) and the hypothetico-deductive method (inductive confirmation of theories taken as purely hypothetical at the point of invention).

Empricism has stood in contrast to rationalism, the opposing position originally associated with the approach of Descartes as opposed to Bacon, which holds that knowledge is created by the human intellect, not by observation. A significant twentieth century version of rationalism is critical rationalism, first brought forward by Austrian-British philosopher Karl Popper. Popper acknowledged the fact that a connection exists between observation and theories, but rejected the way that empiricism describes the nature of this connection. More specifically, Popper claimed that theories are not generated by observation, but that observation is made in the light of theories—that observation is "theory-laden"—and that the only way a theory can be affected by observation is when it comes in conflict with it. Popper proposed falsifiability (the ability of theories to come in conflict with observation) as the landmark of empirical theories, and falsification (the search for observations that conflict with the theory) as the empirical method to replace verifiability and induction by purely deductive notions. Contrasting his views with inductivism, he went so far as to claim that the scientific method does not actually exist: "(1) There is no method of discovering a scientific theory (2) There is no method for ascertaining the truth of a scientific hypothesis, i.e., no method of verification; (3) There is no method for ascertaining whether a hypothesis is 'probable', or probably true" Instead, he claimed that there is really only one universal method, and that this method is not specific to science: The negative method of criticism, trial and error. It covers all products of the human mind, including science, mathematics, philosophy, art and so on, and even extends to the evolution of life. Popper especially questioned the claim that there is a difference between the natural and the social sciences and criticized the prevalent philosophy of the social sciences as scientistic, as a "slavish imitation of *what certain people mistake* for the method and language of science". He contributed to the so-called Positivism dispute with respect to this question, a philosophical dispute between Critical rationalism (Popper, Albert) and the Frankfurt School (Adorno, Habermas) about the methodology of the social sciences. Popper, together with students William W. Bartley and David Miller, also questioned the classical theory of rationality. This theory claims that rational knowledge in general, and scientific knowledge in particular, stands out as knowledge that can be justified in a way that other claims cannot be justified. Popper criticized the very concept of justification (see justificationism), held that science or rationality in general have no way of justifying or sanctioning ideas at all and argued that rationality is simply willingness to accept criticism and change one's views accordingly, and to criticize the views of others—not the ability to justify one's views, or the ability to criticize the lack of justification of the views of others. Popper, Bartley and Miller also argued against limits of rationality, especially against seeing falsifiability as a limit of rationality. Accordingly, they rejected the view that science has authority and instead considered it as inherently fallible.

Another approach, Instrumentalism, colloquially termed "shut up and calculate", emphasizes the utility of theories as instruments for explaining and predicting phenomena. It essentially claims that scientific theories are black boxes with only their input (initial conditions) and output (predictions) being relevant. Consequences, notions and logical structure of the theories are claimed to be something that should simply be ignored and that scientists shouldn't make a fuss about (see interpretations of quantum mechanics).

A position often cited in political debates of scientific skepticism against controversial movements like creationism, that purport to be scientific, but have controversial criticisms of mainstream science, is methodological naturalism. Its main point is that a difference between natural and supernatural explanations should be made, and that science should be restricted methodologically to natural explanations. That the restriction is merely methodological (rather than ontological) means that science should not consider supernatural explanations itself, but should not claim them to be wrong either. Instead, supernatural explanations should be left a matter of personal belief outside the scope of science. Methodological naturalism maintains that proper science requires strict adherence to empirical study and independent verification as a process for properly developing and evaluating explanations for observable phenomena. The absence of these standards, arguments from authority, biased observational studies and other common fallacies are frequently cited by supporters of methodological naturalism as criteria for the dubious claims they criticize not to be true science.

1.4 IMPORTANCE OF SCIENCE

The modern world is scientific world and today science is everybody’s concern. At this stage one cannot think a world without Science. The most conspicuous aspect of our civilization today is the pervasive and ramifying impact of science in every department of life from household management to welfare.

Such remarkably amazing achievement of science as in present century did never occur before in the long history of human civilization.

A citizen of a modern world sees the countless manifestation of science all around him. There is no aspect of man's life today which has not been influenced by science in one way or the other. This is because, we are living in an of scientific culture. Science has shrunk the world and totally changed the human outlook. In fact, science has an all pervading influence on every sphere of human activity.

In recent times, there has been rapid addition of knowledge to the world of science. Great advancement in science and technology and use of the scientific achievements in promoting the well being of mankind their application in the field of industry, communication, transport, engineering, agriculture, medicine, has made science more important than before. Science has in fact, radically transformed the physical environment of the citizens of the modern world. Advancements in science depend upon our understanding of nature and it also heightens the scientific knowledge. To understand the world round us and to improve the quality of life of society, the youth today needs scientific attitude.

1.5 SCIENCE EDUCATION AND PRACTICAL IN SCHOOLS

Science is a subject to be learned by doing, in other words, it could be said that Science is a more verb than it is a noun. Science is the systematized and classified knowledge achieved by the experimental studies of nature. Science is a cumulative and endless series of empirical observations which result in the formation of concepts and theories, with both concepts and theories being subject to modification in the light of further empirical observation.

The true aim of teaching Science is not to give a mass of facts to be remembered but to train the pupil to a right habit of investigation and of inference. In the word of **Indian Education Commission (1966)**, 'If Science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it could degenerate even into a new superstition'.

Science is an activity and it is what goes on in laboratories. The most outstanding contribution to the practical teaching of Science is that all pupils should be allowed to discuss things for themselves and should be placed in the position of the original observers. Mere chalking and talking will not help for teaching or learning of Science. Demonstrations in Science are carried out in order to arouse interest and wonder in the pupils and to convince them about the truth of the principles.

1.6 SCIENCE LABORATORIES

Science is not a thing to be talked about but a practical subject and the correct way to learn is by doing. It is said, "An ounce of practice is better than ton of theory". Laboratory, being a bee-hive of practical work, needs better equipments and proper establishment. Dr. R.H. White House was the first to devise the plan for Secondary Schools Science Laboratories. All purpose Science laboratories is very suitable for a country like India. The major contribution of laboratory to teaching of Science includes the following.

1. Laboratory is a place for student to solve problems or attempt to solve problems. Student will solve a problem only if it is HIS and is perplexed by it and wants to do something about it.

2. Science laboratory provides for the solution of problems that students have encountered in the laboratory, the classroom or elsewhere. Satisfactory solution involves critical thought. The student has occasion to refine the problem, identify the assumptions, interpret data and test hypotheses. He has opportunity to formulate generalizations and draw conclusions.

3. Science laboratory promotes students' understanding of the scientist's role in society. Though laboratory work, the student comes to understand not only methods used by scientist but also his relationship with society.

4. Science laboratory provides illustrations of phenomenon, of principles, and their application; it provides the means to verify facts, laws and generalizations.

5. Science laboratory contributes to the students' knowledge and understanding of facts, principles, concepts and generalizations of Science.

6. Science laboratory contributes to the development of skills, habits and attitudes.

Before the students actually start practical work, it is very important that they should be made clear of what they are to find out and how through preliminary instructions.

17 NEP 202 RECOMMENDATIONS ON SCIENCE TEACHING

The National Education Policy (NEP) 2020 of India includes several recommendations related to the teaching of science. Here are some key highlights:

Promotion of Inquiry-based Learning: NEP 2020 emphasizes the promotion of inquiry-based, discovery-based, and experiential learning approaches in science education. This approach encourages students to explore scientific concepts through hands-on activities, experiments, and real-world applications, fostering a deeper understanding of scientific principles.

Integration of Science with Other Subjects: The policy advocates for the integration of science with other subjects such as mathematics, technology, engineering, and environmental studies. This interdisciplinary approach helps students make connections between different fields of knowledge and understand the relevance of science in various contexts.

Focus on Critical Thinking and Problem-solving Skills: NEP 2020 emphasizes the development of critical thinking, analytical reasoning, and problem-solving skills among students. Science education is not just about memorizing facts but also about developing the ability to analyze information, formulate hypotheses, and solve complex problems using scientific methods.

Emphasis on Hands-on Learning and Practical Skills: The policy underscores the importance of hands-on learning experiences and practical skills development in science education. It recommends the provision of well-equipped science laboratories, maker spaces, and innovation labs in schools to facilitate hands-on experimentation and innovation.

Inclusion of Local Contexts and Indigenous Knowledge: NEP 2020 encourages the incorporation of local contexts, indigenous knowledge systems, and traditional practices into science curriculum and teaching. This approach helps make science education more culturally relevant, engaging, and inclusive for all students.

Teacher Training and Professional Development: The policy emphasizes the need for continuous teacher training and professional development programs to enhance the quality of science teaching. Teachers are encouraged to adopt innovative pedagogical practices, update their subject knowledge, and use technology effectively to support science learning.

Assessment Reforms: NEP 2020 advocates for a shift towards competency-based assessment in science education, focusing on assessing students' conceptual understanding, problem-solving abilities, and practical skills rather than rote memorization. It recommends the use of diverse assessment methods, including performance-based assessments, portfolios, and project-based evaluations.

Overall, NEP 2020 aims to transform science education in India by promoting a holistic, inquiry-driven, and learner-centered approach that equips students with the knowledge, skills, and attitudes needed to thrive in a rapidly changing world.

1.8 SCIENCE TEACHING STANDARDS

Science teaching is a complex activity that lies at the heart of the vision of science education presented in the *Standards*. The teaching standards provide criteria for making judgments about progress toward the vision; they describe what teachers of science at all grade levels should understand and be able to do. To highlight the importance of teachers in science education, these standards are presented first. However, to attain the vision of science education described in the *Standards*, change is needed in the entire system.

Teachers are central to education, but they must not be placed in the position of being solely responsible for reform. Teachers will need to work within a collegial, organizational, and policy context that is supportive of good science teaching. In addition, students must accept and share responsibility for their own learning. In the vision of science education portrayed by the *Standards*, effective teachers of science create an environment in which they and students work together as active learners. While students are engaged in learning about the natural world and the scientific principles needed to understand it, teachers are working with their colleagues to expand their knowledge about science teaching.

To teach science as portrayed by the *Standards*, teachers must have theoretical and practical knowledge and abilities about science, learning, and science teaching. The standards for science teaching are grounded in five assumptions.

- The vision of science education described by the *Standards* requires changes throughout the entire system.
- What students learn is greatly influenced by how they are taught.
- The actions of teachers are deeply influenced by their perceptions of science as an enterprise and as a subject to be taught and learned.
- Student understanding is actively constructed through individual and social processes.

- Actions of teachers are deeply influenced by their understanding of and relationships with students.

1.9 SCIENTIFIC ATTITUDE AMONG SECONDARY SCHOOL STUDENTS

This is the stage after which majority of the learners will enter the world of work. Scientific attitudes and skills developed at this stage would become foundation for further growth. They need to be exposed to the nature and the structure of science and the support it provides to the technological developments. At this stage, learning of science would continue to be built around natural and social elements of environment. Focus would continue to be on understanding of concepts and applications in the areas of matter and its properties, energy, relationship of various physical processes and the technological applications of principles of science.

The biological sciences will deal with living organism, their organisation and life processes. An integrated approach to science and technology leading to their application in areas like health and nutrition, industry, agriculture and animal husbandry and allied areas would establish linkages of science to societal aspirations.

Science, technology, society and environment would coalesce in teaching and learning of science at this stage. Practical activities to be chosen should have relevance for future life through acquisition of skills and values. The learners need to be encouraged to work both individually as well as in the groups.

Critical, creative and generative thinking has to be developed. Improvisation should be encouraged but designing would also be provided for as a component in exploration. Flexibility in experimentation needs to be widely promoted. Teachers could help the learners devise appropriate experimentation and activities within the school and also outside school involving immediate environment such as farming, factories, industries and community.

1.10 TAMIL NADU GOVERNMENT POLICY NOTE 2023-24 ON SCHOOL EDUCATION

The quality of education shapes the citizens of tomorrow and forms the cornerstone of policy formulation. Education is the foundation laid today to shape the tomorrow of our children. Recognising the importance of this service, the Government of Tamil Nadu accords utmost priority to ensure universal and equitable access for all its children to quality, inclusive and holistic education. The government has allocated the highest budgetary provision of Rs. 40,299 crore for 2023-24 for the School Education Department. The principal objectives of the Government are to ensure that enrolment of all school-age children is sustained; to attain 100% retention of all enrolled children up to the secondary level; to eradicate the incidence of drop-outs, especially those impacted by Covid; to improve the learning outcomes among children and enable them to attain age-appropriate learning levels with special emphasis on foundational literacy and numeracy skills; to equip children with requisite life-skills to ensure their safety and well-being; to improve the basic amenities in all schools; to capacitate teachers as well as administrators with effective and regular training; to harness technology to improve the teaching-learning processes; and finally to impart new-age life skills to students. The Department's focus in the past year has been to bridge learning losses among students, which were exacerbated by the shutdown of schools during the pandemic. The ambitious Illam Thedi Kalvi (Education at Doorstep) exhibited substantial outcomes in bridging learning gaps among the marginalised sections of students. The programme has been designed to be integrated with the expansive Ennum Ezhuthum to tackle the loss of foundational skills in reading, writing and Math. Across the initiatives, an overarching emphasis has been placed on helping children achieve their age appropriate learning outcomes.

