EFFECTIVENESS OF EPISODIC CONCEPTUALIZATION STRATEGY ON REDUCING MISCONCEPTION IN SELECT CONCEPTS OF PHYSICS AMONG IXth STANDARD STUDENTS

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DECLARATION

I, SHANA P V, do hereby declare that this dissertation entitled **EFFECTIVENESS OF EPISODIC CONCEPTUALIZATION STRATEGY ON REDUCING MISCONCEPTION IN SELECT CONCEPTS OF PHYSICS AMONG IXTH STANDARD STUDENTS** has not been submitted by me for the award of any Degree, Diploma, Title or Recognition before.

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CERTIFICATE

I, NOWFAL C, do hereby certify that the dissertation titled, **EFFECTIVENESS OF EPISODIC CONCEPTUALIZATION STRATEGY ON REDUCING MISCONCEPTION IN SELECT CONCEPTS OF PHYSICS AMONG IXTH STANDARD STUDENTS** is a record of bonafide study and research carried out by **SHANA P V** under my supervision and guidance, has not been submitted by her for the award of any Degree, Diploma, Title of Recognition before.

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Learning process is necessarily the basic strategy of any education system. Learning is a continuous purposeful process evolved through systematic sequential attempt to impart knowledge in either formal or informal situation. Clarifying misconception due to various reasons including teaching strategies, learning environment, learner personal factors and more, which in turn becomes the causative factor for high rate of failure and unlearning . It has been obvious that, learning, whatever is complex its nature in any context, whether it is formal, informal or non-formal, never becomes successful unless the learners, who takes the central position if any learning situation is able to comprehend clearly what he wants to learn. This meaningful comprehension of teaching methods, based on the careful consideration of constructivism in its epistemological, psychological and educational aspects are seen to contrast with the traditional ones and are supposed to have remarkable impact on the cognitive, affective and psychomotor domains of the learner. The teacher who uses the traditional methods found their teaching almost exclusively reserved for the presentation of the contents to be learned with all the imperfections leading children in to misconception in various subject. Misconception are often seen in the teaching of all subjects as blocking factor which forces the learner to lag behind for a fault not his own.

Constructivism has emerged as one of the greatest influences on the practice of education in the last twenty five years. Teachers have embraced constructivist based pedagogy with an enthusiasm that is rare in these days of quick fines and a shopping mall approach to school improvement for many teachers, the focus on

constructing meaning in the teaching -learning process resonates with prior beliefs because constructivist based instruction firmly places educational priorities on students learning . Constructivism is a theory or philosophy of learning based on the idea that knowledge is constructed by the knower based on mental activity. The proper teaching strategies help teachers in solving learner's problems and bringing remarkable improvement change the behavior of students

Science is the system of knowing the universe though data collected by observation and controlled experimentation thus science and scientific invention changed man's whole life by making it costly, comfortable and luxurious. It changes entire existence of the man in important aspects such as health power, communication and transportation. It helps us to develop scientific attitude in the mind of the learner.

Hence constructivism strategy is not continuously affected by the science learners. It causes misconceptions in science subjects. Science results form a process of conceptualization of subject matter. The task of science teacher is to help students to understand some content knowledge of science

In a subjects like physics, misconception can be a critical barrier towards understanding important concepts. The goals of physics are to develop precise models of physical reality; hence physics can be a subject which demands both abstract thinking patterns and materialistic practical sense. The tool that physicist uses range from the physical to the abstract from balance scales to laser beam emitter's to mathematics understanding this wide range of tools and the methods for applying them is essential to understanding the process that physicist go through in

studying the physical world keeping in view the importance of concept clarity in learning of physics, such methods addressing various abstract concepts through meaningful interrelated modules is a need of hour in teaching of physics, thus ithelps the learners to form clear concept. As a matter of facts, higher concepts in physics can only be attained through meaningful recapitulation of previous concept to provide an elbow support. Physics learning requires presentation of learning materials leading to formation of concepts so concepts are to be presented by using an innovative strategy for increasing the content knowledge of the student. This strategy combined together are interrelated concepts in an episodic way that was concerned by the investigators with a view that would help for the meaningful formation of all the higher order concepts an experimental strategy from the prospective of above factor became essential. This strategy could be named as the episodic conceptualization strategy. In this strategy a higher concept is made clear to the students on the basic of continuous way of teaching, experiment, concept mapping, formative and summative evaluations, activities and so on with the help of verbal support of lower concepts thus making their learning free from conceptual error and misconception .

Misconceptions are referred to as the wrong or false idea of a concept in a student according to their pre-concepts. Misconception are not only to be observed in today's children or students even scientist and philosophers developed and lived with many misconceptions ideas of a subject are developed without having any prior knowledge of the subject is not necessarily wrong but can be described as alternatives, original or pre-concepts for his/her lessons. In physics subjects,

misconceptions are formed on the basic of teaching learning strategies. Every concept of physics provides an experiment or an activity oriented classroom for learning and the most basic thing is the episodic way of teaching in concepts for developing the clarity of a student. Episodic conceptualization strategy is an innovative strategy which highlights the importance of pre-requisites for the effective transmission of any new topics. It is based on the David P Ausubell's theory of meaningful assimilation of verbal learning. This strategy seems to be an attempt to present any new concepts followed by their previous learning in a meaningful and progressive way. Before presenting any new concept, presentation of hierarchy of previous related concepts to create a meaningful connection helping the learner to form the concept clarity, is the major attraction of this strategy. Analyzing the previous studies in the area it can be seen that despite all the studies talk about the importance of concept clarity in the subject like physics; hardly attempts were made to settle the problems related with misconceptions by presenting a teaching strategy to substitute the existing one. Number of studies around the globe as reported that misconception in physics is a felt problem and it should be addressed in this research in physics. For problem solving in domains like physics, no one disputes an important role for prior, domain specific knowledge.

Akhilesh and Gafoor (2007) studied the misconceptions of the physics among secondary school students. In this study Akhilesh found the misconception regarding 12 concepts of physics among secondary school students. He selected the concepts of matter, solar- system, density, velocity, mass, gravity, work, energy, light, sound, electricity and temperature. In this study data were collected by using

test of concept attachment in physics (TCAP) and using this, Akhilesh found that students couldn't get the correct idea about the concepts in physics. Hence he concluded that teaching should develop strategies to create cognitive conflict in students organize instruction to diagnose errors in students thinking and help students translate from one mode of representation to another. Anderson and Smith examined the understanding of science concepts of students. This study reported that majority of students understood the concepts when they used visual aids to learn the concepts. In the study suggested that using concept maps as a strategy to teach physics, in particular the topic of physics. Renjith and Joshith (2015) studied the effectiveness of episodic conceptualization strategy on achievement in physics among secondary school students. And the main aim of this study is to find out the impact of episodic conceptualization strategy for the enhancement of achievement of secondary school students. The study concluded that traditional method of teaching couldn't attribute anything in enhancing the achievement of secondary students. Acoustics examined that they obtained of the conceptual map analysis before teaching. Acoustics shows the efficiency of concept mapping in the classroom, when the maps are made in constructivist and investigative environment. Understanding the importance of the variable, the present study is an attempt to reduce the misconception in IX^{th} standard physics subject using episodic conceptualization strategy on the basis of previous studies classroom experiences, and curriculum.

Need and Significance of the study

The curious thing is that even with this paradigm shift in present educational system, so much of what we currently know is just getting to be wrong. So many of our assumption are getting to be wrong and still others totally move us far away from the reality. In today's educational system in fact there exists several misconception stands unclear. Since the concepts form the basis of subject like physics, advanced study in physics depends on how much the learners is able to comprehend basic fundamental concept. So the students may experience high rate of failure in physics unless they could form the basic concepts and in turn it will affect this entire study habits and study skills.

The call for transforming schools from teaching basic skills towards school for thought seems to a growing consensus among educators. Researchers and educators worldwide, have respondent to that calls investigating costly resources in projects whose primary goal is to enhance students thinking. Science education aims at increasing common knowledge about science and widening social awareness of scientific finding and issues. Learning science requires, learning its language, which often differs from daily language. Learning science goes beyond scientific facts, principles and theories. One of its aims is to attain conceptual understanding of the science. Today, education intends to produce citizens who can deal with the words concept and scientific symbols necessary for the success in the technologically advanced modern age. It causes the difficulty in learning science. Hence learning of physics become much more difficult by the presence of numerous misconceptions from the developmental view of science education, children do not come to school at

zero in science learning. They have already reacted to gravity, energy, lightening, thunder, darkness, light, weather, and host of other scientific phenomena. They may bring misconception superstitions and fear, which become liability to society in long run.

Misconception is developed in students about scientific processes and beliefs that run counter to the beliefs and theories held by scientists. As a teacher it is our duty to investigate the root cause of these types of misconceptions and extreme care is to be taken to help the learner to like science with the large content in a limited period of time seems to add difficulty in comprehending its content investigating the factors which move the learner far away from the reality of science concept. It can be understood that our present educational system is held accountable for this drastic condition failing to design are effective strategy considering each concept as a continuum of some basic concepts which in turn focuses the fact that meaningful comprehension of concepts only takes place when it is treated not as a separate entity but as a combination of inter related and concepts. Even though the curriculum of textbooks is changed, the teaching strategies still remain unchanged. Our educational process lacks such a logical strategy to approach various subjects like science but it still treats concepts as individual entity in its transaction. Among the science subjects the concept of physics is most difficult one to comprehend.

In physics, one concept is the continuation of another concept. If the child gets the concept of volume, then only he can understand the concept of density. The density and weight of the ice are the areas very often mistaken by the learner. Similarly students don't have a clear concept about mass and weight. They cannot

properly distinguish between the differences. Most of the students have been reported to face difficulty in the following areas of the subject matter. Force and motion, distance and displacement, electromagnetic force and magnetic force etc. Hence the misconception in the lower level concept will affect the higher level learning of the student.

However a serious impediment to wide and successful implementation of many such projects is the lack of adequate methods, episodic conceptualization strategy is a new direction on this area. Science is a subject where a teacher must select an appropriate strategy for teaching by internationalizing the knowledge acquired in different concept because this is the only subject where the students feel as a remedy to their problems a leisure that they want to keep forever and many other things. So the teacher must equip himself with a skill of analyzing the concept and with an instructional strategy as well concept help to understand the language of science. Thus concepts have wide applicability in science teaching.

The classroom is a place where these misconception and problems should classify perfectly but it is not an effect because of teaching and learning strategies implied in the classroom don't bear this fact leading to misconception. Incorporating the connection between lower concept and higher concepts in physics, a strategy which would attempt to present each higher concept with the support of episodically presented lower concepts combined together different physical concept as a continuum of single entity becomes immediate urgent of the classroom learning. The study is conducted by the investigators to bridge the gap between comprehending of each higher concept, by forming a new strategy named episodic conceptualization

through meaningful presentation of concepts, mind mapping experiments etc. and also substituting traditional learning strategy.

Statement of the problem

The problem for the present study has been titled as

"EFFECTIVENESS OF EPISODIC CONCEPTUALIZATION STRATEGY ON REDUCING MISCONCEPTION IN SELECT CONCEPTS OF PHYSICS AMONG IXTH STANDARD STUDENTS"

Definition of the key terms

The key terms used for the study have been operationally defined below.

Effectiveness

Effectiveness as the degree to which something is successful is producing a desired result; success: (Oxford Dictionary).

Effectiveness is the ability to be successful and produce the intended results.(Cambridge Dictionary of Education).

In this study the term stands to refer the degree to which objectives are achieved and the extent to which targeted problems are solved.

Episodic conceptualization strategy

For the study the term is used to refer an innovative strategy in which each higher concept is presented as episodic module in such a way each higher concept is

frequently preceded and supported by previous lower concept that helps meaningful concept formation.

Misconception

According to oxfords advance learners dictionary, misconception is a view or opinion that is incorrect based on faulty thinking or understanding and pupils pre concepts in the teaching learning process.

Misconception in physics can be operationally defined as a view or opinion that is incorrect based on faulty thinking or understanding of concepts in physics.

Standard IXth pupil

All the students studying in the standard IXthof school functioning according to Kerala syllabus are treated as standard IXthpupil for the study.

Variable of the study

In this study investigator wishes to find out effectiveness of episodic conceptualization strategy on reducing misconception in select concept of physics among IXth standard students. Present study involves two types of variables viz, independent variable in the study is episodic conceptualization strategy and dependent variable is misconception in physics.

Objectives of the study

The main objectives of study are,

1. To find out whether there exist any significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
2. To find out whether there exist any significant difference in the mean post-test of misconception in Physics of pupils in experimental and control group.
3. To find out whether there exist any significant difference in the mean gain score of test of misconception in Physics of pupils in experimental and control group.
4. To compare the adjusted mean score of test of misconception in Physics of pupils in experimental and control group by taking pretest scores as covariant.
5. To investigate the effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics.

Hypotheses

Based on the objectives given above the following hypotheses are formulated for the study.

1. There exists significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
2. There exists significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.

3. There exists significant difference in the mean gain score of test of misconception in Physics of pupil in experimental and control group.
4. There exists significant difference in the adjusted mean score of test of misconception in Physics of pupils in experiment and control group by taking pretest score and covariant.
5. Episodic conceptualization strategy is effective on reducing misconception in select concepts of physics.

Methodology

Methodology is the vital part of any research as it guides the way to proceed. The methodology used for the present study is given briefly under the following headings

The present study used the experimental design in which pretest and post-test non-equivalent group (Quasi experimental group) are used. The notation is given below,

O1 X O3

O2 C O4

Sample selected

The population for the study is standard IX pupils of Kerala state. The Sample for the studyconstitutes two divisions of standard IX pupils from some schools, each consist of 40 to 50 students.

Tools used

The investigator used the following tools for the study

- Test of Misconception in Physics.
- Lesson Transcript based on episodic conceptualization strategy.
- Lesson transcript based on conventional method of teaching.

Statistical Techniques used

The investigator used the following statistical techniques for the study,

- Descriptive statistics
- Test of significant difference between mean scores
- Ancova (analysis of covariance).

Scope and Limitation

The study indicates that the concepts which are concrete in nature have been comparatively low rate of misconceptions. Hence the teacher have been bothered about the facts about nature and concepts, which have major role in making misconceptions in students mind, while designing instruction and framing of the science curriculum and even for the selection of learning experience.

The previous studies proved that secondary school students such as standard IX^{th} pupil have serious misconception in the area of mass, weight, magnetism, electromagnetism etc. the misconception are formed in students because of the teaching learning strategy of curriculum. Teachers have practical knowledge, concept mapping, experimental provision and technological advancement for

studying subjects like physics. Hence they didn't get those opportunities in classroom learning. The main need of this study is to reduce the misconceptions of physics among IXthstandard students on the basis of the newly applied strategy which is called episodic conceptualization strategy. The study helped the investigator to introduce a new strategy for regularly misconception in physics. It also makes use of a standardised tool to test misconception that would be helpful for researchers and teachers. Approved statistical techniques were applied by the researcher. So the strtegyof the study can be generalised.

Limitations

Even though the present study was conducted with maximum possible care and septicity, certain limitations which could hardly be avoided, have crept in to the study, they are

- The study was confined to a small samples of two class divisions of standard IXthas considered as the representatives of standard IXthstudents.
- The topic selected was a small unit and study was limited to physics only.
- Shortage of time has necessitated the investigator to limit the study to one dependent and independent variable, namely misconception and episodic conceptualization strategy.
- Only comparison was made with existing strategy.
- No treatment was given given for equalizing both groups.

Organization of the Report

The report of the present study is organized in the following way.

Chapter 1 includes a brief introduction need and significance of the study, definition of key term, variable, objectives, hypotheses and scope and limitations of the study.

Chapter 2 includes a brief theoretical overview of the variable, studies related to the variables and a summary of review of related literature.

Chapter 3 includes methodology of the study in detail with description of tools used for measurement, sample for the study, data collection of data and the statistical techniques used for analysis.

Chapter 4 describes preliminary analysis, details of the major statistical analysis of the data, interpretation and discussion of the data.

Chapter 5 presents major findings, tenability of the study, educational implication and suggestions for the research.