In today's digital age, technology has been effectively leveraged at scale to develop and deliver curated formative quizzes to students and track their growth in learning. With programmes like Vaanavil Mandram, STEM is being accorded special emphasis to trigger the scientific temperament of students. They visit science centres in institutes of higher education to obtain widened exposure and are instilled with a sense of curiosity. To provide holistic education to students, extra-curricular upskilling programmes like Kalai Arangam and Kalai Thiruvizha have been launched, much to the delight of children. The regional and state level talent showcased by students has been received with much acclaim by the larger community. Career counselling for high school and higher secondary students has been taken up in a systematic manner ensuring that the child is guided from school to college and onward towards their desired employment opportunities, under the umbrella of the multipronged Naan Mudhalvan programme. All these initiatives are spearheaded by the various Directorates under the Department of School Education - Directorate of Elementary Education, Directorate of School Education, Directorate of Private Schools, Samagra Shiksha, Directorate of Non-Formal and Adult Education - these entities are supported ably by units such as the State

Council for Education, Research and Training(SCERT), Directorate of Government Examinations, Directorate of Libraries, Teachers Recruitment Board and the Tamilnadu Textbook and Educational Services Corporation.

1.11 TEACHING AND LEARNING AT CORPORATION SCHOOLS OF TAMIL NADU

Teaching and learning practices in corporation schools in Tamil Nadu largely follow the guidelines set by the state education department. Here are some key aspects:

Curriculum: Corporation schools generally follow the state board curriculum prescribed by the Tamil Nadu State Board of Education. This curriculum covers subjects like languages (Tamil and English), mathematics, science, social studies, and others.

Teaching Methods: While traditional methods of teaching are still prevalent, there is a growing emphasis on interactive and experiential learning approaches. Teachers often use a combination of lectures, group discussions, activities, and multimedia resources to engage students and make learning more effective.

Teacher Training: Efforts are made to provide regular training and professional development opportunities for teachers to enhance their teaching skills and keep them updated with modern pedagogical practices.

Technology Integration: With the increasing availability of technology, some corporation schools are incorporating digital tools and resources into the teaching-learning process. This includes using educational software, multimedia content, and sometimes even online classes for certain subjects.

Assessment and Evaluation: Assessment methods typically include regular tests, quizzes, projects, and annual exams conducted by the state board. The emphasis is not only on academic performance but also on assessing students' overall growth and understanding of concepts.

Infrastructure and Resources: Corporation schools may face challenges related to infrastructure and resources, including classroom space, teaching materials, and equipment. Efforts are made to address these challenges through government initiatives and collaborations with NGOs and other organizations.

Community Involvement: Corporation schools often seek to involve parents and the local community in the education process through activities such as parent-teacher meetings, community events, and volunteering opportunities.

Overall, while there may be variations in teaching-learning practices among different corporation schools in Tamil Nadu, the overarching goal is to provide quality education and improve learning outcomes for all students, particularly those from marginalized backgrounds.

1.12 Student Learning in Physics at Secondary Schools

Learning physics at the secondary school level in Tamil Nadu, including in Corporation schools, typically involves a structured curriculum designed to introduce students to fundamental concepts in physics while also fostering critical thinking and problem-solving skills. Here's an overview of how students learn physics at this level:

Curriculum: The physics curriculum at the secondary level in Tamil Nadu is usually aligned with the guidelines set by the Tamil Nadu State Board of

Education. It covers topics such as mechanics, heat, light, sound, electricity, magnetism, and modern physics concepts.

Textbooks and Resources: Students typically use textbooks approved by the state board, which are designed to provide a comprehensive understanding of physics concepts. Additionally, schools may supplement these textbooks with reference materials, laboratory manuals, and multimedia resources to enhance learning.

Theory Classes: Physics is taught through theoretical classes where teachers explain concepts using lectures, demonstrations, and visual aids. Teachers often encourage student participation through discussions and questioning to ensure understanding.

Practical Sessions: Laboratory experiments and practical demonstrations play a crucial role in learning physics. Students are provided with hands-on experience to observe phenomena, conduct experiments, and verify theoretical concepts. These practical sessions help reinforce learning and develop experimental skills.

Problem-Solving: Physics involves a significant emphasis on problem-solving skills. Students are presented with a variety of numerical problems and exercises to solve, which helps them apply theoretical concepts to real-world situations. Teachers guide students through problem-solving strategies and techniques.

Assessment: Assessment in physics typically includes periodic tests, assignments, and exams conducted by the school according to the academic calendar. These assessments evaluate students' understanding of concepts, problem-solving abilities, and practical skills.

Extracurricular Activities: Some schools may organize extracurricular activities such as science fairs, exhibitions, and competitions to further engage students in physics and encourage exploration beyond the classroom.

Teacher Support: Teachers play a vital role in facilitating student learning. They provide guidance, clarification, and encouragement to students, ensuring they grasp complex concepts and develop a deeper understanding of physics principles.

Overall, the approach to learning physics at the secondary school level in Tamil Nadu focuses on building a strong foundation of theoretical knowledge, practical skills, and problem-solving abilities, preparing students for higher education and future careers in science and technology.

1.13 TOPIC OF THE STUDY

The topic selected by the investigator to study is stated as ***"A Study on the Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District".***

1.14 KEY TERMS USED

Attitude

Attitude can be defined as a psychological construct that represents a person's evaluation, feelings, beliefs, and predispositions towards objects, people, events, or ideas. It encompasses an individual's overall stance or orientation, which influences their thoughts, behaviors, and responses in various situations.

Higher Secondary School Students

Higher Secondary School Students are those who are studying the school subjects from the classes XI and XII in government and private schools.

Science Attitude

Science attitude refers to an individual's disposition, beliefs, feelings, and predispositions towards science as a subject, discipline, or way of understanding the natural world. It encompasses the following aspects:

Interest and Curiosity: A positive science attitude often involves a genuine interest in exploring scientific concepts, phenomena, and discoveries. Curiosity about the natural world drives individuals to seek knowledge and understanding through scientific inquiry.

Appreciation and Respect: Individuals with a positive science attitude appreciate the value of science in addressing real-world problems, improving human lives, and advancing knowledge. They respect the scientific method and the contributions of scientists to society.

Open-mindedness and Skepticism: A healthy science attitude involves being open-minded to new ideas, evidence, and perspectives while maintaining a critical stance. It includes skepticism towards unsupported claims and a willingness to evaluate information based on scientific evidence and reasoning.

Confidence and Self-efficacy: A positive science attitude includes confidence in one's ability to engage with scientific concepts, conduct experiments, and solve scientific problems. Self-efficacy beliefs play a crucial role in motivating individuals to pursue science-related activities and careers.

Persistence and Resilience: Developing a positive science attitude requires perseverance in the face of challenges and setbacks. Individuals with a resilient attitude towards science are willing to embrace failure as an opportunity for learning and growth.

Ethical Responsibility: A strong science attitude involves recognizing the ethical implications of scientific knowledge and technology. It includes a commitment to using science for the betterment of society while being mindful of potential risks and consequences.

Cultivating a positive science attitude is essential for fostering scientific literacy, promoting lifelong learning, and inspiring future generations of scientists, engineers, and critical thinkers. It involves nurturing curiosity, fostering inquiry-based learning experiences, and creating supportive environments that encourage exploration and discovery in science.

Physics Learning

Physics learning involves the acquisition of knowledge and understanding of the fundamental principles, laws, and phenomena that govern the natural world. Here are some key aspects of physics learning:

Conceptual Understanding: Physics learning begins with building a conceptual understanding of fundamental principles such as mechanics, thermodynamics, electromagnetism, optics, and quantum mechanics. Students learn about the nature of matter, energy, forces, motion, and interactions between objects.

Mathematical Skills: Physics relies heavily on mathematical concepts and tools for describing, analyzing, and predicting physical phenomena. Students learn to apply mathematical techniques such as algebra, calculus, geometry, and trigonometry to solve problems and derive equations that describe physical relationships.

Experimental and Observational Skills: Hands-on experimentation and observation are essential components of physics learning. Students engage in laboratory activities to observe phenomena, collect data, and conduct experiments to test hypotheses and verify theoretical predictions. These experiences help reinforce theoretical concepts and develop practical skills.

Problem-Solving Abilities: Physics learning focuses on developing problem-solving skills, critical thinking, and analytical reasoning abilities. Students learn to apply scientific methods and principles to analyze complex problems, identify relevant variables, formulate hypotheses, and devise solutions using mathematical and conceptual tools.

Interdisciplinary Connections: Physics learning often involves making connections with other disciplines such as mathematics, engineering, chemistry, biology, and environmental science. Students explore interdisciplinary topics such as biophysics, astrophysics, geophysics, and materials science, which highlight the interconnectedness of scientific knowledge.

Application to Real-World Contexts: Physics learning emphasizes the practical applications of physics principles in everyday life, technology, and scientific research. Students explore how physics concepts are used in various fields such as engineering, medicine, telecommunications, renewable energy, and space exploration.

Overall, physics learning is a dynamic and interactive process that fosters curiosity, critical thinking, and a deeper appreciation for the fundamental principles that govern the universe. It equips students with the knowledge, skills, and mindset to engage with the world scientifically and contribute to advancements in science and technology.

Corporation Schools

In Tamil Nadu, corporation schools are government-run schools managed by municipal corporations. These schools aim to provide education to children residing in urban areas, especially those from economically disadvantaged backgrounds. Corporation schools often offer education from primary level to secondary level and sometimes even higher secondary level. They play a crucial role in ensuring access to education for all children and are an integral part of the public education system in Tamil Nadu.

1.15 OBJECTIVES OF THE STUDY

The present study has the following objectives

1. To study attitudes of higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.
2. To study attitudes of higher secondary school students' towards study of Physics in terms of their eagerness towards subject.

3. To study attitudes of higher secondary school students’ towards study of Physics in terms of their subject learning interest.

4. To study attitudes of higher secondary school students’ towards study of Physics in terms of their rapport with teachers.

5. To study whether is a significant difference between the attitudes of male and female higher secondary school students’ towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

6. To study whether is a significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their eagerness towards subject.

7. To study whether is a significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their subject learning interest.

8. To study whether is a significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their rapport with teachers.

9. To study whether a significant difference between the attitudes of class XI and XII students towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

10. To study whether is a significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their eagerness towards subject.

11. To study whether is a significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their subject learning interest.
12. To study whether is a significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their rapport with teachers.

1.16 NEED AND IMPORTANCE OF THE STUDY

Science is not a thing to be talked about but a practical subject and the correct way to learn is by doing. It is said, “An ounce of practice is better than ton of theory”. Laboratory, being a bee-hive of practical work, needs better equipments and proper establishment (Sharma, R.C, 1975). All purposes of Science laboratories is very suitable for a country like India. The major contribution of laboratory to teaching of Science includes the following.

1. Laboratory is a place for student to solve problems or attempt to solve problems. Student will solve a problem only if it is HIS and is perplexed by it and wants to do something about it.
2. Science laboratory provides for the solution of problems that students have encountered in the laboratory, the classroom or elsewhere. Satisfactory solution involves critical thought. The student has occasion to refine the problem, identify the assumptions, interpret data and test hypothesis. He has opportunity to formulate generalizations and draw conclusions.
3. Science laboratory promotes students’ understanding of the scientist’s role in society. Though laboratory work, the student comes to

understand not only methods used by scientist but also his relationship with society.

4. Science laboratory provides illustrations of phenomenon, of principles, and their application; it provides the means to verify facts, laws and generalizations.
5. Science laboratory contributes to the students' knowledge and understanding of facts, principles, concepts and generalizations of Science.
6. Science laboratory contributes to the development of skills, habits and attitudes.

Before the students actually start practical work, it is very important that they should be made clear of what they are to find out and how through preliminary instructions. Apart from this, the students must have interest, involvement and self-confidence on doing practical works. In this background, the investigator selected the present study under the topic '***A Study on the Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District***'.

1.17 DELIMITATIONS OF THE STUDY

- This study is confined to the Corporation higher secondary school science group students of Coimbatore District of Tamil Nadu State.
- It is restricted to the study of gender and class of study.

Chapter – 2

REVIEW OF RELATED LITERATURES

2.1 INTRODUCTION

Research takes advantages of knowledge, which has accumulated in the past as a result of constant human endeavor. It can be never undertaken in isolation of work that has already been done on the problems, which are directly or indirectly related to a study proposed by investigator. A careful review of related to modernization may help to eliminate the duplication of what has been already done and provides suggestions for meaning of investigation. Knowledge of related modernization enables the investigator to know about the recommendations of previous research listed in their studies for further research. The related studies and review to earlier research reports facilitate to know about the tools and instruments which proved to be useful and promising in the previous studies also provides insight into the statistical method through which, the correlation it results to be established.

2.2 PURPOSE OF THE REVIEW OF RELATED LITERATURE

To know what work has been done so far and what is yet to be done on the problem area.

i. To get a clear perspective of the field of study.

ii. For selecting a significant problem.

iii. In choosing an appropriate method of investigation.

iv. Human knowledge is an ever growing one, it uses the previous knowledge to go higher.

v. To ensure that it is not mere repetition.

The aim of this chapter is to record briefly the findings of a few research studies conducted on topics that are related to the problem under study. “Practically all human knowledge can be found in books and Libraries. Unlike other animals that must start a new with each generation, man builds upon the accumulated and related knowledge of the past. His constant adding to the vast store of knowledge makes of the past. His constant adding to the vast store of knowledge makes possible progress in all areas of human endeavour. A familiarity with literature in a my problem areas helps the student to discover what is already known, what others have attempted to find out, what methods of attack have been promising or disappointing and what problems remain to be solved.

2.3 STUDIES ON STUDENTS’ SCIENCE ACHIEVEMENT

Yumusak, Necemettin ; Sungur Semara; and Cakiroglu, Jale (2007) conducted a study on *Turkish Secondary School Students' Biology Achievement in Relation to Academic Self-Regulation*. This study aimed at investigating the contribution of motivational beliefs, cognitive, and metacognitive strategy use to Turkish high school students' achievement in biology. In order to investigate the specified purpose of the study, 519 tenth-grade students were administered the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991) and a Biology Achievement Test developed by the researchers.

Results of multiple linear regression analyses showed that extrinsic goal orientation, task value, rehearsal strategy use, organization strategy use, management of time and study environment, and peer learning contributed significantly to the prediction of achievement scores.

2.4 STUDIES ON SCHOOL SCIENCE

The placement of high school students in their course of study in general and in science studies in particular is attributed to many factors. Studies which try to predict students' outcomes are usually cross-sectional rather than longitudinal and focus on the relationships among a variety of variables such as those in the "educational productivity model" (Fraser, Welch, & Welberg, 1986; Welch, Welberg, & Fraser, 1986). Among the variables in this model are ability, motivation, quality of instruction, attitudes toward teachers, quantity of instruction, class and home environment, race, and gender. The "prediction" is based on relationships among a variety of items in a specific time period. Interestingly, gender is an important predictor of students' achievement in science learning.

School subject choice (science in particular), can be thought of as an expression of gender stereotypes that exist in society at large. These stereotypes portray the male as the dominant person, the one who works outside the home in often prestigious occupations, while the female is usually portrayed as being subordinate and confined to the home (Tracy, 1987; Steitmatter, 1985). Moreover, these stereotypes reinforce the fact that females predominantly choose the humanities and domestic sciences, while males choose science- and technology-related fields (Clarricoates, 1978).

It is claimed that schools, teachers, and the school curriculum, encourage girls to adopt passive and dependent behavior, and males to adopt aggressive and independent behavior. Moreover, gender stereotypes in textbooks have been well documented (Sarrio, Jacklin, & Title, 1973; Simpson, 1974). The effect of extracurricular activities on peer group culture also leads to similar results (Eder & Parker, 1987). Further, "the activities, experiences, interests, achievements, and modes of thinking of girls have been accorded lower status and have been judged deficient" (Manicom, 1984).

The situation in Israel is not much different from other societies (Friedler & Tamir, 1989; Clarricoates, 1981). For example, in Israel 19.1% of grade 12 males examined for matriculation major in physics, while only 5.2% of the females do so. In mathematics 26.4% of males take the 5-unit (the highest level) examination, while only 12.7% of females do so (Shprinzak & Amir, 1988).

In other studies different attitudes toward school subjects were found; for example, in a cross-cultural study, both Canadian and Chinese students manifested gender differences in their attitudes toward computers and mathematics (Coilis & Williams, 1987). In both grades 8 and 12, boys had significantly more positive attitudes toward these subjects than did girls. However, no differences were found with regard to science among Canadian and Chinese students.

In a study in Sweden of grades 3, 4, 7, 8, & 9 in 1970 and 1983 "boys performed better than girls" in science (Engstrom & Noonan, 1990, p. 450). However, the findings indicated by students' responses to "science subjects in school are interesting" is more complicated: "In grades 3 and 4 the attitudes are almost the same for boys and girls. Then from grade 7, while boys steadily get a little bit more negative year by year, girls vary much over the years up to grade 9. In grade 9, boys and girls tend to yield the same negative attitude. The main changes in the girls' attitudes found in grade 8 are a higher proportion of I do not know answers".

In a study conducted of 28,000 students in Maryland, Virginia, analysis of the data "confirms findings from other surveys concerning gender differences in achievement in mathematics. Boys and girls perform evenly well through the first years of high school, but in the final years, fewer girls than boys opt for more advanced mathematics courses and male students tend to score higher than females on the mathematics sections of the Scholastic Aptitude Test (SAT)" (Norman, 1988, p. 408).

Differences in Israel are also manifested in a study by Tamir (1990). Boys in grades 9 and 12 were found to have more positive attitudes toward science subjects than did girls, and they scored higher. A significant difference was found between boys and girls in physics in grades 9 and 12 (boys scoring higher), whereas in biology and chemistry there was no such difference.

2.5 STUDIES ON SCIENCE LEARNING

Students' affection dimension about science learning have been studies for decades, and the research results (Gardner 1975, 1996; Schibeci 1984 and references therein) all showed the importance of understanding and cultivating students' learning interests about science and their relationship to learning achievement (Simpson et al. 1994). Apart from examining students' affection dimension, it is significant to convey the relationship of science, technology and society (STS) as we are living in this science and technology dominating century.

Students’ Affective Dimension of Science Learning As neatly defined by Simpson et al. (1994), the affective dimension of science learning contains an array of constructs like attitudes (including some essential ingredients such as feeling, cognition and behaviour), values, beliefs, and motivation. They pointed out that attitude should be considered as an essential indicator of the quality of science education. The attitudes in their affective dimension actually referred to student attitudes (specific feelings) towards science, attitudes towards science teachers, and attitudes towards the science curriculum. Noticeably, these attitudes are different from the ‘‘scientific attitudes’’ (e.g. Gardner 1975; Schibeci 1984; Ramsden 1998; Lichtenstein et al. 2008) that are more directly related to the outcomes of science learning. In a comprehensive review article, Gauld and Hukins (1980) defined the conceptual structure of the scientific attitude and stated that scientific attitude comprises the scientific dimension and the affective dimension. The former dimension consists of (1) general attitudes towards ideas and information (e.g. curiosity, open-mindedness and creativity etc.); (2) attitudes related to the evaluation of ideas and information and (3) commitment to particular beliefs or worldview (e.g. loyalty to truth, nature is understandable etc.) while the latter dimension focuses on a person’s willingness to use scientific methods or preference (rather than the ability) to do so.

In fact, those attitudes are often included as the learning objectives/outcomes in many local/national science curriculum documents/standards. The main reasons are that. 1. ‘‘adoption of scientific attitudes gives the student a better understanding of the nature of the scientific process because, to some extent at least, the student is acting out the role of a scientist as his behaviour is directed by scientific attitudes''.

2. ''scientific attitudes are important for all students in their everyday lives independently of their supposed importance to scientists… under the influence of these attitudes problems will be approached and information and ideas evaluated in a scientific manner, and consequently, with a greater chance of arriving at a satisfactory solution'' (Gauld and Hukins 1980).

The study of student attitudes towards science or science learning has become a key component of science education in the past three to four decades. The research carried out in this field in the 1960s and early 1970s has been critically reviewed by Gardner (1975), who summarized (1) the methodological issues behind the measurement of attitudes, which still remains a key concern 20 years later (Gardner 1996), and (2) the relationships with other variables, such as the other attitudes and cognitive abilities of students and personality, gender, school context, science curriculum, and science pedagogies. More recently, a number of research papers have focused on the design of new research instruments and on the design of classroom instructions or strategies to effect change in student attitudes towards science and science learning. For example, Francis and Greer (1999) developed a new measure of attitudes towards science that has been administered to 2,129 secondary school students in Northern Ireland. It was found that younger pupils demonstrated a more positive attitude towards science than did their older counterparts.

Siegel and Ranney (2003) developed a new questionnaire instrument to reflect changes in student attitudes towards science over time and applied it to assess two high school science classes. Tuan et al. (2005) developed a new questionnaire with six scales (self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation) to measure 1,407 junior high school students' motivation towards science learning in Taiwan. Krogh and Thomsen (2005) applied the concept of cultural border crossing for this kind of attitudinal research from the cultural perspective and found that cultural border crossing factors are key predictors of attitudes towards physics learning in Danish upper secondary schools. Baram-Tsabari et al. (2006) proposed a novel methodology that makes use of US children's self-generated questions to indicate their level of interest in science.

Although there are some gender differences, yet they are in anyway smaller than that found in the developed countries in which young people are less interested in technology related jobs and girls are even having much lesser interest. Gender Issues About Science Learning Over the last two decades, educational research in science led to some conclusive findings that there are significant gender differences in students' interest, attitudes, academic achievements and experiences of science learning (e.g. Johnson 1987; Kahle and Meece 1994; Weinburgh 1995; Burkham et al. 1997; Jones et al. 2000; Brotman and Moore 2008). For examples, boys show more positive attitudes towards science than girls (Weinburgh 1995) while Japanese girls' attitudes towards science tend to become increasingly negative since reaching junior secondary level (Nakazawa and Takahira 2001). Girls are typically more concerned about the human dimensions of science (or life science field plus topics on environmental issues) than more abstract scientific principles, experiments or instruments while they were much less interested in laboratory based sciences, physical science and engineering subjects because they cannot make affective links between those subjects and what they care about

(Miller et al. 2006). Similar results were found that children in UK demonstrated a gender difference in their preference for physical sciences and biological science by the age of nine (Johnson 1987).

Regarding the academic achievement in science subjects, girls had a very slight advantage in life science (Lee and Burkham 1996) but this gender gap in life science achievement changed from slight differences to differences favouring boys among high achievers. On the other hand, gender differences in high school physical science achievement changed from a substantially larger male advantage among high achievers to a uniform gap 2 years later for all ability level (Burkham et al. 1997). From students' perceptions of science, Jones et al. (2000) indicated that ''significantly more females than males reported that science was difficult to understand, whereas more males reported that science was destructive and dangerous, as well as more 'suitable' for boys''. As found by Gilbert and Calvert (2003), most of the female scientists described an experience of a sudden shift from their largely positive experiences of science in junior secondary school years to the negative experiences in their upper secondary years. Even though they were immersed with the subject matter of science from an early age, yet they ''all described later feelings of alienation, of being 'cut off' from the possibility of developing a deeper, more 'adult' relationship with science'' (likely due to sudden shift in the teaching approach exposed to them).

To account for the above-mentioned gender difference in science learning, different researchers (e.g. Burkham et al. 1997; Gilbert 2001; Nakazawa and Takahira 2001; Skog 2001; Gilbert and Calvert 2003; Brotman and Moore 2008) put forwards various theories for relating the reasons with the following four main factors:

- Societal factors—parents and teachers often see science as more important for boys (a male domain) and so they may offer their daughters or female students fewer opportunities for science activities than boys (Burkham et al. 1997). This is coupled with the traditional gender roles and peer influence, leading to gender differences on the level of active participation in the science laboratory activities (Nakazawa and Takahira 2001).
- Psychological and identity factors—in Gilbert and Calvert's (2003) study, most of the surveyed scientists viewed scientific work as actively requiring 'masculine' modes of thinking. Although those female scientists rightly pointed out that good female 'role models' were important to young women in science education, yet all of them could not produce any convincing stories to make their lives as role models for young female students. Hence, science achievement does not naturally lead to an increase in self-esteem amongst females. In reality, high-achieving females are particularly likely to underestimate their abilities and performance in science subjects (Skog 2001) as they even consider their success and achievements to be undeserved or pure luck (Viefers et al. 2006).
- Curriculum, pedagogy and school factors—teachers' influence which is embedded with unconscious gender bias in the teachers' expectation and teaching of boys and girls is one of the main causes for the gender differences in the students' experiences and interests in science learning (Nakazawa and Takahira 2001; Skog 2001). Therefore, boys are often allowed to grab most of the science teaching and learning activities in teacher-centred classrooms (Burkham et al. 1997). In the science curriculum itself which is often linked up with the development of

masculinity, it tends to stress on changing females to become more similar to males in their behaviour and thinking by rejecting and repressing everything feminine (Gilbert 2001). On conducing a review of the research on the participation of girls in physics as funded by the UK Institute of Physics, Murphy and Whitelegg (2006) pointed out that the contents, contexts and approaches for problem- solving and investigations in physics education more closely relate to boys' (more than girls') out-of school activities which are associated with masculine (rather than feminine) attributes as defined by the culture. Zohar and Bronshtein's (2005) research study revealed that most physics teachers overlooked the scope and educational significance of the gender gap in their subject and lacked any knowledge about gender inclusive practices. Furthermore, schools often assigned more qualified teachers to teach advanced mathematics and science courses which were dominated by male students and so those high-ability boys would benefit more from the school science education.

- Career factors—to become future scientists, females are doubly disadvantaged because they are not only underrepresented as a group but also they are even further outperformed by other high-ability males (Burkham et al. 1997). Boys are more able to place a higher value on a dominant goal than that of girls, and to experience less conflict between career goals and future maternal/ paternal roles (Crombie et al. 2005). Girls who choose the 'soft' science subjects, aim to prepare for work in female job areas in which they can take care of other people and this is a kind of ''rationality of caring'' (Skog 2001). The gender difference in the interest of learning different branches of science is mirrored in the children's job aspirations in which there are similar perceptions about sex-appropriateness of many types of jobs as found by Johnson (1987).

2.6 STUDIES ON SCIENCE AND TECHNOLOGY

In relation to classroom instructions, Scherz and Oren (2006) investigated images of science and technology among middle school students in Israel and the effects of these images using a new instructional innovation to introduce students to science and technology in real-life situations.

Students' Attitudes Towards Technology Based on a few major review articles of research findings from the late 1960s to early 1980s, Ramsden (1998) drew the miserable conclusion that over the past few decades, young people have generally held unfavourable attitudes towards science and technology. Osborne et al. (2003) confirmed this finding through a comprehensive review of the relevant literature of the past 20 years and its implications. He concluded that to understand and remediate the continuing decline in the numbers of students pursuing further study in science or science-related careers in many Western/developed countries, research on student attitudes towards science was very essential.