Chapter 2

REVIEW OF RELATED LITERATURE

- *Theoretical overview of Misconception*
- *Studies related to Misconception*
- *Theoretical overview of strategic instruction*
- *Studies related to strategic instruction*
- *Conclusion*

REVIEW OF RELATED LITERATURE

Review of literature is one of the important aspects of a research study. This stage provides the investigator with deep knowledge in to the particular field of knowledge that is related to his topic. In educational research the researcher must become familiar with the problems through related studies and understanding theoretical aspects of the variables selected. The review of literature also provides an insight into the methods, measures, subjects and approaches used by other research workers and can thus lead to significant improvement of the design.

The objective of this study is to determine that how to reduce the misconception in physics by using the episodic conceptualization strategy among IXth standard students in secondary school students. The idea comes from the physics teaching learning process in constructivism method. Conventional methods are mainly focused on the activities in learning. Not focused on the concept clarity properly. It causes increasing the misconceptions in physics concepts. Episodic strategy affects the teaching learning process of physics subject effectively.

The theoretical overview of Misconception in Physics

Science subject is a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws. It is a study of the nature and behavior of natural things and knowledge. The subject is an attempt to explain natural phenomena. Scientific knowledge relies heavily, but not entirely on observation, experimental evidence, rational arguments and

skepticism. There is no one way to do science. Therefore, there is no universal step in science.

Nature of science subject

In science subject new knowledge must be reported clearly and openly. Scientists require accurate record- keeping, peer review and reproducibility. In this subject observations are theory laden and scientists are creative, innovative and have a discoverable nature to reveal the hidden truths, facts in world. Over the centuries, science builds in both an evolutionary and a revolutionary way. Science is part of social and cultural traditions. Scientific ideas are affected by the social and historical setting hence technology is the integral part of science subject. Laws and theories serve different roles in science. Therefore students should not that theories do not become laws even with additional evidence.

In general, the nature of science refers to key principles and ideas which provide a description of science as a way of knowing as well as characteristics of scientific knowledge. Many of these intrinsic ideas are lost in the everyday aspects of a science classroom, resulting in students learning skewed notions about how science is conducted.

Scientific knowledge is tentative although scientific knowledge is supported by a wealth of data from repeated traits. It is not considered the final word. Scientific knowledge is at the same time stable and malleable scientists continually test and challenge previous assumptions and findings. After all, science is a human endeavorand we know human perspective is limited and fallible. This idea of

fundamental uncertainty is vital to scientific studies and is the basis of great scientific discoveries.

Science subject discovers the facts or hypotheses or theories. The key terms are often misinterpreted. Students often think of the pieces of scientific knowledge they learn as facts. The scientific knowledge as facts, because that would tend to perpetuate the idea that scientific knowledge is inalterable. Scientific facts are observable phenomenon in a particular situation. In science, hypothesis is an educated guess. “Although a hypothesis is a partly a guess” in the sense that it is an idea, this inevitable definition is not adequate. In general a hypothesis is a statement, based on previous observations that can be tested scientifically. The idea that a scientific hypothesis must be testable often eludes students.

In science, physics and chemistry subjects are mainly focused on scientific methods. In the first chapter of most science textbooks, there will be a section laying out the scientific method, a step by step process that apparently must be followed in order to conduct scientific studies. The danger in this approach is not only that learning the scientific method is a bummer to students, but that it is also quite restrictive in its scope. Scientists usually do not walk through the method sequentially. They often bounce around, perhaps forming a new hypothesis during experimentation. Hence experiments are the major part of science education. The teaching learning process of science subjects are carried by experiments. Studies in which no experimentation is performed are also scientific studies, but do not follow the scientific method.

Observations and inferences are important terms in science education. It is very effective for students to understand the different facts and concepts in science education. In those cases of observation, science education is a recent history also generally concentrates on the teaching of science concepts and addressing misconceptions that learners may hold regarding science concepts.

Science education has been strongly influenced by constructivist thinking. Constructivism in science education has been informed by an extensive research programmed in to student thinking and learning in science, and in particular exploring how teachers can facilitate conceptual change towards canonical scientific thinking. Constructivism emphasizes the active role of the learner and the significance of current knowledge and understanding in mediating learning, and importance of teaching that provides an optional level of guidance to learners. Science textbook should provide with opportunities to observe the surroundings and engage in simple experiments and investigative activities in earlier classes. The classroom experience, undoubtedly, might have helped pupil to record the information systematically and assimilate ideas through discussion and analysis. While understanding the scientific approach, there should also be the attitude to take forward the skills to apply them in day-today life. Moreover, an eco-friendly perspective must be adopted too. All these, through direct experiences enquiry and understanding preferably.

Importance of concept in Science

A scientific concept is an idea or model explaining some natural phenomenon. For example, our understanding of objects falling toward the Earth is

explained in our concept of gravity. There are different forms of scientific concepts. They differ primarily in the amount of supporting evidence and acceptance by the scientific community. A concept that has supporting evidence and is becoming increasingly accepted by the scientific community as truth. Example: Theory of Dinosaur Extinction. A concept that is widely accepted by the scientific community. There is a large amount of supporting evidence in favor of the law. Laws describe concepts that invariably test true under the same conditions. Example: Law of Gravity. All concepts begin as a hypothesis. As more evidence is collected to support the hypothesis, more of the scientific community comes to accept the concept and it becomes a theory. Only those concepts that are proven true over and over again are accepted as scientific laws. Some concepts are never accepted as laws because the scientific community may continue to debate the concept or it might not always prove true. Scientific literacy is a critical component of this endeavor. Scientific literacy is more than just knowledge of scientific concepts; it is the ability to apply scientific knowledge to everyday problem-solving situations that impact health, safety, and the environment. During the past quarter-century, education research has provided a deeper understanding of how students learn science and of the knowledge and skills required for academic achievement. This knowledge is invaluable to teachers in guiding instructional decisions, and has implications for science education at all levels.

Science, technology and innovation are increasingly important to our economic well-being and quality of life. At Let's Talk Science, we define "science literacy" broadly to include science, technology, engineering and math (STEM).

Science literacy helps us understand and shape our daily lives. It helps us as we interact with our environment, asking questions and seeking answers. This question-and-answer process lies at the heart of knowing and doing science. It's a way of thinking and knowing about the natural and physical components of the world we live in. Science not only shapes our daily lives, it is also the foundation of an innovative culture and can be found at the core of significant political decisions. Doing science develops our ability to ask questions, collect information, organize and test our ideas, problem-solve and apply what we learn. Even more, science offers a powerful platform for building confidence, developing communication skills and making sense of the world around us – a world that is increasingly shaped by science and technology. In science, numeracy, like language and literacy, is essential to doing science. The skills of sorting and classifying, estimating and counting, measuring, graphing, collecting data and analyzing are frequently used when doing science. Science is a way of knowing and thinking about the natural and physical world that surrounds us. Observing, measuring, and inferring, classifying, predicting and communicating are some of the skills that are fundamental to science investigations, problem solving and decision making. These key skills all contribute to science as a body of knowledge and a way of knowing. Conducting science investigations and explorations involves use of inquiry skills. Inquiry is a circular process; the conclusions can take the learner back to the original question and lead to more questions, involving other learners in the process. By formulating their own questions, planning, and conducting investigations, learners build new meanings, understanding and knowledge. This helps develop their critical thinking, reasoning and decision-making skills that will serve a learner for a lifetime. Science also

requires using technical skills, which are important to procedures used in various disciplines of science, such as doing a titration in chemistry or using a spring scale in physics. Part of learning these technical skills is developing an understanding of the safety considerations involved when handling materials and equipment and performing experiments.

Teaching Science is not about preparing students for a world that is static and fixed but it concerns getting students ready to cope with changes and challenges in their lives. Traditional direct instruction in Science generally focuses on mastery of content with less emphasis on the development of scientific skills and attitudes; students are the receivers while the teacher the dispenser. In most class room contexts, teachers are pre occupied with academic activities in pursuit of the schools' successes; often in the form of their students gaining as many strategies. An effective standards-based science curriculum provides an excellent and equitable science education for all students and provides for a deep understanding of essential science concepts. The science curriculum must be made relevant to students by framing lessons in contexts that give facts meaning, teach concepts that matter in students' lives, and provide opportunities for solving complex problems. Not only do students need to know the laws of nature, they also must know when to apply these laws in solving problems. Relating learning to students' previous experiences or knowledge and engaging students' interest by linking learning to the students'/school's environment or setting are ways to encourage students to make connections. The more students make connections between what they already know and new learning, the more student achievement will be improved. Teaching

concepts in a variety of contexts is more likely to produce flexible learning that can be generalized or used across a broader spectrum of applications. Student-cantered classrooms often utilize real-world events in order to create an effective learning environment. Integrating science with other disciplines also supports transfer of knowledge and skills from one setting to another.