Francis and Greer's (1999) results reflected that ‘‘males record a more positive attitude towards science than female’’. Based on the ROSE data collected from 25 participating countries/regions, Sjøberg and Schreiner (2005) found that young people hold a positive view towards science and technology and they consider science and technology important for society. However, they found out that ‘‘the more developed a country is, the less positive young people are towards the role of science and technology in society’’. Their studies also revealed that ‘‘in poorer countries, young people have a rather heroic image of scientists as persons, while this is not the case in highly developed western societies’’. In developing countries, both girls and boys favour a career in technology.

2.7 STUDIES ON STUDENTS’ SCIENCE ATTITUDE

Understanding of students’ attitudes is important in supporting their achievement and interest toward a particular discipline. Students’ attitudes toward science have been extensively studied (Dhindsa & Chung, 2003; Osborne, Simon, & Collins, 2003), but research was initially focussed greatly on science in general (Dawson, 2000) and less attention was addressed to particular disciplines like biology, physics or chemistry (Salta & Tzougraki, 2004). This can partly camouflage students’ attitudes because science is not viewed as homogeneous subject (Spall et al., 2003).

In general, students’ attitudes toward science decrease with age (reviewed by Ramsden, 1998; Osborne, Simon, & Collins, 2003), boys show more positive attitudes toward science than girls (Simpson & Oliver, 1985; Schibeci & Riley, 1986; O’Brien & Porter, 1994; Francis & Greer, 1999) and more negative attitudes are associated with the physical sciences rather than biological sciences (e.g. Spall, Barrett, Stanisstreet, Dickson & Boyes, 2003; Spall, Stanisstreet, Dickson & Boyes 2004). Keeves and Kotte (1992) and Jones, Howe and Rua (2000) showed that, unlike chemistry or physics, girls showed more positive attitudes toward biology than boys. Dawson (2000) was comparing changes in Australian students’ interests and attitudes over 20 years reported that, girls’ preferences in biology lead in human biology and general biology, but boys were greatly interested in earth sciences. Current study of Baram-Tsabari and Yarden (2005) using method of children’s spontaneous questions found that children’s interest in human biology increases with age relative to the interest in zoology which showed opposite tendency. Except gender differences, research on UK students' (aged 11 – 16) attitudes showed that attitudes toward biology exhibit different age-related patterns than attitudes toward physics (Spall et al., 2004).

Attitudes toward physics became more negative as age of students increases, relative to more positive attitudes toward biology (Spall et al., 2004). In contrast, Stark and Gray (1999) in a large sample of Scottish students found that boys' preferences for science topics shifted from biologically oriented to physics as the age of students increases, while girls' preference for biological topics were less affected by age and relative high. This means that research in biology would explore different patterns in attitudes related with gender and/or age than other science courses. All factors reported above including basic factors such as such as effects of teacher, parents or environment (George & Kaplan, 1998; Haladyna & Shaughnessy, 1982) would affect students' attitudes toward biology. However, the effect of teacher is disputable; while Gardner (1975) reported evidence that curriculum and teacher effects on attitudes were slight, other studies suggest that students' attitudes are quite malleable, and that individual teachers can have a major effect on both overall science interests and on more specific topic related ones (Bottomley & Ormerod, 1981; Kelly, 1988). This area, however, still received less attention.

2.8 STUDIES ON SCIENCE TEACHING

Most elementary schools use textbooks to teach science (when science is taught at all), but hands-on science curricula have become increasingly popular over the last two decades (cite). Hands-on science typically engages students in research activities in the classroom. Complete curricula of hands-on activities have been developed to effectively replace the use of science textbooks in elementary classroom: Full Option Science System (FOSS; Delta Education), developed at the Lawrence Hall for Science (at the University of California, Berkeley), Science and Technology for Children (STC; Carolina Biological Supply Company), developed by the National Science Resources Center (a joint enterprise of the National Academy of Sciences and the Smithsonian Institution), and Insights (Kendall/Hunt). Other curricula offer a combination of textbook and hands on activities (e.g. Scott Forseman Science). The hands-on activities provide students with opportunities to engage in exploration and sense making with the science content.

Researchers on elementary science reform emphasize the need for students to engage in scientific inquiry (Driver et al., 1994; Harlen, 2004). Engaging students in inquiry can provide a powerful learning experience where students not only learn about science content but also gain reasoning and research skills. Students come to understand the nature of scientific problem solving as the pursuit of meaningful questions through the use of procedures that are thoughtfully generated and evaluated (Magnusson & Palincsar, 1995). The hands-on science curricula (e.g. FOSS, Insights) also describe their materials as promoting scientific inquiry. The positive value of science teaching through inquiry is nearly universal in the literature, but the implementation of this pedagogy in classrooms has been problematic.

Critics of the reforms have pointed out that the implementation of hands-on curricula can err either on the side of too much or too little guidance. Research on high school science labs shows that highly structured activities may teach students to simply ‘follow the recipe’ and result in little meaningful learning of content or research methodology (NRC, 2005). In the other extreme, if teachers provide too little guidance, the activity becomes “discovery learning” which has not been very effective in previous studies (Mayer, 2004). Observations of hands-on science have indicated that some teachers do not fully implement the curriculum as it is designed (Aschbacher & Roth, 2002). Instead, some teachers have the students conduct hands-on activities without the preparation, analysis and reflection that is often called for. Without having detailed knowledge of the actual implementation of the hands-on curricula, it is not possible to tell how much inquiry is happening. For this reason we will refer to “hands-on science curricula” and note that inquiry is likely to be an element of some of this teaching.

Research on the effectiveness of hands-on science curricula tends to show a positive effect for small tightly controlled studies. Studies where researchers closely monitored the curriculum (often involving technology) have resulted in more science learning (Kracjik et al, 1998; Lehrer, Schauble, Carpenter & Penner, 2000; White & Frederiksen, 1998; Young & Lee, 2005). Research in the 1970s and 1980s showed an advantage for hands-on science (Bredderman, 1983; Shymanski, Hedges & Woodworth, 1990). Stohr-Hunt’s (1996) analysis of test data and teachers’ self report of hands-on frequency show very small increases in scores for students who had more hands-on

experience. More recent studies have looked at hands-on science implementation within a single district. Research from El Centro Schools shows district reading and writing scores improved after the adoption of hands-on science curricula (Amaral, Garrison, & Klentschy, 2002) and that when teachers have professional development in Scaffolded Guided-Inquiry students learning improves (Vanosdall, Klentschy, Hedges & Weisbaum, 2007). Schymansky, Yore & Anderson (2004) report that added professional development for teachers did not lead to gains in science scores or attitudes about science. The use of hands-on curricula continues to expand, but textbook science is still generally treated as the norm. We are not aware of any research that establishes that textbooks are better than the absence of science education. Many elementary teachers or schools choose a third option which is to teach little or no science, choosing instead to focus on math and language skills which are more heavily tested.

Teaching science with hand-on inquiry may have more effects that student achievement. A number of papers have linked hands-on or inquiry teaching to changes in students attitudes (Kyle, Bonnstetter, McCloskey, & Fults, 1985; Chang & Mao, 1999; Shymanski, Yore, Anderson, 2004). Many studies report that inquiry activities resulted in greater interest in science and motivation to do science. One study, Gibson & Chase (2002) reported that inquiry activities not only led to more interest in science but that this interest persisted long after the inquiry intervention was over. The thought is that if students are more interested in science because of inquiry experiences, they may be more likely to study science in the future and persist in science classes. Nieswandt (2007) did not find direct effect of attitudes on achievement but found an indirect connection in longitudinal data. Interest in science has been linked to future enrollment in science courses and pursuit of science related careers (Sinclair, 1994).

2.9 STUDIES ON THE PURPOSE OF PRACTICAL WORK

It is my belief that unpicking the Gordian knot that ties science education to its practical base requires, first and foremost, a reconceptualisation of the aims and purpose of science education. (Osborne, 1998)

Wellington (1998) comments that *'teachers are always surprised, even shocked, when asked to consider what practical work in science is for'* (p. 6; see also Donnelly, 1995). This phenomenon might simply reflect the almost sacrosanct position of 'the practical' in school science (Delamont *et al.*, 1988). Less anecdotal evidence of teachers' attitudes towards practical work comes from sources such as the ICM survey carried out on behalf of NESTA (the National Endowment for Science, Technology and the Arts) (n=510). ICM reported that 84% of the participants considered practical work to be 'very' important with 14% considering it 'quite' important (p. 5). The high level of importance attached to practical work begs the question, why is practical work so important? The answer to that question emerges from an examination of the research into teachers' views of the aims of practical work.

Over the years, there have been several studies that have reported teachers' views of the aims of practical work. Kerr (1964) identified 10 aims reported by teachers and a further 10 more were reported by Beatty and Woolnough (1982). Swain, Monk and Johnson (1998) in an unpublished study found another 10 aims. However, the four most popular aims in all three studies were:

- to encourage accurate observation and description;
- to make phenomena more real;
- to arouse and maintain interest;
- to promote a logical and reasoning method of thought.

By comparing the three studies, some trends appear, which might be explained by the influence of the National Curriculum. Four aims were rated more highly in the 1998 Swain *et al.* study than they were in the Beatty and Woolnough study carried out in the late 1970s:

• to practise seeing problems and seeking ways to solve them;

• to develop a critical attitude;

• to develop an ability to cooperate;

• for finding facts and arriving at new principles.

Millar (2004) argues that: It is also important to distinguish, and keep in mind, that the school science curriculum in most countries has two distinct purposes. First, it aims to provide every young person with sufficient understanding of science to participate confidently and effectively in the modern world – a 'scientific literacy' aim. Second, advanced societies require a steady supply of new recruits to jobs requiring more detailed scientific knowledge and expertise; school science provides the foundations for more advanced study leading to such jobs. These two purposes may lead to different criteria for selection of curriculum content, to different emphases, and (in the particular context of this paper) to different rationales for the use of practical work.

In an attempt to make sense of the various aims, Wellington (1998) offers a *'crude summary of arguments'* for the use of practical work:

Cognitive arguments: It is argued that practical work can improve pupils' understanding of science and promote their conceptual development by allowing them to 'visualise' the laws and theories of science. It can illustrate, verify or affirm 'theory work'.

Affective arguments: Practical work, it has been argued, is motivating and exciting – it generates interest and enthusiasm. It helps learners to remember things; it helps to 'make it stick'.

Skills arguments: It is argued that practical work develops not only manipulative or manual transferable skills such as observation, measurement, prediction and inference. These transferable skills are said not only to be valuable to future scientists but also to possess general utility and vocational value.

However, Wellington notes several counter arguments to all these claims for practical work. Firstly, doing science and understanding science theories are different (Theobald, 1968; Leach and Scott, 1995). Secondly, there is evidence that many pupils, particularly girls, are not very positive about doing experiments (Murphy, Qualter *et al.*, 1990). Thirdly, evidence for the transferability of skills is limited (Ausubel, 1964; Chapman, 1993; Lave, 1998). Wellington also notes that the arguments for the value of practical work in promoting group work have also been criticised (see, Wellington, 1994).

It would appear that the might be some scope for the science education community to engage in consideration of the purpose of science education and, in particular, the aims and purpose of ‘practical work’. As Bennett and Kennedy (2001) point out, the plurality of espoused aims for practical work in science make the task of assessment very difficult.

2.10 STUDIES ON THE PHYSICS TEACHING LEARNING

High-quality STEM (science, technology, engineering, and mathematics) education is considered an international priority for addressing global challenges (Shernoff et al., 2017; Tanenbaum et al., 2016). However, physics education has traditionally been, and remains, a particularly difficult case to handle (Banilower, 2013; Hodapp et al., 2009). The vast majority of high school physics teachers are not certified to teach the subject (Kena et al., 2015), and even fewer have a college degree in the field (Tesfaye & White, 2012), leaving most physics instructors ill-prepared to effectively teach their courses (Meltzer, 2012). Reforming physics education has been fairly high on the priority list for administrators and secondary teachers (Meltzer & Otero, 2015). Helping teachers transition from traditional lectures to more engaging pedagogies is at the core of this reformation (e.g., Liu & Sun, 2021), which has been especially important recently due to COVID-dictated remote education. Sunal et al.'s Physics Teaching and Learning: Challenging the Paradigm covers several strategies aimed at helping physics teachers improve their practice.

The eighth volume in the Research in Science Education (RISE) series; this 254- page edited collection comprises nine chapters written by 26 authors. The goal of the RISE series is to present "currently unavailable, or difficult to gather, materials from a variety of viewpoints and sources in a usable and organized format" (p. vii) for K-12 teachers. This volume is accessible and clearly organized into three major themes: improvements to teacher professional development programs, scholarship of teaching and learning (SoTL) projects, and overarching issues in physics education. However, readers seeking groundbreaking work or research not already freely accessible should look elsewhere.

The first section focuses on professional development programs for physics teachers, specifically the positive effects that professional development can have on enhancing teachers' pedagogical content knowledge, or the type of expertise that only educators develop which allows them to effectively relate the content to their pedagogy. The authors use the crucial aspects of professional development laid out by Desimone (2011) to guide their studies: inquiry-based content learning, active learning pedagogy, extensive and continuous hours of training, alignment of teacher training with district goals, and collaboration among inservice teachers. They find that physics professional development workshops that employ the modeling instruction approach yield significant changes in teachers' classrooms. Modeling instruction workshops are especially effective in professional development programs for physics teachers, having them shift between student role and educator role. According to the authors, this shift tends to change the way instructors perceive teaching and learning, often resulting in a student-centered pedagogy that focuses on inquiry and reflective thinking.