Complexity of Science concept

The rapid changes and increased complexity of today's world present new challenges and put new demands on our education system. There has been generally a growing awareness of the necessity to change and improve the preparation of students for productive functioning in the continually changing and highly demanding environment. In confronting this challenge it is necessary to consider the complexity of the education system itself and the multitude of problems that must be addressed. Clearly, no simple, single uniform approach can be applied with the expectation that significant improvements of the system will occur. Indeed, any strategy for change must contend with the diverse factors affecting the education system, the interactions of its parts, and the intricate interdependencies within it and with its environment. As we consider these problems, we become increasingly cognizant of the various possibilities of using concepts and methods of the study of complex systems for providing direction and strategies to facilitate the introduction of viable and successful changes. A key insight from complex systems is that simple solutions are not likely to be effective in cases such as the education system, and that providing a balance or coexistence of what seem to be opposites may provide the greatest opportunities for successful courses of action. In the following we consider

1. Integrating the commonly polarized goals of education; i.e. the goal that focuses on transmitting knowledge with the goal that emphasizes the development of the individual student.
2. Adapting teaching to different student characteristics by using diverse methods of teaching. Adaptation to the ability levels, patterns of different abilities, learning styles, personality characteristics, and cultural backgrounds.
3. Integrating the curriculum by developing inter-disciplinary curriculum units that enable students to acquire knowledge from different disciplines through a unifying theme while having the opportunity to contribute in different and special ways to the objectives of the integrated units.

The major educational goals are approaches to teaching can be categorized according to major educational goals that affect teaching strategies. On one hand the goal of education is viewed as the transmission of knowledge by the teachers to the students. On the other hand the goal of education is viewed as facilitating students' autonomous learning and self-expression. The former approach which converges toward the teaching of specified subject matter may be termed 'convergent' teaching and the latter approach which stresses open ended self-directed learning may be termed 'divergent' teaching. The convergent approach is highly structured and teacher-centered; the students are passive recipients of knowledge transmitted to them and learning achievements are measured by standardized tests. The divergent approach is flexible, student-centered, where the students are active participants in the learning process and learning achievements are assessed by a variety of

evaluation tools such as self-evaluation in parallel to teacher evaluation; documentation portfolios; and special projects. In the highly complex education system there may be various combinations of the different approaches to teaching and probably no 'pure' convergent or divergent teaching. Still, the tendency in the education system of today is toward the convergent approach. In fact, among the current suggestions for implementing educational reforms to deal with the considerable problems of the education system, there has been a strong emphasis on setting convergent goals, an aspect of which is the use of across-the-board standardized testing. Testing has been commonly viewed as a prudent way to determine the success or failure of the teaching and learning process. There has been a relatively limited use of other means of evaluation which are more complicated and more demanding in terms of application and interpretation. As educators seek ways to meet the demands put upon the education system in today's world of rapid changes and ever increasing complexity, it may be helpful to recognize that there is a need for both convergent and divergent approaches to teaching and learning. Educators who stress the importance of the acquisition of specific knowledge as a useful way to prepare the students for productive future functioning, must come to realize that even for the purpose of this goal alone, a divergent approach is needed today. With the great proliferation of knowledge and rapid changes in most fields as well as the appearance of many new fields, it is critical to develop students' capacity for self-directed learning and self-growth. On the other hand, those who emphasize the importance of autonomous growth and creative self-expression must realize that the students need academic skills (such as reading, writing, calculating, etc.) as prerequisites for productive self-expression. Since the creative process involves new

ways of using existing knowledge, it is important to provide opportunities for students to acquire such knowledge (which can be acquired by convergent teaching). Hence, convergent and divergent teaching strategies are both needed and the challenging question is how to find the balance between them within the complexity of the process of teaching and learning. It is likely that the two approaches may increasingly become not mutually exclusive but interrelated and interdependent. An important development is the growing awareness that academic achievement could improve by adapting teaching to student's individual differences. This awareness is finding its most distinct expression in the education system's attempts to deal with the issues of students with special needs. However, other aspects of adaptation to students' individual differences get far less attention.

In general, adaptation to individual differences under convergent teaching tends to be limited. The students are all expected to strive toward one goal of learning specified required knowledge; some may attain it and others may fall by the wayside or be given some remediation with limited results. Nevertheless, there are various possibilities of effective adaptation to individual differences under convergent teaching. In addition to adaptation in the rate of learning, where each student can be allowed to work at his/her own pace, there are many possibilities of adaptation through the use of diverse methods of teaching. Even when all the students are taught the same material, teachers can use different methods, different techniques or different media, to cater to individual differences in abilities and personality characteristics. Such a 'multi-convergent' approach can be more effective in giving the students opportunities to use their aptitudes and inclinations

for learning and attaining higher achievements. As the students experience success and consequently a sense of competence, their motivation is enhanced to pursue further learning. Such an approach has a better potential for success than the common reality of students with learning difficulties, who often struggle through remediation with a sense of inadequacy and discouraging experiences of failure. Adaptation to individual differences under divergent teaching may be expected to be productive because of its emphasis on student autonomous, active, self-reliant learning. Yet, there are students who may not function well under divergent conditions because of their strong need for guidance, direction, and structure. Divergent teaching can cater to such needs by individual guidance, along with ongoing assessment and subsequent modifications. This is a 'guided-divergent' approach which is more structured and less flexible than the open divergent teaching but less narrow and limiting than convergent teaching.

Among the most difficult problems faced by the education system are those associated with teaching effectiveness? The current preparation of teachers for specific age levels, specific subject matter, specific academic skills, etc., does not take into consideration sufficiently the complexity of factors such as students' various characteristics. There is a strong need to train teachers to adapt instruction to the diverse student abilities, learning styles; personality traits and needs by using more differentiated teaching strategies (See also Complexity in the Classroom. In addition to the preparation of teachers to more differentiated teaching, there could be more divergent use of teaching resources. Worthwhile teaching can be done with advantageous results by persons other than the traditional classroom teachers. For

example, valuable teaching can be done by peers of different ages and abilities. Also, parents, grandparents, and relatives could participate in and contribute productively to the teaching process. Furthermore, teaching can be enhanced by volunteers, retirees, people with various areas of expertise from the worlds of science, business, engineering, medicine, public service, entertainment, and others. Also, high-tech resources such as multimedia technology, computer programs, telecommunication, the Internet, audio-visual techniques, and others can provide beneficial options. Student learning can be greatly enriched further by traveling - near and far; interaction with people of different cultures; different geographical areas; different occupations, different ways of life; different outlooks.

Science is both a body of knowledge that represents current understanding of natural systems and the process whereby that body of knowledge has been established and is being continually extended, refined and revised. Both elements are essential: one cannot make progress in science without an understanding of both. Likewise, in learning science one must come to understand both the body of knowledge and the process by which this knowledge is established, extended, refined and revised. The body of knowledge includes specific facts integrated and articulated in to highly developed and well tested theories. These theories, in turn, can explain bodies of data and predict outcomes of experiments. They are also tools for further development of the subject. An important component of the science is the knowledge of the limitation of current theories, that is, an understanding of those aspects of theories that is well tested and hence are well established, and of those aspects that are not well tested and hence are provisional and likely to be modified

as new empirical evidence is acquired. Teaching the facts theories principals of science will only give a partial knowledge if it is not well equipped with necessary experiments regarding the topic. All these create lot of complexities in science among them one of the most important complexities is misconception.

Interrelation of science concept with experiments

Experimentation is important to help establish the causes of certain events or happenings. Experiments play a restricted role in transmitting knowledge, but may be used as deductions demonstrating concepts; they are useless or harmful in teaching problem-solving but important as aids in testing alternative solutions and in training specific scientific skills; and finally, they are not the best means for evoking and maintaining curiosity in adolescents. Special consideration is paid to the role of concepts and concretizations in science, adolescent thinking and science instruction. Science that uses what is known to try and prove ideas and concepts that are as yet untested. Practical work in science at schools is widely accepted as a vital component of teaching and learning. It is an effective way to enhance students' motivation and extend their knowledge in understanding theories and ideas about natural world. It is also a well-known fact that students prefer practical work to any other learning activities. However, students do not always learn from a practical task the things their teachers want them to learn. According to Millar and Abrahams, "A few weeks after carrying out a practical task most students recall only specific surface details of the task and many are unable to say what they learned from it or what they were doing it for". Practical work is essential only when it is used effectively.