Moving beyond professional development and into the classroom, several contributors address tangible, in-classroom methods aimed at improving physics education. These studies could be classified as SoTL projects, although none of the authors identify them as such. SoTL "tends to be classroom-oriented, rather than theory- or hypothesis-driven… linked to what [faculty] see in the learning, or misunderstandings, of their students" (Felten, 2013, p. 121). With a narrow focus on unique practitioner issues, these chapters are well suited for that categorization. For example, one study focuses on computational modeling of complex systems. While prominent STEM educators recommend the incorporation of computer science into physics education (Chabay & Sherwood, 2008; diSessa, 2001), it is not yet a widespread practice. This chapter emphasizes that instructors need to have a strong background in computer science in order to adequately incorporate computational modeling into their curriculum. However, the persistent notion that computational modeling is "a promising avenue for motivating talented students" (p. 130, emphasis added) can be a bit of a turnoff for those who subscribe to the growth mindset model and believe that any student can excel despite their inherent abilities (Dweck, 2006). Another chapter explores the use of personification in physics, where human characteristics are attributed to material substances. The authors of this chapter argue that the use of personification is beneficial in helping students build a bridge from metaphorical explanations to formal conceptual understanding. Another chapter that resonates with a SoTL approach presents a research-informed strategy for teaching energy to teenage students in a conceptual manner. Here, the authors concluded that their teaching sequence did increase students' conceptual understanding of energy more than traditional curriculum, but they do not claim that a conceptual approach to energy is more effective than a material approach.

Chapter -3

METHODOLOGY

3.1 INTRODUCTION

For the successful conduct of any research requires suitable methodology with specific operational steps and well conducted tools. The present investigation has the main objective to study the *Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District.* This chapter present the details of the sample for the study, tool used for the study, procedure of data collection, scoring and the statistical techniques used for the analysis.

3.2 METHOD OF THE STUDY

The present investigation was undertaken by using survey method. The survey method gathers data from a relatively large number of cases at a particular time. It is interested in knowing something about the whole population.

3.3 LOCATION OF THE STUDY

The present study was conducted in Coimbatore district of Tamilnadu.

3.4 SAMPLE OF THE STUDY

The term sample refers to a small group of individuals taken from a large population. A sample may be defined as "a finite number of observation or cases, selected from all areas in a particular universe, often assumed to be representative of the total group or universe of which it is a part". (Good 1973). A sample is a small proportion of a population selected for observation and analysis by observing the characteristics of the sample: One can make certain inferences about the characteristics of the population from which it is drawn (John W.Best 2001.)

The present study consists of 120 samples selected using simple random selection procedure from four Coimbatore Corporation Higher Secondary Schools of Tamil Nadu. Among them 60 were male and 60 were female higher secondary school science group students. Further, 60 were selected from Class XI and the remaining from Class XII respectively. The details of distribution of sample selection are given in the following table.

Table – 3.1

Distribution of the Sample

Sample	**Class XI**	**Class XII**	**Total**
Male	30	30	60
Female	30	30	60
Total	60	60	120

3.5 TOOL USED

For the present investigation the researcher has chosen the tool – **Students' Physics Attitude Scale** (SPAS) to assess the attitudes of corporation higher secondary school students of science group towards learning Physics subject.

3.6 DESCRIPTION OF THE TOOL

This tool is in Likert type and it has 30 statements. Each statement in this attitude scale set against five point scale i.e. Strongly agree, agree, undecided, disagree and strongly disagree. A score of 5 is given to the response strongly agree to the positive statements, 4 for agree likewise the score 3, 2 and 1 was given to undecided, disagree and strongly disagree respectively. Similarly the reverse order scoring procedure was followed to the negative statements.

The maximum score for this perception scale is 150. Therefore if one who gets a score below 50 indicates the level of attitude of students towards studying Physics at Corporation schools of Coimbatore is **POOR;** and a score between 50 and 100 indicates the level of attitude of students towards studying Physics at Corporation schools of Coimbatore is **SATISFACTORY** and a score above 10 indicates the level of attitude of students towards studying Physics at Corporation schools of Coimbatore is **GOOD**.

Actually, the tool- – **Students' Physics Attitude Scale** (SPAS) consisted with three components such as - **Eagerness toward Physics, Physics Learning Interest** and **Rapport with Physics Teacher.**

Each component of the tool has 10 statements. Each statement in this attitude scale set against five point scale i.e. Strongly agree, agree, undecided, disagree and strongly disagree. A score of 5 is given to the response strongly agree to the positive statements, 4 for agree likewise the score 3, 2 and 1 was given to undecided, disagree and strongly disagree respectively. Similarly the reverse order scoring procedure was followed to the negative statements. The maximum score for this perception scale is 50.

Therefore if one who gets a score below 17 indicates the level of attitude of students towards studying Physics in terms of the component mentioned is **POOR;** and a score between 17 and 34 indicates the level of attitude of students towards studying Physics in terms of the component mentioned is **SATISFACTORY** and a score above 34 indicates the level of attitude of students towards studying Physics in terms of the component mentioned is **GOOD**.

To make standardization of the selected tool the investigator followed the procedures given below.

i. Selection of Items for the Final Study

The number of items in each test draft was two times the number of items required in the final tool. The items with wider range of difficulty were constructed. The tool draft was given to various higher secondary school science teachers and the experts having experience of test construction for frank opinion and criticism.

All the opinions and suggestions were collected carefully and incorporated in the presentation of the tool items for this study. Based on the opinions of teachers and experts, the final tool with 30 items was administered to 10 samples to know the reliability of the tool.

ii. Reliability

The reliability test was conducted for the tool by using the 'Test -Retest' method. The correlation coefficient of the reliability test scores are given below.

Table 3.2

Reliability Test Using Test & Retest Method

S.No.	**Eagerness toward Physics**		**Physics Learning Interest**		**Rapport with Physics Teacher**		**In Total Attitude**	
	Test	**Re-test**	**Test**	**Re-test**	**Test**	**Re-test**	**Test**	**Re-test**
1	24	26	22	27	30	33	76	86
2	21	23	33	36	25	26	79	85
3	26	29	22	34	23	24	71	87
4	28	29	26	26	20	21	74	76
5	29	30	28	30	28	30	85	90
6	24	31	23	26	27	29	74	86
7	32	33	22	25	22	22	76	80
8	27	31	27	28	29	32	83	91
9	31	35	22	25	28	30	81	90
10	25	29	30	31	20	22	75	82
r	**0.84**		**0.63**		**0.99**		**0.61**	

Results (r=0.84; 0.63; 0.99 and 0.61 component wise and in total attitude of the students' score) of the reliability tests mentioned in the above table shows that the tool prepared for the study was reliable.

iii. Validity of the Tool

The research tool prepared by the investigator was distributed to a group of five teacher educators, and five higher secondary school science teachers. They opined that the prepared tool had face validity and content validity.

3.7 DATA GATHERING PROCEDURE

The investigator personally met the selected corporation higher secondary school heads and after getting permission from the investigator met the selected science group student sample. Investigator elaborated the nature of the research work selected for the study at Corporation Schools in Coimbatore district and requested them to cooperate for collecting the required data for this study by filling up this Students' Physics Attitude Scale. The investigator gave a brief introduction about this research to the selected samples and also provides an outline to fill up the tool. After completing the tool by the selected students, the investigator collected the data carefully. All these data were subjected to scoring based on scoring procedure.

3.8 HYPOTHESES

The investigator has selected the following mentioned null hypotheses to verify the objectives of the present study.

H01: There is no significant difference between the attitudes of male and female higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

H02: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their eagerness towards subject.

H03: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their subject learning interest.

H04: significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their rapport with teachers.

H05: There is no significant difference between the attitudes of class XI and XII students towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

H06: There is no significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their eagerness towards subject.

H07: There is no significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their subject learning interest.

H08: There is no significant difference between the attitudes of class XI and XII students towards study of Physics in terms of their rapport with teachers.

3.9 STATISTICAL TECHNIQUES USED

For the analysis of the data, the following statistical techniques have been used -1.Descriptive analysis (Mean & S.D), 2.Differential analysis (‘t’ test).

Chapter -4

DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

In the present study, the investigator analyzed the data by using the following statistical techniques-Descriptive analysis and Differential analysis. The descriptive analysis of the data involves computing measures of central tendency as the mean and the measures of variable like standard deviation. Differential analysis involves the most important procedure by which the researchers make inferences involving the determination of the statistical significance of differences between groups. It involves 't' test, which is numerical procedure that taken into account of the size of mean difference between two groups, the number of students in each group and amount of variation to determine whether the mean performance of the groups are significantly differ or not.

4.2 LEVEL OF SIGNIFICANCE

The research workers chose several arbitrary standards for the convenience. These arbitrary standards are called level of significance. Most commonly used level of significance is 0.01 and 0.05 level. For the present investigation, the researcher used 0.05 level of significance for analyze.

4.3 DESCRIPTIVE ANALYSIS

The descriptive analysis is formulated based on the dependent and independent variables and are furnished as follows.

4.3.1 Student Physics Attitude in general

The maximum score of the Student Physics Attitude Scale is 150 in total and maximum score of each component of the tool is 50. The mean and SD scores of the sample obtained in Student Physics Attitude Scale in general are 101.29 and 9.00 respectively. This indicates that the attitude of the selected higher secondary students of Corporation schools at Coimbatore is at **good level** since the mean score of students in overall score is more than 100.

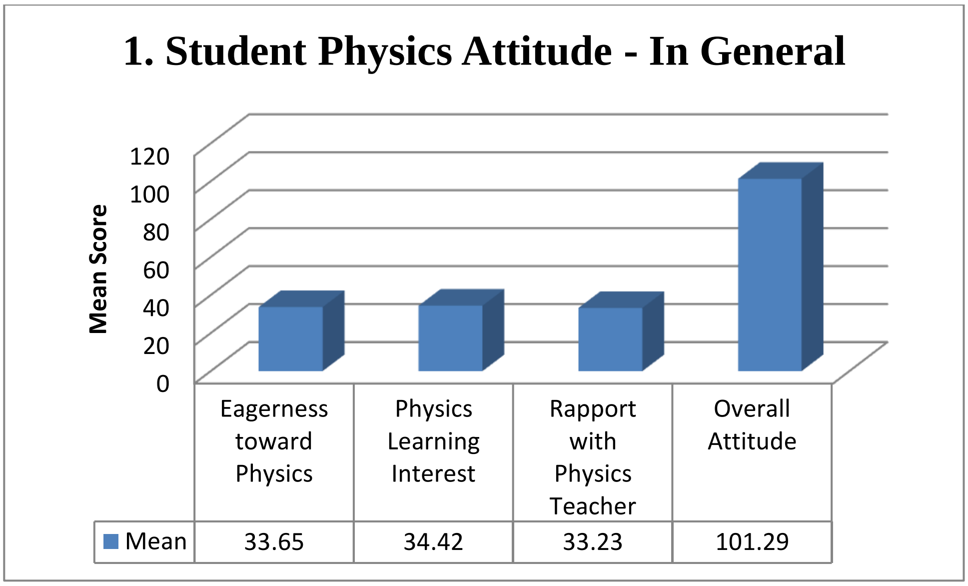
Similarly, the mean scores of students in the components - Eagerness toward Physics, Physics Learning Interest and Rapport with Physics Teacher are 33.65, 34.42 and 33.23 respectively. Since the students mean scores in the components Eagerness toward Physics and Rapport with Physics Teacher are between 17 and 34 it show that the students had **satisfactory level** of attitudes in these components. But their mean score in the component – Physics learning interest is more than 34 and hence it means that they had more attitudes towards this component. The following table data is evidence for these results.

Table 4.1

Student Attitude level towards Physics with reference to their Mean & SD Scores

Statement	Sample	Minimum	Maximum	Mean	SD
Eagerness toward Physics	120.00	26.00	53.00	33.65	2.90
Physics Learning Interest	120.00	26.00	53.00	34.42	3.27
Rapport with Physics Teacher	120.00	25.00	55.00	33.23	3.42
Overall Attitude	**120.00**	**79.00**	**161.00**	**101.29**	**9.00**

Comparison of Mean Scores of Sample in Student Physics Attitude Scale



The following table shows the statement wise mean scores of student in the component - Eagerness toward Physics.

Table 4.2

Statement wise Mean Score Comparison in component - Eagerness toward Physics

Statement	Sample	Minimum	Maximum	Mean
A1	120	1	4	3.00
A2	120	2	4	2.25
A3	120	2	5	3.70
A4	120	2	5	4.37
A5	120	2	4	2.16
A6	120	2	4	2.23
A7	120	2	4	3.65
A8	120	2	5	4.58
A9	120	2	4	3.01
A10	120	2	22	4.72
A Total	120	26	53	33.65

Note: A – represent the first Component

The statement wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.00
- the 2nd statement is 2.25
- the 3rd statement is 3.70
- the 4th statement is 4.37
- the 5th statement is 2.16
- the 6th statement is 2.23
- the 7th statement is 3.65

- the 8th statement is 4.58
- the 9th statement is 3.01
- the 10th statement is 4.72

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the first component.

- basic knowledge of physics is essential for everyone
- they submit their physics homework to teacher in punctual time
- they often discuss with their friends to make clarity in doubtful areas in physics

The following table shows the statement wise and class wise mean scores of student in the component - Eagerness toward Physics.