Science is the study of facts. At the same time, science is also about discovering the world around us, of knowing things, and having new and wonderful idea. It is against this very definition of science that most educators believe that scientific learning that takes place in classrooms alone is not true learning. For fostering scientific learning in early childhood, active, hands-on learning is very important. And this can best be achieved through science lab experiments. Science lab experiments promote the development of scientific thinking in students. Rather than making the kids memorize the facts, they are made to think and understand things and the world around them. Science lab experiments allow students to ask questions, probe for answers, conduct investigations, and collect data. They are engaged in the investigative nature of scientific learning. Children in fact do science in science labs than simply learning science through textbooks in classrooms.

Science experiments promote discovery and learning. Discovering new ideas is an integral part of learning science. It is something that teachers can't give to students. Students themselves have to discover new ideas and concepts during their search for knowledge. In science school lab, children conduct experiments. They adopt alternatives, try to work out things in different areas and understand what works and what didn't really work. Many a times, children work on wrong ideas. But it's only when they work on the wrong ideas that they understand the real ideas in a much better manner. In school science labs, children are viewed as active learners and not just passive recipients of knowledge. Children are given various opportunities to learn and experiment. Science experiments play a very crucial role in the ongoing intellectual development of children. In science laboratories, children

get time, space, as well as resources to exercise their curiosity. They are given the freedom to engage in new explorations, experimentations, and explanations. A lot schools are becoming aware of this productive aspect of science projects and experiments and are therefore incorporating them in their course curriculum. By investing in safe and high quality science lab equipment, schools can provide the most effective tools to their students for supporting constructive learning and fostering scientific thinking in students.

Physics is an experimental science. The theoretical concepts and relationships introduced in the lecture part of the course describe the general nature and behavior of real phenomena. They were, appropriately, discovered by (or inducted from) careful observation and thoughtful analysis of actual experiments. Genuine understanding entails being able to relate the abstract ideas to the particular facts to which they correspond. The premise of the scientific method is that (observation of) nature is the ultimate judge of the truth of any physical theory. Indeed, experiments designed to prove certain ideas have often ended up showing them to be wrong. Consequently, all physical concepts must be verified experimentally if they are to be accepted as representing laws of nature.

Accordingly, the introductory physics laboratories have the following purposes and goals:

1. To provide an experimental foundation for the theoretical concepts introduced in the lectures. It is important that students have an opportunity to verify some of the ideas for themselves.

2. To familiarize students with experimental apparatus, the scientific method, and methods of data analysis so that they will have some idea of the inductive process by which the ideas were originated. To teach how to make careful experimental observations and how to think about and draw conclusions from such data.
3. To introduce the methods used for estimating and dealing with experimental uncertainties, including simple ideas in probability theory and the distinctions between random (statistical) and systematic "errors." This is essential in understanding what valid conclusions can be deduced from experimental data and that, properly obtained, these conclusions are valid, notwithstanding the uncertainty of the data.
4. To learn how to write a technical report which communicates scientific information in a clear and concise manner?
5. To introduce new concepts and techniques which have a wide application in experimental science, but have not been introduced in the standard courses. These may require that the student consult additional textbooks.

The laboratory is not a contest whose object is to get the "right answer." The purpose is to learn how to gain knowledge by looking at reality, not an attempt to make reality conform to preconceptions. The important thing is to learn how to be observant, to really see what happens, and to deal with this information with the strictest integrity. And to understand, or learn to understand, the meaning of what happens.

Even if you get results totally at variance with theory (as may happen due to a mistake, or a systematic uncertainty) you will get a high grade if you report it honestly and demonstrate that you understand what you did and how your results occurred. On the other hand, if you get perfect agreement with theory by faking your data you will fail. Practical ability to do experiments and analyze data is usually acquired through practice and experience. Practice is very important in learning any new discipline; such as, for example, a new language. A good lecture may be very helpful but not fully useful without actual practice. In experimental science, practice involves solving many problems (i.e. Homework) and performing a variety of experiments (i.e. labs). Practice is essential to being able to make the connection between theory and experience.

Studies related with Misconception in Physics

For the purpose of the study, the investigator conducted a detailed survey of related studies on variable, Misconception in physics. There are some studies conducted on these variables and reported to have remarkable effects on education. A large number of studies have investigated the relationship between misconception and achievement in physics subject in a wide array of variables and different contexts.

Dermirci (2005) conducted a study about students' misconceptions in force and motion Concepts by incorporating a web-assisted physics program. The aim of this study was to incorporate a web-assisted program to normal traditional classroom instruction and study about students' misconceptions in force and motion concepts in physics. The Web-based physics program was incorporated with the traditional

lecture. The result from this study showed that the use of Computer Based Instruction dispels students' misconception about force and motion as Hicks and Laue (1989); Finegold and Grosky (1988); and Scott et al. (1992) concluded. Based on the data from this study, incorporating the web-assisted physics program was significantly effective on high school students' Force Concept Inventory (FCI) pre- and posttest mean difference scores, and increased their achievements in force and motion concepts in physics. This study has reemphasized that there is a need for a teacher to probe the understanding of his/her students before, during, and after their instruction (White & Gunstone, 1992).

Niazi and Dogar (2006) conducted a comparative study of misconception in physics curriculum among the students of O-level and SSC level. The Study was designed to investigate that whether the required objectives of the curriculum are being achieved? And to what extent is classroom teaching preparing the students to meet the requirements and challenges of the 21st century. The objective of the study is to improve the quality of teaching learning process in the subject of physics at secondary level. The population of the study comprised of 16 schools of ICT (Islamabad Capital territory) offering O-level with Cambridge University's curriculum and 34 public schools of ICT, offering Pakistani National curriculum (2006) for their SSC classes. The sample of the study was selected in two stages. During the 1st stage 25% educational institutions were selected as sample of the study through random sampling. A standardized instrument of TIMMS (2008) was used to collect the data. It was content based achievement test. It was recommended teaching method for both the systems. The conclusion was that there existed

misconnections among the students of both the streams; male students had sounder concepts as compared to female students. Similarly at the pre-test stage although students of both the groups showed misconceptions but O-Level students had less misconception as compared to SSC Students. It is also clear that the concepts of SSC students become sounder at post-test stage after being exposed with student centered inquiry based teaching.

Thompson and Logue (2006) studied an exploration of common student misconception in science. This study formed the basis of an assignment for a teacher-training course. The objectives of the study were to define three scientific concepts and identify for each some of the misconceptions that students commonly have. The study showed that the level of misconceptions varied between concepts. There appeared to be some patterns in the level and type of misconceptions between the three age groups, suggesting that a more rigorous study in this area would be of value.

Bayraktar (2007) studied misconception of Turkish pre-service teachers about force and motion. The purpose of this study was to diagnose the misconceptions held by pre-service physics teachers about force and motion. The secondary aim of the study was to detect whether misconceptions vary according to gender, educational level, and culture. Results of the study showed that student-teachers of physics hold very strong misconceptions about impetus and active force. No significant differences were found between male and female students' scores on the concept test. The results also showed that misconceptions about force and motion decreased through the years of education. Findings of the study are very

similar to the other research findings conducted on the subject in other countries. Student-teachers' conceptions about Newton's Third Law, on the other hand, were significantly better than those observed in other research done in other countries such as the US and Finland.

Akhilesh (2007) conducted a study on misconception in physics among secondary school students. The major objectives of this study is to find out the percentage of error committed in each of the concepts involved in select areas in physics viz (1) matter (2) Solar system (3) density (4) velocity (5) mass (6) gravity (7) work (8) Energy (9) light (10) sound (11) electricity (12) Temperature, by the secondary school students. The another objective is to identify the misconceptions in select areas in physics viz (1) matter (2) Solar system (3) density (4) velocity (5) mass (6) gravity (7) work (8) Energy (9) light (10) sound (11) electricity (12) Temperature, in which there exist significant gender and locality difference in the percentage of error among secondary school students. Forty-two per cent of high school students have misconception regarding majority of concepts in the TCAP. For the study data was collected using test of concept attainment in physics (TCAP) developed for the purpose. In the areas density, sound, work and gravity the extent of misconception is nearly three fourth of the sample. Out of the 63 concepts in Physics that show gender difference in misconceptions, 37 concepts have higher rate of misconception among girls, than boys do. Only 26 concepts in Physics have higher rate of misconceptions among the boys, than in girls. In the areas work and velocity, boys have higher number and rate of misconception than girls, while for density, energy, sound, solar system, and gravity girls have higher rate and number

of misconception. In velocity and its definition, work, mass, sound, and energy urban students have higher number and rate of misconception; while for force and inertia, density, energy transformation, solar system, and light, rural students have higher rate and number of misconception.

Shyni (2009) conducted a study on misconception in physics and biology among teachers training institute of students of Kerala. It was a survey to find out the misconception in physics and biology. The major objective of this study is to find out the extent of misconception in physics and biology among TTI students, and to identify the major misconception in each area of misconception in physics and biology. Test of concept attainment and test of achievement in science are used for this study. The major findings are the extent of misconception in physics is very high and the biology is comparatively less. An average TTI student has misconception in all areas of physics with some of the areas having very high rates of misconceptions. And the students have misconception in all areas of biology. The rate of misconception is less when compared to physics.

Libeeshmon (2013) was conducted a study on misconception in optics in relation to teaching strategies among standard Xth students in the total sample and in the relevant subsamples based on gender. For this study, Test of concept attainment in optics and questionnaire on teaching physics classrooms are used. The major findings indicate that X standard students have low level of misconception in optics. And majority of the students were got the concepts Refraction, Reflection, Focus of Mirror, Focus of lenses, Ray diagrams, Image formation, power of lenses & short sight and long sight through Diagnostic strategy. Where the students were taught the

concepts Properties of light, mirrors and lenses by their teachers through Group experimental and direct contact strategy.

Halim, Yong, Meerah (2014) conducted a study on Overcoming Students' Misconceptions on Forces in Equilibrium: An Action Research Study. This collaborative action research involving a supervisor and a student teacher aims to assist 23 Form Four (16 years old) students to overcome their misconceptions on the topic of forces in equilibrium state. This study adopts the action research cycle: Identify-Plan-Act-Reflect. The pre-test results showed that students had problems in recognizing the forces. Consequently, a teaching intervention was planned and carried out to improve students' ability to identify and recognize the forces that exist for an object in the equilibrium state. The teaching intervention emphasizes on the basic characteristics of the force arrow namely the direction, magnitude, labeling and starting point of force. The post test results showed that students' ability to draw the force arrows correctly had improved, with the exception of identifying the starting point of force. The action research study managed to guide the student teacher to identify and help to overcome misconceptions of her students.

Abrahams, Homer, Sharpe and Zhou (2015) are conducted a study on A comparative cross-cultural study of the prevalence and nature of misconceptions in physics amongst English and Chinese undergraduate students. The study despite the large body of literature regarding student misconceptions, there has been relatively little cross-cultural research to directly compare the prevalence of common scientific misconceptions amongst students from different cultural backgrounds. The main purpose of this study is to undertake a preliminary examination of the prevalence

and reasons for some previously studied scientific misconceptions amongst English and Chinese undergraduate students so as to ascertain whether there is any evidence of cultural difference. The major findings of this study, differences in the prevalence of misconceptions amongst English and Chinese undergraduates appear to arise from differences in the way in which specific areas of physics are taught in both countries. It might be possible to reduce the prevalence of misconceptions in both countries if a better understanding could be developed of how and why, undergraduates use certain erroneous analogies, and why some teaching approaches seem more effective in reducing the prevalence of misconceptions than others.

Wind and Gale (2015) conducted a study on Diagnostic Opportunities Using Rasch Measurement in the Context of a Misconceptions-Based Physical Science Assessment. The purpose of this study is to explore diagnostic information about student understanding of physical science concepts provided by a Rasch-based analysis of MDDMC items. Furthermore, the study demonstrates the use of the Rasch-based MDDMC methodology as a tool for examining changes in student misconceptions by using a physical science curriculum. This study uses data from an assessment of physical science concepts that was designed as part of a larger design-based implementation research (DBIR) program (Penuel & Fishman, 2012; Penuel, Fishman, Cheng, & Sabelli, 2011). This study used two major steps to explore student response patterns to physical science MDDMC items over time. The first step was Dichotomous Rasch Model involved the use of the dichotomous Rasch model to estimate achievement measures and item difficulty calibrations on the logit-scale based on student responses to the MDDMC items before and after a

course of instruction. The second is Distractor Analysis The Winsteps computer program (Linacre, 2014) was used to obtain the frequency of students selecting each answer choice (A, B, C, or D) along the range of student achievement estimates on the logit scale at each time point that were used to create pre-and post-assessment distractor analysis plots for each item. In this section, the distractor analysis methodology is illustrated using four MDDMC items. The patterns observed among these four illustrative items reflect the overall patterns that were observed among the MDDMC items examined in this study. This study employed a Rasch-based analysis of MDDMC items as a method to gather diagnostic information about student understanding of physical science concepts, as well as changes in student conceptions following a course of instruction. Student responses to MDDMC items that were included in pre- and post-administrations of a physical science assessments were explored in-depth using distractor analysis techniques that examined the relationship between estimates of student achievement from the Raschmodel and observed patterns of responses that signaled misconceptions. In this section, findings are summarized and discussed as they relate to the two guiding questions for this study.

Subayani (2016) conducted a study on The Profile of Misconceptions among Science Subject Student Teachers in Primary Schools. This research sought to uncover the profile of misconceptions experienced by 48 students of Primary School Teaching Major, studying Science in University of Muhammadiyah Gresik. This research uses descriptive qualitative using survey and interview. It investigates the misconceptions of information related to science learning experienced by elementary

school student teachers. The subjects studied (n = 48) are the first semester students who are selected randomly and come from educational background of high and vocational schools from different majors including science, social studies, and culinary majors. Results of the study are presented without manipulation and the data is analyzed inductively. The researcher acted as the main instrument so her presence could not be replaced by another person or other instruments. The conclusion of the study showed that misconceptions of sciences are experienced by all prospective teachers of primary school who come from different backgrounds of high school (natural sciences, social sciences, and vocational culinary major). The results also showed that the students who came from natural sciences had fewer misconceptions when compared with social science or culinary students. The causes of misconceptions about sciences include improper reasons when writing answers, the relationship between the concept and meaning of the sentence which is too general or too narrow, incomplete understanding of the items, careless reading of the items, insufficient knowledge related to the concept, their high school teachers' defective delivery and/or knowledge.

Sadler and Sonnert (2016) conducted a study on Understanding misconceptions- teaching and learning in middle school physical science. This study measured gains on key concept during a one year middle school physical science course. As in common in this type of research, investigators controlled difference in student demographics, such as race, ethnicity, home language spoken and parents education by using individual test items. Investigators could access how strongly teacher's subject matter knowledge and knowledge of student's misconception were

associated with student gains. The major findings of this study are practical implications, which are professional development; an emphasis on increasing teacher's subject-matter knowledge without sufficient attention to the pre-conceived mental models of middle school students may be ineffective in ultimately improving their student's physical science knowledge.

Tumay (2016) conducted a study on Emergence, Learning Difficulties, and Misconceptions in Chemistry Undergraduate Students' Conceptualizations of Acid Strength. In this study, it is argued that the issue of emergence has also significant implications for understanding learning difficulties and finding ways of addressing them in chemistry. Particularly, it is argued that many misconceptions in chemistry may derive from students' failure to consider emergence in a systemic manner by taking into account all relevant factors in conjunction. Based on this argument, undergraduate students' conceptions of acids, and acid strength (an emergent chemical property) were investigated and it was examined whether or not they conceptualized acid strength as an emergent chemical property. The participants were 41 third- and fourth-year undergraduate students. A concept test and semi structured interviews were used to probe students' conceptualizations and reasoning about acid strength. Findings of the study revealed that the majority of the undergraduate students did not conceptualize acid strength as an emergent property that arises from interactions among multiple factors. They generally focused on a single factor to predict and explain acid strength, and their faulty responses stemmed from their failure to recognize and consider all factors that affect acid strength. Based on these findings and insights from philosophy of chemistry, promoting

system thinking and epistemologically sound argumentative discourses among students is suggested for meaningful chemical education.