Table 4.3

Statement wise and Class wise Mean Score Comparison in component – Physics Learning Interest

Class	Statistics	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	ATot
XI	Mean	2.97	2.27	3.90	4.63	2.10	2.25	3.67	4.57	3.08	4.45	33.88
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.49	0.66	0.48	0.80	0.35	0.60	0.73	0.98	0.38	1.03	1.95
XII	Mean	3.03	2.23	3.50	4.10	2.22	2.20	3.63	4.58	2.93	4.98	33.42
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.49	0.65	0.87	1.35	0.52	0.51	0.78	1.03	0.41	2.33	3.61
Total	Mean	3.00	2.25	3.70	4.37	2.16	2.23	3.65	4.58	3.01	4.72	33.65
	N	120	120	120	120	120	120	120	120	120	120	120
	SD	0.49	0.65	0.73	1.14	0.45	0.56	0.75	1.00	0.40	1.81	2.90

Note: A – represent the first Component

The statement wise and class wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 2.97 and 3.03 which means that the XII students' attitude is better than that of XI students
- the 2nd statement is 2.27 and 2.23 which means that the XI students' attitude is better than that of XII students
- the 3rd statement is 3.90 and 3.50 which means that the XI students' attitude is better than that of XII students
- the 4th statement is 4.63 and 4.10 which means that the XI students' attitude is better than that of XII students
- the 5th statement is 2.10 and 2.22 which means that the XII students' attitude is better than that of XI students
- the 6th statement is 2.25 and 2.20 which means that the XI students' attitude is better than that of XII students
- the 7th statement is 3.67 and 3.63 which means that the XI students' attitude is better than that of XII students
- the 8th statement is 4.57 and 4.58 which means that the XII students' attitude is better than that of XI students
- the 9th statement is 3.08 and 2.93 which means that the XI students' attitude is better than that of XII students
- the 10th statement is 4.45 and 4.98 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 33.88 and 33.42 which means that the XI students' attitude is better than that of XII students in terms of Eagerness towards Physics.

The following table shows the statement wise and gender wise mean scores of student in the component - Eagerness toward Physics.

Table 4.4

Statement wise and Gender wise Mean Score Comparison in component – Physics Learning Interest

Gender	Statistics	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	ATO
Male	Mean	3.00	2.33	3.60	4.37	2.22	2.20	3.57	4.52	3.00	4.73	33.53
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.41	0.73	0.76	1.16	0.52	0.51	0.81	1.08	0.45	2.47	3.41
Female	Mean	3.00	2.17	3.80	4.37	2.10	2.25	3.73	4.63	3.02	4.70	33.77
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.55	0.56	0.68	1.12	0.35	0.60	0.69	0.92	0.34	0.72	2.29
Total	Mean	3.00	2.25	3.70	4.37	2.16	2.23	3.65	4.58	3.01	4.72	33.65
	N	120	120	120	120	120	120	120	120	120	120	120
	SD	0.49	0.65	0.73	1.14	0.45	0.56	0.75	1.00	0.40	1.81	2.90

Note: A – represent the first Component

The statement wise and gender wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.00 and 3.00 which means that there is no difference between the male and female students' attitude

- the 2nd statement is 2.23 and 2.17 which means that the male students' attitude is better than that of female students
- the 3rd statement is 3.60 and 3.80 which means that the female students' attitude is better than that of male students
- the 4th statement is 4.37 and 4.37 which means that the male students' attitude is better than that of female students
- the 5th statement is 2.22 and 2.10 which means that the male students' attitude is better than that of female students
- the 6th statement is 2.20 and 2.25 which means that the male students' attitude is better than that of female students
- the 7th statement is 3.57 and 3.73 which means that the female students' attitude is better than that of male students
- the 8th statement is 4.52 and 4.63 which means that the female students' attitude is better than that of male students
- the 9th statement is 3.00 and 3.02 which means that the female students' attitude is better than that of male students
- the 10th statement is 4.73 and 4.70 which means that the male students' attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 33.53 and 33.77 which means that the male students' attitude is better than that of female students in terms of Eagerness towards Physics.

The following table shows the statement wise mean scores of student in the component - Physics Learning Interest.

The following table shows the statement wise mean scores of student in the component - Physics Learning Interest.

Table 4.5

Statement wise Mean Score Comparison in component - Physics Learning Interest

Statement	Sample	Minimum	Maximum	Mean
B1	120	1	5	3.16
B2	120	2	5	2.42
B3	120	2	5	3.72
B4	120	2	5	4.37
B5	120	2	5	2.38
B6	120	2	5	2.41
B7	120	2	5	3.68
B8	120	2	5	4.58
B9	120	2	4	3.01
B10	120	2	22	4.72
BTO	120	26	53	34.42

Note: B – represent the Second Component

The statement wise mean scores of the sample obtained in the second component – Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.16
- the 2nd statement is 2.42

- the 3rd statement is 3.72
- the 4th statement is 4.37
- the 5th statement is 2.38
- the 6th statement is 2.41
- the 7th statement is 3.68
- the 8th statement is 4.58
- the 9th statement is 3.01
- the 10th statement is 4.72

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the second component.

- Often they feel stress in physics classes
- they try to focus more on memorizing the concepts of physics
- they feel that learning physics is very hard to me

The following table shows the statement wise and class wise mean scores of student in the component - Physics Learning Interest.

Table 4.6

Statement wise and Class wise Mean Score Comparison in component – Physics Learning Interest

Class	Statistics	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	BTO
XI	Mean	3.17	2.40	3.92	4.63	2.10	2.53	3.67	4.57	3.08	4.45	34.52
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.81	0.89	0.50	0.80	0.35	1.02	0.73	0.98	0.38	1.03	2.33
XII	Mean	3.15	2.43	3.52	4.10	2.65	2.28	3.68	4.58	2.93	4.98	34.32
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.63	0.95	0.89	1.35	1.12	0.72	0.83	1.03	0.41	2.33	4.02
Total	Mean	3.16	2.42	3.72	4.37	2.38	2.41	3.68	4.58	3.01	4.72	34.42
	N	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
	SD	0.72	0.91	0.75	1.14	0.87	0.88	0.78	1.00	0.40	1.81	3.27

Note: B – represent the Second Component

The statement wise and class wise mean scores of the sample obtained in the component - Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 3.17 and 3.15 which means that the XI students' attitude is better than that of XII students
- the 2nd statement is 2.40 and 2.43 which means that the XII students' attitude is better than that of XI students
- the 3rd statement is 3.92 and 3.52 which means that the XI students' attitude is better than that of XII students

- the 4th statement is 4.63 and 4.10 which means that the XI students' attitude is better than that of XII students
- the 5th statement is 2.10 and 2.65 which means that the XII students' attitude is better than that of XI students
- the 6th statement is 2.53 and 2.28 which means that the XI students' attitude is better than that of XII students
- the 7th statement is 3.67 and 3.68 which means that the XII students' attitude is better than that of XI students
- the 8th statement is 4.57 and 4.58 which means that the XII students' attitude is better than that of XI students
- the 9th statement is 3.08 and 2.93 which means that the XI students' attitude is better than that of XII students
- the 10th statement is 4.45 and 4.98 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 34.52 and 34.32 which means that the XI students' attitude is better than that of XII students in terms of Physics learning interest.

The following table shows the statement wise and gender wise mean scores of student in the component – Physics learning interest.

Table 4.7

Statement wise and Gender wise Mean Score Comparison in component – Physics Learning Interest

Gender	Statistics	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	BTO
Male	Mean	3.13	2.47	3.60	4.37	2.40	2.38	3.60	4.52	3.00	4.73	34.20
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.62	0.93	0.76	1.16	0.87	0.87	0.85	1.08	0.45	2.47	3.75
Female	Mean	3.18	2.37	3.83	4.37	2.35	2.43	3.75	4.63	3.02	4.70	34.63
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.81	0.90	0.72	1.12	0.88	0.91	0.70	0.92	0.34	0.72	2.73
Total	Mean	3.16	2.42	3.72	4.37	2.38	2.41	3.68	4.58	3.01	4.72	34.42
	N	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00
	SD	0.72	0.91	0.75	1.14	0.87	0.88	0.78	1.00	0.40	1.81	3.27

Note: B – represent the Second Component

The statement wise and gender wise mean scores of the sample obtained in the component – Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.13 and 3.18 which means that the female students' attitude is better than that of male students
- the 2^{nd} statement is 2.47 and 2.37 which means that the male students' attitude is better than that of female students
- the 3^{rd} statement is 3.60 and 3.83 which means that the female students' attitude is better than that of male students

- the 4^{th} statement is 4.37 and 4.37 which means that there is no difference between the male and female students’ attitude
- the 5^{th} statement is 2.40 and 2.35 which means that the male students’ attitude is better than that of female students
- the 6^{th} statement is 2.38 and 2.43 which means that the female students’ attitude is better than that of male students
- the 7^{th} statement is 3.60 and 3.75 which means that the female students’ attitude is better than that of male students
- the 8^{th} statement is 4.52 and 4.63 which means that the female students’ attitude is better than that of male students
- the 9^{th} statement is 3.00 and 3.02 which means that the female students’ attitude is better than that of male students
- the 10^{th} statement is 4.73 and 4.70 which means that the male students’ attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 34.20 and 34.63 which means that the female students’ attitude is better than that of male students in terms of Physics learning interest.

The following table shows the statement wise mean scores of student in the component - Rapport with Physics Teacher.

The following table shows the statement wise mean scores of student in the component - Rapport with Physics Teacher.

Table 4.8

Statement wise Mean Score Comparison in component - Rapport with Physics Teacher

Statement	Sample	Minimum	Maximum	Mean
C1	120	1	4	3.00
C2	120	1	4	2.32
C3	120	1	5	3.65
C4	120	1	5	4.15
C5	120	1	4	2.31
C6	120	1	4	2.30
C7	120	1	4	3.57
C8	120	1	5	4.31
C9	120	1	4	3.05
C10	120	1	22	4.58
CTO	120	25	55	33.23

Note: C – represent the third Component

The statement wise mean scores of the sample obtained in the second component – Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.00
- the 2nd statement is 2.32
- the 3rd statement is 3.65
- the 4th statement is 4.15

- the 5th statement is 2.31
- the 6th statement is 2.30
- the 7th statement is 3.57
- the 8th statement is 4.31
- the 9th statement is 3.05
- the 10th statement is 4.58

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the second component.

- Their physics teacher always attends his classes properly
- their physics teacher does not encourage the students during the classroom interaction
- they want to become a physics teacher

The following table shows the statement wise and class wise mean scores of student in the component - Rapport with Physics Teacher.

Table 4.9

Statement wise and Class wise Mean Score Comparison in component – Rapport with Physics Teacher

Class	Statistics	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	CTO
XI	Mean	2.97	2.43	3.90	4.47	2.33	2.37	3.62	4.27	3.20	4.37	33.92
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.58	0.81	0.48	0.93	0.71	0.76	0.80	1.23	0.48	1.16	2.50
XII	Mean	3.03	2.20	3.40	3.83	2.28	2.23	3.52	4.35	2.90	4.78	32.53
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.49	0.68	0.98	1.53	0.67	0.62	0.95	1.25	0.57	2.48	4.04
Total	Mean	3.00	2.32	3.65	4.15	2.31	2.30	3.57	4.31	3.05	4.58	33.23
	N	120	120	120	120	120	120	120	120	120	120	120
	SD	0.53	0.76	0.81	1.30	0.68	0.69	0.88	1.24	0.55	1.94	3.42

Note: C – represent the third Component

The statement wise and class wise mean scores of the sample obtained in the component - Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 2.97 and 3.03 which means that the XII students' attitude is better than that of XI students
- the 2nd statement is 2.43 and 2.20 which means that the XI students' attitude is better than that of XII students
- the 3rd statement is 3.90 and 3.40 which means that the XI students' attitude is better than that of XII students

- the 4^{th} statement is 4.47 and 3.83 which means that the XI students' attitude is better than that of XII students
- the 5^{th} statement is 2.33 and 2.28 which means that the XI students' attitude is better than that of XII students
- the 6^{th} statement is 2.37 and 2.23 which means that the XI students' attitude is better than that of XII students
- the 7^{th} statement is 3.62 and 3.52 which means that the XI students' attitude is better than that of XII students
- the 8^{th} statement is 4.27 and 4.35 which means that the XII students' attitude is better than that of XI students
- the 9^{th} statement is 3.20 and 2.90 which means that the XI students' attitude is better than that of XII students
- the 10^{th} statement is 4.37 and 4.78 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 33.92 and 32.53 which means that the XI students' attitude is better than that of XII students in terms of Rapport with Physics Teacher**.**

The following table shows the statement wise and gender wise mean scores of student in the component – Rapport with Physics Teacher.