Theoretical over view of strategic instruction in Science

Teaching strategy

Teaching strategies refer to methods used to help students learn the desired course contents and be able to develop achievable goals in the future. Teaching strategies identify the different available learning methods to enable them to develop the right strategy to deal with the target group identified. Different subject require different strategies, because some subjects are more practical than others. Teaching strategies refer to the structure, system, methods, techniques, procedures and processes that a teacher uses during instruction. These are strategies the teacher employs to assist student learning. Strategies are used in different ways in which teaching can be done effectively. Some of these strategies are collaborative or cooperative learning, discussion strategies, problem solving strategies, learner centered strategies and audio visual learning among others.

Some of the strategies are outlined below.

Direct instruction of teachers

Direct instruction is the use of straightforward, explicit teaching techniques, usually to teach a specific skill. It is a teacher-directed method, meaning that the teacher stands in front of a classroom and presents the information.

Small group instruction

It is an instruction which consider a work with small groups based on ability level of interest.

Collaborative Teaching and Learning Strategies

Collaborative learning is an instructional method in which student's team together on an assignment. In this method, students can produce the individual parts of a larger assignment individually and then "assemble" the final work together, as a team. Whether for a semester-long project with several outcomes or a single question during class, collaborative learning can vary greatly in scope and objectives.

Cognitive strategy instruction

Cognitive Strategies Instruction (CSI) is an explicit instructional approach that emphasizes the development of thinking skills and processes as a means to enhance learning (Scheid, 1993). Students are taught metacognitive or self-regulation strategies in structured cognitive routines that help them monitor and evaluate their learning (Dole, Nokes, & Drits 2009). Specifically, three major concepts are associated with CSI:

1. Cognition – a student's ability to know what to do in order to complete a task
2. Metacognition – a student's ability to monitor his/her performance, and be flexible to change plans when the task is not being successfully completed

3. Problem solving – a student's ability to plan, reason, select relevant information and monitor results

Constructivism

Constructivism is a learning theory based on the idea that new knowledge is "constructed" on top of learners' existing knowledge. According to the theory, students are not "empty vessels" that need to be "filled." Rather, students' existing knowledge serves as an important foundation for new learning. This approach to teaching and learning requires that teachers take the time to get to know students in depth, and to integrate what they learn about students into their instruction. In other words, a constructivist classroom is a student-centered classroom. Using constructivist approaches will help students reconstruct their prior knowledge based on their new experiences and thus, make their own meaning.

Cooperative Learning

Cooperative learning is sometimes called small-group learning, is an instructional strategy in which small groups of students work together on a common task. The task can be as simple as solving a multi-step math problem together, or as complex as developing a design for a new kind of school.

Instructional strategies in science

Science is not simply a collection of facts. It is a discipline of thinking about rational solutions to problems after establishing the basic facts derived from observations. It is hypothesizing from what is known to what might be and then attempting to test the hypothesis. Logical thinking must come first; the facts can

come later. Knowledge is sometimes labeled as the products of science. It generally refers to facts, concepts, principles, laws, and theories. Process skills are the empirical and analytic procedures used by scientists in solving problems. Scientific attitudes refer to the general predispositions that characterize the work of scientists.

Innovative Strategies in Science teaching learning process

Strategy is the art and science of directing and controlling the movements and activities of the army. If strategy is good, we can get victory over our enemies. In teaching this term is meant those procedures and methods by which objectives of teaching are realized in the class.

An effective standards-based science curriculum provides an excellent and equitable science education for all students and provides for a deep understanding of essential science concepts. The National Science Education Standards states that the Standards apply to all students, regardless of age, gender, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science. Different students will achieve understanding in different ways, and different students will achieve different degrees of depth and breadth of understanding depending on interest, ability, and context. But all students can develop the knowledge and skills described in the Standards, even as some students go well beyond these levels. (p. 2). Educators are responsible for ensuring that all students achieve high levels of academic success. Realizing that individuals learn in a variety of ways, it is necessary to provide for student differences through the purposeful use of a variety of teaching strategies that nurture the diverse ways those students learn. Ideally, these strategies enhance student learning by

I. Stimulating active participation by all students

II. Attending to the different ways students learn

III. Providing opportunities for students to experience authentic scientific inquiry

IV. Providing challenges for all students

V. Providing opportunities for students to collaborate with others in diverse groups and settings

It is important to recognize that not every strategy can or should be applied in every teaching situation. Instructional strategies are tools to be used in designing and implementing instruction in a way that supports and nurtures student learning. It is important to note that strategies may be used concurrently; for example, instructional technology strategies may be used to enhance the context for learning. Well-designed laboratory experiences incorporate a number of effective teaching and learning methodologies including inquiry and manipulation strategies. A teacher's task is to determine what preconceptions and knowledge the students bring to the classroom, what concepts and skills they need to learn, and what support structures need to be provided in order for them to meet the learning goals. It is the role of the teacher to judiciously select from a variety of strategies and techniques those which will most effectively enable learners to develop deep understandings of the topics and meet the intended learning targets.

The following teaching strategies have been shown by research to have a positive influence on student achievement.

Enhanced Context Strategies

The science curriculum must be made relevant to students by framing lessons in contexts that give facts meaning, teach concepts that matter in students' lives, and provide opportunities for solving complex problems. Not only do students need to know the laws of nature, they also must know when to apply these laws in solving problems. Relating learning to students' previous experiences or knowledge and engaging students' interest by linking learning to the students'/school's environment or setting are ways to encourage students to make connections. The more students make connections between what they already know and new learning, the more student achievement will be improved. Teaching concepts in a variety of contexts is more likely to produce flexible learning that can be generalized or used across a broader spectrum of applications. Student-centered classrooms often utilize real-world events in order to create an effective learning environment. Integrating science with other disciplines also supports transfer of knowledge and skills from one setting to another.

Collaborative grouping strategies

Collaborative grouping occurs when teachers arrange students in flexible groups to work on various tasks such as exploring significant problems or creating meaningful projects. The ability to collaborate is a necessary skill for success in the real world and requires working with others rather than competing with them. In the classroom, collaboration includes the whole process of communication between and among teacher and students. It provides opportunities for students to work in diverse groups and improve social, communication, and problemsolving skills. It can also

promote deeper understanding of content and improve student achievement. Collaborative grouping strategies encourage student participation and a shared responsibility for learning that enables the teacher to act as guide, facilitator and at times, even learner. The composition of the group may be random or based on interest, and may be heterogeneous or homogeneous. The size and type of group used for any specific activity depends on the objective of the lesson. In general, small groups of 3-4 are more effective than large groups in positively influencing student achievement. Cooperative learning groups are a type of structured collaborative learning. Collaborative grouping strategies may be used in combination with most other teaching strategies (including inquiry and enhanced context strategies) and may be augmented by the use of information technology strategies. When using collaborative grouping strategies, it is important to have definite goals and objectives. It is also important to set clear expectations at the outset (perhaps through an evaluation rubric) and to resolve conflicts among students as soon as they arise.

Integrative Teaching

This is a teaching strategy which puts together the parts of a whole in order to arrive at a holistic, complete and more accurate view of reality (Corpus and Salandanan, 2003). It is infused by the multiple intelligences, the varied learning styles and the daily experiences of the learners. It empowers learners to become lifelong learners and active makers of meaning. Integrative teaching is a three-level strategy that is the facts level, the concept level and the values level. Integrative teaching involves the practice of recognizing and articulating relationships among

subject matters and applying learning from one context to another. It also involves building bridges between the academe and the wider world, between public issues and personal experience. The main advantages of this strategy is to makes content more meaningful because the content is presented the way it is in the real world and it is student-centered, involves active learning with the teacher acting as facilitator of learning

Concept mapping

A concept map is a special form of a web diagram for exploring knowledge and gathering and sharing information. Concept mapping is employed to develop connections among concepts in the unit. A concept map consists of nodes or cells and links. The nodes contain the concepts and are usually enclosed in a box or circle. The links are represented by arrows. The labels in the links explain the relationship between the nodes. The arrow describes the direction of the relationship and is read like a sentence. As an assessment tool, the concept map will give you information on how the student relates the identified concepts from the lesson. This way, you can be sure that students understand the lesson. Figure 1 and 2 shows the examples of concept mapping.