Table 4.10

Statement wise and Gender wise Mean Score Comparison in component – Rapport with Physics Teacher

Gender	Statistics	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	CTO
Male	Mean	3.00	2.33	3.60	4.12	2.33	2.27	3.47	4.38	3.05	4.67	33.22
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.41	0.73	0.76	1.35	0.68	0.66	0.93	1.08	0.50	2.52	3.60
Female	Mean	3.00	2.30	3.70	4.18	2.28	2.33	3.67	4.23	3.05	4.48	33.23
	N	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
	SD	0.64	0.79	0.85	1.26	0.69	0.73	0.82	1.38	0.59	1.13	3.25
Total	Mean	3.00	2.32	3.65	4.15	2.31	2.30	3.57	4.31	3.05	4.58	33.23
	N	120	120	120	120	120	120	120	120	120	120	120
	SD	0.53	0.76	0.81	1.30	0.68	0.69	0.88	1.24	0.55	1.94	3.42

Note: C – represent the third Component

The statement wise and gender wise mean scores of the sample obtained in the component – Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.00 and 3.00 which means that the is no difference between male and female students’ attitude
- the 2nd statement is 2.33 and 2.30 which means that the male students’ attitude is better than that of female students
- the 3rd statement is 3.60 and 3.70 which means that the female students’ attitude is better than that of male students

- the 4th statement is 4.12 and 4.18 which means that the female students' attitude is better than that of male students
- the 5th statement is 2.33 and 2.28 which means that the male students' attitude is better than that of female students
- the 6th statement is 2.27 and 2.33 which means that the female students' attitude is better than that of male students
- the 7th statement is 3.47 and 3.67 which means that the female students' attitude is better than that of male students
- the 8th statement is 4.38 and 4.23 which means that the male students' attitude is better than that of female students
- the 9th statement is 3.05 and 3.05 which means that there is no difference between the male and female students' attitude
- the 10th statement is 4.67 and 4.48 which means that the male students' attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 33.22 and 33.23 which means that there is no much difference between the male and female students' attitude in terms of Rapport with Physics Teacher**.**

4.4 Differential Analysis

1. **Comparison of Mean Scores of Sample in Student Physics Attitude Scale as per the variable ‘Class’ through ‘t’ test**

Table – 4.11

Mean and SD Scores of Samples of Class XI and XII

Components	CLASS	N	Mean	SD	t	p
Eagerness toward Physics	XI	60	33.88	1.95	0.88	0.38
	XII	60	33.42	3.61		
Physics Learning Interest	XI	60	34.52	2.33	0.33	0.74
	XII	60	34.32	4.02		
Rapport with Physics Teacher	XI	60	33.92	2.50	2.26	0.03
	XII	60	32.53	4.04		
Overall Attitude	XI	60	102.32	6.21	1.25	0.21
	XII	60	100.27	11.08		

The table 4.11 shows that the comparisons of mean scores of sample in terms of Student Physics Attitude Scale components - Eagerness toward Physics, Physics Learning Interest and Rapport with Physics Teacher with reference to the students’ studying classes – XI and XII. The following results are arrived from the above table.

- The calculated t- value (1.25) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of students of class XI and XII in the Student Physics Attitude Scale in general and therefore it is found that there was no significant difference between the mean scores of class XI and XII students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu.

Hence, the null hypothesis

H01: There is no significant difference between the attitudes of class XI and XII higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

– **is accepted**

- The calculated t- value (0.88) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of students of class XI and XII in the tool component - Eagerness toward Physics and therefore it is found that there was no a significant difference between the mean scores of class XI and XII students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' Eagerness toward Physics.

Hence, the null hypothesis

H02: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their eagerness towards subject. – **is accepted**

- The calculated t- value (0.33) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of students of class XI and XII in the tool component – subject learning interest. Therefore it is found that there was no significant difference between the mean scores of class XI and XII students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' subject learning interest.

Hence, the null hypothesis

H03: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their subject learning interest.– **is accepted**

- The calculated t- value (2.26) is greater than the table t –value at 0.05 and $p < 0.05$ while comparing the mean scores of students of class XI and XII in the tool component - rapport with teachers and therefore it is found that there was a significant difference between the mean scores of class XI and XII students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' rapport with teachers.

Hence, the null hypothesis

H04: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their rapport with teachers. – **is rejected**

2. **Comparison of Mean Scores of Sample in Student Physics Attitude Scale as per the variable 'Gender' through 't' test**

Table – 4.12

Mean and SD Scores of Male and Female Samples

Components	Gender	N	Mean	SD	t	p
Eagerness toward Physics	Male	60	33.77	2.29	0.44	0.66
	Female	60	33.53	3.41		
Physics Learning Interest	Male	60	34.63	2.73	0.72	0.47
	Female	60	34.20	3.75		
Rapport with Physics Teacher	Male	60	33.23	3.25	0.03	0.98
	Female	60	33.22	3.60		
Overall Attitude	Male	60	101.63	7.37	0.41	0.68
	Female	60	100.95	10.44		

The table 4.11 shows that the comparisons of mean scores of sample in terms of Student Physics Attitude Scale components - Eagerness toward Physics, Physics Learning Interest and Rapport with Physics Teacher with reference to the students' gender. The following results are arrived from the above table.

- The calculated t- value (0.41) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of male and female students in the Student Physics Attitude Scale in general and therefore it is found that there was no significant difference between the mean scores of male and female students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu.

Hence, the null hypothesis

H05: There is no significant difference between the attitudes of male and female higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.
– **is accepted**

- The calculated t- value (0.44) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of students of class XI and XII in the tool component - Eagerness toward Physics and therefore it is found that there was no significant difference between the mean scores of male and female students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' Eagerness toward Physics.

Hence, the null hypothesis

H06: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their eagerness towards subject. – **is accepted**

- The calculated t- value (0.72) is less than the table t –value at 0.05 and p > 0.05 while comparing the mean scores of students of class XI and XII in the tool component – subject learning interest. Therefore it is found that there was no significant difference between the mean scores of male and female students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' subject learning interest.

Hence, the null hypothesis

H07: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their subject learning interest.– **is accepted**

- The calculated t- value (0.03) is greater than the table t –value at 0.05 and $p > 0.05$ while comparing the mean scores of students of class XI and XII in the tool component - rapport with teachers and therefore it is found that there was a a significant difference between the mean scores of male and female students in their attitude towards studying Physics at Corporation Schools of Coimbatore district in Tamil Nadu in terms of students' rapport with teachers.

Hence, the null hypothesis

H08: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their rapport with teachers. – **is accepted**

Chapter -5

SUMMARY OF FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

The main objective of the present investigation is to study the *Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District.* This chapter deals with the summary of the findings arrived on the basis of data analysis, and the recommendations to further research activities.

5.2 SUMMARY OF THE STUDY

Sample of the Study

The present study consists of 120 samples selected using simple random selection procedure from four Coimbatore Corporation Higher Secondary Schools of Tamil Nadu. Among them 60 were male and 60 were female higher secondary school science group students. Further, 60 were selected from Class XI and the remaining from Class XII respectively.

Tool Used

For the present investigation the researcher has chosen the tool – **Students' Physics Attitude Scale** (SPAS) to assess the attitudes of corporation higher secondary school students of science group towards learning Physics subject.

The description of the tool and scoring procedure were clearly explained in the chapter.3.

Data Collection

The investigator personally met the selected corporation higher secondary school heads and after getting permission from the investigator met the selected science group student sample. Investigator elaborated the nature of the research work selected for the study at Corporation Schools in Coimbatore district and requested them to cooperate for collecting the required data for this study by filling up this Students' Physics Attitude Scale. The investigator gave a brief introduction about this research to the selected samples and also provides an outline to fill up the tool. After completing the tool by the selected students, the investigator collected the data carefully. All these data were subjected to scoring based on scoring procedure.

5.3 HYPOTHESES

The investigator has selected the following mentioned null hypotheses to verify the objectives of the present study.

H01: There is no significant difference between the attitudes of class XI and XII higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

H02: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their eagerness towards subject.

H03: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their subject learning interest.–

H04: There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their rapport with teachers.

H05: There is no significant difference between the attitudes of male and female higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.

H06: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their eagerness towards subject.

H07: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their subject learning interest.

H08: There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their rapport with teachers

5.4 FINDINGS

The analyzed data results were given as follows.

Descriptive Analysis

The maximum score of the Student Physics Attitude Scale is 150 in total and maximum score of each component of the tool is 50. The mean and SD scores of the sample obtained in Student Physics Attitude Scale in general are 101.29 and 9.00 respectively. This indicates that the attitude of the selected higher secondary students of Corporation schools at Coimbatore is at **good level** since the mean score of students in overall score is more than 100.

Similarly, the mean scores of students in the components - Eagerness toward Physics, Physics Learning Interest and Rapport with Physics Teacher are 33.65, 34.42 and 33.23 respectively. Since the students mean scores in the components Eagerness toward Physics and Rapport with Physics Teacher are between 17 and 34 it show that the students had **satisfactory level** of attitudes in these components. But their mean score in the component – Physics learning interest is more than 34 and hence it means that they had more attitudes towards this component.

Statement wise Mean Score Comparison in component - Eagerness toward Physics

The statement wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.00
- the 2nd statement is 2.25
- the 3rd statement is 3.70
- the 4th statement is 4.37
- the 5th statement is 2.16

- the 6^{th} statement is 2.23
- the 7^{th} statement is 3.65
- the 8^{th} statement is 4.58
- the 9^{th} statement is 3.01
- the 10^{th} statement is 4.72

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the first component.

- basic knowledge of physics is essential for everyone
- they submit their physics homework to teacher in punctual time
- they often discuss with their friends to make clarity in doubtful areas in physics

Statement wise and Class wise Mean Score Comparison in component – Physics Learning

The statement wise and class wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 2.97 and 3.03 which means that the XII students' attitude is better than that of XI students
- the 2^{nd} statement is 2.27 and 2.23 which means that the XI students' attitude is better than that of XII students
- the 3^{rd} statement is 3.90 and 3.50 which means that the XI students' attitude is better than that of XII students

- the 4th statement is 4.63 and 4.10 which means that the XI students' attitude is better than that of XII students
- the 5th statement is 2.10 and 2.22 which means that the XII students' attitude is better than that of XI students
- the 6th statement is 2.25 and 2.20 which means that the XI students' attitude is better than that of XII students
- the 7th statement is 3.67 and 3.63 which means that the XI students' attitude is better than that of XII students
- the 8th statement is 4.57 and 4.58 which means that the XII students' attitude is better than that of XI students
- the 9th statement is 3.08 and 2.93 which means that the XI students' attitude is better than that of XII students
- the 10th statement is 4.45 and 4.98 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 33.88 and 33.42 which means that the XI students' attitude is better than that of XII students in terms of Eagerness towards Physics.

Statement wise and Gender wise Mean Score Comparison in component – Physics Learning Interest

The statement wise and gender wise mean scores of the sample obtained in the component - Eagerness toward Physics of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.00 and 3.00 which means that there is no difference between the male and female students' attitude
- the 2nd statement is 2.23 and 2.17 which means that the male students' attitude is better than that of female students
- the 3rd statement is 3.60 and 3.80 which means that the female students' attitude is better than that of male students
- the 4th statement is 4.37 and 4.37 which means that the male students' attitude is better than that of female students
- the 5th statement is 2.22 and 2.10 which means that the male students' attitude is better than that of female students
- the 6th statement is 2.20 and 2.25 which means that the male students' attitude is better than that of female students
- the 7th statement is 3.57 and 3.73 which means that the female students' attitude is better than that of male students
- the 8th statement is 4.52 and 4.63 which means that the female students' attitude is better than that of male students
- the 9th statement is 3.00 and 3.02 which means that the female students' attitude is better than that of male students
- the 10th statement is 4.73 and 4.70 which means that the male students' attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 33.53 and 33.77 which means that the male students' attitude is better than that of female students in terms of Eagerness towards Physics.

Statement wise Mean Score Comparison in component - Physics Learning Interest

The statement wise mean scores of the sample obtained in the second component – Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.16
- the 2nd statement is 2.42
- the 3rd statement is 3.72
- the 4th statement is 4.37
- the 5th statement is 2.38
- the 6th statement is 2.41
- the 7th statement is 3.68
- the 8th statement is 4.58
- the 9th statement is 3.01
- the 10th statement is 4.72

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the second component.

- Often they feel stress in physics classes
- they try to focus more on memorizing the concepts of physics
- they feel that learning physics is very hard to me

Statement wise and Class wise Mean Score Comparison in component – Physics Learning Interest

The statement wise and class wise mean scores of the sample obtained in the component - Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 3.17 and 3.15 which means that the XI students' attitude is better than that of XII students
- the 2nd statement is 2.40 and 2.43 which means that the XII students' attitude is better than that of XI students
- the 3rd statement is 3.92 and 3.52 which means that the XI students' attitude is better than that of XII students
- the 4th statement is 4.63 and 4.10 which means that the XI students' attitude is better than that of XII students
- the 5th statement is 2.10 and 2.65 which means that the XII students' attitude is better than that of XI students
- the 6th statement is 2.53 and 2.28 which means that the XI students' attitude is better than that of XII students
- the 7th statement is 3.67 and 3.68 which means that the XII students' attitude is better than that of XI students
- the 8th statement is 4.57 and 4.58 which means that the XII students' attitude is better than that of XI students
- the 9th statement is 3.08 and 2.93 which means that the XI students' attitude is better than that of XII students

- the 10th statement is 4.45 and 4.98 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 34.52 and 34.32 which means that the XI students' attitude is better than that of XII students in terms of Physics learning interest.

Statement wise and Gender wise Mean Score Comparison in component – Physics Learning Interest

The statement wise and gender wise mean scores of the sample obtained in the component – Physics Learning Interest of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.13 and 3.18 which means that the female students' attitude is better than that of male students
- the 2nd statement is 2.47 and 2.37 which means that the male students' attitude is better than that of female students
- the 3rd statement is 3.60 and 3.83 which means that the female students' attitude is better than that of male students
- the 4th statement is 4.37 and 4.37 which means that there is no difference between the male and female students' attitude
- the 5th statement is 2.40 and 2.35 which means that the male students' attitude is better than that of female students
- the 6th statement is 2.38 and 2.43 which means that the female students' attitude is better than that of male students

- the 7th statement is 3.60 and 3.75 which means that the female students' attitude is better than that of male students
- the 8th statement is 4.52 and 4.63 which means that the female students' attitude is better than that of male students
- the 9th statement is 3.00 and 3.02 which means that the female students' attitude is better than that of male students
- the 10th statement is 4.73 and 4.70 which means that the male students' attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 34.20 and 34.63 which means that the female students' attitude is better than that of male students in terms of Physics learning interest.

Statement wise Mean Score Comparison in component - Rapport with Physics Teacher

The statement wise mean scores of the sample obtained in the second component – Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The mean score of the sample in

- the first statement is 3.00
- the 2nd statement is 2.32
- the 3rd statement is 3.65
- the 4th statement is 4.15
- the 5th statement is 2.31
- the 6th statement is 2.30
- the 7th statement is 3.57

- the 8th statement is 4.31
- the 9th statement is 3.05
- the 10th statement is 4.58

The above data indicate that the students had more attitudes towards Physics in terms of the following statements of the second component.

- Their physics teacher always attends his classes properly
- their physics teacher does not encourage the students during the classroom interaction
- they want to become a physics teacher

Statement wise and Class wise Mean Score Comparison in component – Rapport with Physics Teacher

The statement wise and class wise mean scores of the sample obtained in the component - Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The class XI and XII wise mean score of the sample in

- the first statement is 2.97 and 3.03 which means that the XII students' attitude is better than that of XI students
- the 2nd statement is 2.43 and 2.20 which means that the XI students' attitude is better than that of XII students
- the 3rd statement is 3.90 and 3.40 which means that the XI students' attitude is better than that of XII students
- the 4th statement is 4.47 and 3.83 which means that the XI students' attitude is better than that of XII students

- the 5th statement is 2.33 and 2.28 which means that the XI students' attitude is better than that of XII students
- the 6th statement is 2.37 and 2.23 which means that the XI students' attitude is better than that of XII students
- the 7th statement is 3.62 and 3.52 which means that the XI students' attitude is better than that of XII students
- the 8th statement is 4.27 and 4.35 which means that the XII students' attitude is better than that of XI students
- the 9th statement is 3.20 and 2.90 which means that the XI students' attitude is better than that of XII students
- the 10th statement is 4.37 and 4.78 which means that the XII students' attitude is better than that of XI students

In overall, the class XI and XII wise mean score of the sample are 33.92 and 32.53 which means that the XI students' attitude is better than that of XII students in terms of Rapport with Physics Teacher.

Statement wise and Gender wise Mean Score Comparison in component – Rapport with Physics Teacher

The statement wise and gender wise mean scores of the sample obtained in the component – Rapport with Physics Teacher of Student Physics Attitude Scale are furnished as follows.

The gender wise mean score of the sample in

- the first statement is 3.00 and 3.00 which means that the is no difference between male and female students' attitude

- the 2^{nd} statement is 2.33 and 2.30 which means that the male students' attitude is better than that of female students
- the 3^{rd} statement is 3.60 and 3.70 which means that the female students' attitude is better than that of male students
- the 4^{th} statement is 4.12 and 4.18 which means that the female students' attitude is better than that of male students
- the 5^{th} statement is 2.33 and 2.28 which means that the male students' attitude is better than that of female students
- the 6^{th} statement is 2.27 and 2.33 which means that the female students' attitude is better than that of male students
- the 7^{th} statement is 3.47 and 3.67 which means that the female students' attitude is better than that of male students
- the 8^{th} statement is 4.38 and 4.23 which means that the male students' attitude is better than that of female students
- the 9^{th} statement is 3.05 and 3.05 which means that there is no difference between the male and female students' attitude
- the 10^{th} statement is 4.67 and 4.48 which means that the male students' attitude is better than that of female students

In overall, the GENDER wise mean score of the sample are 33.22 and 33.23 which means that there is no much difference between the male and female students' attitude in terms of Rapport with Physics Teacher.

Differential Analysis

- There is no significant difference between the attitudes of class XI and XII higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.
- There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their eagerness towards subject.
- There is no significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their subject learning interest
- There is a significant difference between the attitudes of class XI and XII higher secondary school students towards study of Physics in terms of their rapport with teachers
- There is no significant difference between the attitudes of male and female higher secondary school students' towards study of Physics in Corporation Schools at Coimbatore district of Tamil Nadu.
- There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their eagerness towards subject.
- There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their subject learning interest.
- There is no significant difference between the attitudes of male and female higher secondary school students towards study of Physics in terms of their rapport with teachers.

5.4 RECOMMENDATIONS

The present study gives a clear-cut view about the *Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District*.. Based on the data analyzed and by the investigator, the following recommendations have been made with discussion.

1. The important findings of the present study reveal that the selected higher secondary school science group students felt that their science attitudes are at good level. Therefore, the teachers and management of corporation higher secondary schools may give good science lab facilities to these students to get enough hands on experience in science concepts.
2. Head of the schools may create awareness among the students to utilize the laboratory facilities properly.
3. Schools and educational department may give enough in-service training programs to the science teachers to update their knowledge in science lab activities.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

The following are the some of the suggested research problems for future researcher and for healthy research outcomes on this present theme.

1. The present study could be undertaken at various geographical areas.

2. A study could be conducted using the school teachers as the sample to study their attitude towards teaching physics.

3. A study could be conducted by using the government and private school students as the sample and results may be compared.

4. A study could be conducted to know the attitude of school students towards Chemistry and Biology practical works separately.

5. A study could be conducted to know the relationship between the attitude of school students towards Science practical works and their performance in science practical works.

5. 6 CONCLUSION

From the above analysis, we can conclude that the selected samples felt that their *Attitude of Students towards the Study of Physics in Corporation Schools in Coimbatore District* are at Satisfactory level. The present day human survival is mostly depends on science and technology and therefore, right from the school education, each individual student should be given much importance to develop knowledge and exposure in science and mathematics subjects. Teachers and parents should foster adequate knowledge and skills among students to go for the next level in the educational life. So the present day teachers, especially in Science class, must be aware on preparing the adolescence higher secondary school students for the next level of educational career.

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Students' Physics Attitude Scale

Personal Data of Student

Name of the Student :

Gender : Male / Female

Class Studying : STD

Medium of Instruction : Tamil / English

School Management : Government / Private

Name of School :

Dear Students… Kindly put tick √ mark in one of the given four options as you think it is right answer.

Note: SA – Strongly Agree (முழுமையாக ஒப்புக்கொள்கிறேன்), A – Agree (ஒப்புக்கொள்கிறேன்), UD – Undecided (முடிவெடுக்கவில்லை), DA – Disagree (ஒப்புக்கொள்ளவில்லை), SDA- Strongly Disagree (முழுமையாக ஒப்புக்கொள்ளவில்லை)

S.No.	Statement	SA	A	UD	DA	SDA
Eagerness toward Physics இயற்பியல் மீது ஆர்வம்						
1	Learning Physics related description is most enjoyable to me இயற்பியல் தொடர்பான விளக்கத்தைக் கற்றுக்கொள்வது எனக்கு மிகவும் மகிழ்ச்சியாக இருக்கிறது					
2	Studying more Physics subject at school level is not worth it பள்ளி அளவில் இயற்பியல் பாடத்தை அதிகம் படிப்பது பயனற்றது					
3	Learning by doing physics experiment in laboratory increases my interest in physics ஆய்வகத்தில் இயற்பியல் பரிசோதனை செய்வதன் மூலம் கற்றுக்கொள்வது இயற்பியலில் எனது ஆர்வத்தை அதிகரிக்கிறது					
4	Basic knowledge of physics is essential for everyone இயற்பியல் பற்றிய அடிப்படை அறிவு அனைவருக்கும் இன்றியமையாதது					
5	Physics is one of a boring subject for me இயற்பியல் எனக்கு ஒரு சலிப்பான பாடமாகும்					
6	After successful completion of every experiments in Physics stimulates me to do other experiments இயற்பியலில் ஒவ்வொரு சோதனையையும் வெற்றிகரமாக முடித்த பிறகு, மற்ற சோதனைகளைச் செய்ய என்னைத் தூண்டுகிறது					
7	I prefer to learn more through practical activities in physics நான் இயற்பியலில் நடைமுறை நடவடிக்கைகள் மூலம் மேலும் கற்றுக்கொள்ள விரும்புகிறேன்					
8	I submit my physics homework to teacher in punctual time எனது இயற்பியல் வீட்டுப்பாடத்தை ஆசிரியரிடம் சரியான நேரத்தில்					

	சமர்ப்பிக்கிறேன்					
9	I am always waiting eagerly to physics class period நான் எப்போதும் இயற்பியல் வகுப்பிற்காக ஆவலுடன் காத்திருக்கிறேன்					
10	I often discuss with my friends to make clarity in doubtful areas in physics இயற்பியலில் சந்தேகத்திற்குரிய பகுதிகளில் தெளிவுபடுத்த நான் அடிக்கடி எனது நண்பர்களுடன் கலந்துரையாடுகிறேன்					
Physics Learning Interest						
1	I feel very pleased on answering the questions of my teacher in physics class இயற்பியல் வகுப்பில் எனது ஆசிரியரின் கேள்விகளுக்கு பதிலளிப்பதில் நான் மிகவும் மகிழ்ச்சியடைகிறேன்					
2	Laboratory work in physics develops individual's learning competence இயற்பியலில் ஆய்வக வேலை தனிநபரின் கற்றல் திறனை மேம்படுத்துகிறது					
3	I spend more time to learn physics subject matters till I attain complete proficiency நான் முழுமையான தேர்ச்சி அடையும் வரை இயற்பியல் பாடங்களைக் கற்றுக்கொள்ள அதிக நேரத்தை செலவிடுகிறேன்					
4	Often I feel stress in physics classes பெரும்பாலும் நான் இயற்பியல் வகுப்புகளில் மன அழுத்தத்தை உணர்கிறேன்					
5	More participation in Physics classes result in effective understanding இயற்பியல் வகுப்புகளில் அதிக அளவில் பங்கேற்பது பயனுள்ள புரிதலுக்கு வழிவகுக்கிறது					
6	More absents in physics classes lead to poor scoring in the subject இயற்பியல் வகுப்புகளில் அதிக வருகை இல்லாதது பாடத்தில் மோசமான மதிப்பெண்களுக்கு வழிவகுக்கிறது					
7	I try to relate the physics concept with my daily life situation நான் இயற்பியல் கருத்தை எனது அன்றாட வாழ்க்கை நிலைமையுடன் தொடர்புபடுத்த முயற்சிக்கிறேன்					
8	I try to focus more on memorizing the concepts of physics இயற்பியலின் கருத்தாக்கங்களை மனப்பாடம் செய்வதில் அதிக கவனம் செலுத்த முயற்சிக்கிறேன்					
9	I spend more time to study physics only at the time of examinations நான் தேர்வுகளின் போது மட்டுமே இயற்பியல் படிக்க அதிக நேரம் செலவிடுகிறேன்					

10	I feel that learning physics is very hard to me இயற்பியலைக் கற்றுக்கொள்வது எனக்கு மிகவும் கடினம் என்று நினைக்கிறேன்					
Rapport with Physics Teacher						
1	I am fearful of my physics teacher எனது இயற்பியல் ஆசிரியரைப் பார்த்து நான் பயப்படுகிறேன்					
2	My physics teacher encourages me in learning the physics subject என் இயற்பியல் ஆசிரியர் என்னை இயற்பியல் பாடத்தைக் கற்றுக்கொள்ள ஊக்குவிக்கிறார்					
3	My physics teacher rarely discuss with students related to the topics taught in the class எனது இயற்பியல் ஆசிரியர் வகுப்பில் கற்பிக்கப்படும் தலைப்புகள் குறித்து மாணவர்களுடன் அரிதாகவே விவாதிக்கிறார்					
4	My physics teacher always attends his classes properly எனது இயற்பியல் ஆசிரியர் எப்போதும் தனது வகுப்புகளுக்கு சரியாக வருவார்					
5	My physics teacher will not permit the students to ask doubts in the class எனது இயற்பியல் ஆசிரியர் வகுப்பில் சந்தேகங்களைக் கேட்க மாணவர்களை அனுமதிக்க மாட்டார்					
6	My physics teacher often uses the lecture method in classroom teaching எனது இயற்பியல் ஆசிரியர் வகுப்பறை கற்பித்தலில் விரிவுரை முறையை அடிக்கடி பயன்படுத்துகிறார்					
7	My physics teacher thinks that I am slow learner in physics நான் இயற்பியலில் மெதுவாக கற்றுக்கொள்கிறேன் என்று என் இயற்பியல் ஆசிரியர் நினைக்கிறார்					
8	My physics teacher does not encourage the students during the classroom interaction எனது இயற்பியல் ஆசிரியர் வகுப்பறை உரையாடலின் போது மாணவர்களை ஊக்குவிக்கவில்லை					
9	My physics teacher always insists the students on understanding rather than memorization எனது இயற்பியல் ஆசிரியர் எப்போதும் மனப்பாடம் செய்வதை விட புரிந்துகொள்ள வேண்டும் என்று மாணவர்களை வலியுறுத்துகிறார்					
10	I want to become a physics teacher நான் இயற்பியல் ஆசிரியர் ஆக விரும்புகிறேன்					