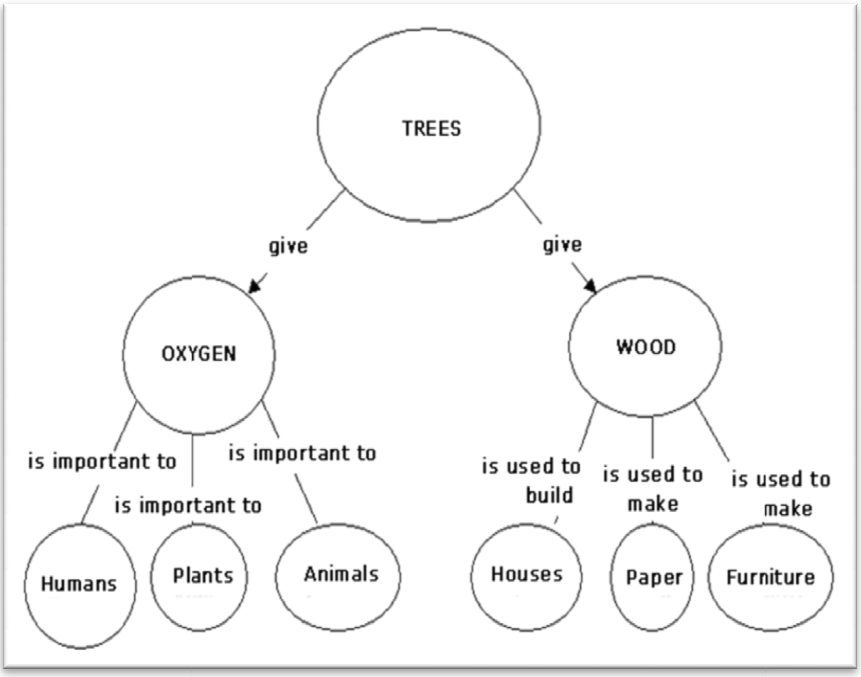

Figure 1: Concept mapping of trees in biology subject.

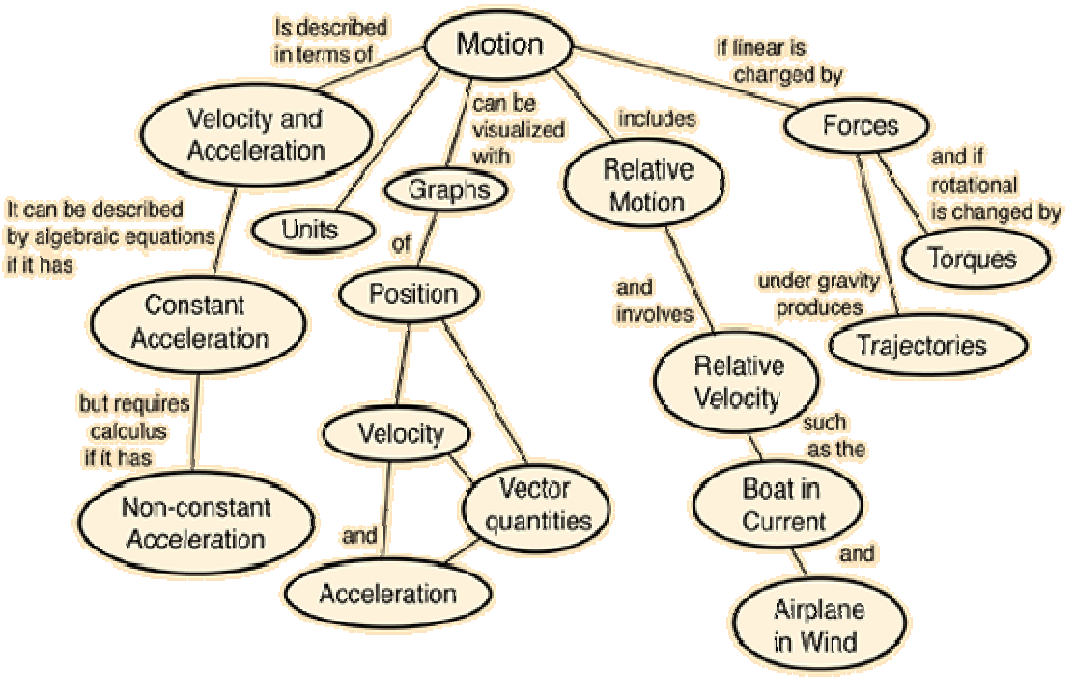

Figure 2: Concept mapping of motion in physics subject.

Questioning strategies

The teacher's use of a variety of questioning strategies can facilitate the development of critical thinking, problem solving, and decision making skills in students. The ability to ask good questions is a skill that requires nurturing and practice on the part of both the teacher and the student. Questioning is interactive and engages students by allowing them to share their ideas and thoughts. It is the role of the teacher to create a safe environment where learners' thoughts and ideas are valued and where students feel comfortable challenging each others' ideas. The teacher need not be the expert about everything, but regard student questions as an opportunity for all, including the teacher, to learn. Questioning strategies allow for ongoing assessment of students' understandings so that instruction can be adjusted to meet their needs. Students are often able to answer fact based questions on tests, but deeper questioning reveals misconceptions in their conceptual understanding. Modeling good question-asking techniques helps students learn to ask good inquiry questions and to solve problems. Questioning strategies may be used to establish relevance, focus attention, encourage creativity, and to have students recall prior knowledge, make connections, and apply knowledge.

Inquiry strategies

Although there are various interpretations of what inquiry means, most science teachers would agree that it involves exploration, asking questions and constructing explanations about natural phenomena. According to the National Science Education Standards, "Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence

derived from their work. Inquiry also refers to the activities in which [students] develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world" (p. 23). The Inquiry Synthesis Project (2006) defined inquiry as containing 1) science content, 2) student engagement in experiencing the science content, and 3) components of instruction that include a question, designing an investigation, data gathering or structuring, drawing conclusions or explanations, and communication of the results of the investigation. It is important for students to have "an adequate knowledge base to support the investigation and help develop scientific explanations" (NSES, 1996).

Inquiry provides opportunities for students to experience the nature of science by engaging them in the practices of scientists. Scientists use a variety of scientific research designs that range from descriptive to comparative to experimental and students should experience using different types of designs. Descriptive research involves describing natural phenomena whereas experimental research is used to determine causation. Through inquiry, students learn how to obtain and make sense of data and how to generate their own knowledge and understandings. Students may make decisions, contribute to group knowledge, have opportunities for creativity and risk-taking, and link prior knowledge to new ideas. The involvement generated during inquiry encourages deep understanding.

Manipulation strategies

Manipulation strategies permit students to work directly with materials and manipulate physical objects in order to experience science. They allow students of all ages to learn using concrete, tangible things that are accessible to their senses.

Auditory, visual, tactile, and kinesthetic learners all benefit from manipulating the things they are studying. Using scientific instruments (everything from rulers to microscopes to computers) allows learners to experience authentic scientific activity while developing necessary skills. Interacting and engaging in investigations with the materials and objects of science also allows students to draw meaning from their experiences. Manipulation strategies require students to become active learners who participate in building their own understanding; students remember content better when they experience it for themselves.

Assessment strategies

The role of assessment in effective teaching has broadened from primarily evaluating student achievement to include diagnosing student needs, advising instructional decisions, and auditing student progress. Assessment should be ongoing and integrated into the instructional process. Prompt, effective feedback from assessment is critical to student achievement.

Instructional technology strategies

Instructional technology (IT) provides numerous ways to help teachers meet the challenge of providing effective instruction and conducting inquiry in the classroom. IT includes a broad spectrum of tools including – but not limited to – computer hardware and software, electronic measuring and data collection devices, digital cameras and video recorders, and scientific calculators as well as the more traditional videos and overhead projectors. Technology can enable simplified calculation, information access, and data collection. Interweaving technology

throughout the curriculum can provide meaningful ways for teachers to present information and for students to learn technology skills. Computer simulations enable students to manipulate variables and quickly see the results of changing the values of variables. Developing a web site for a class creates a place to post assignments and worksheets, link to relevant information and data sources, and communicate with parents and students. The use of IT enables teachers to facilitate communication, collaboration, critical thinking, data interpretation and problem solving skills and to promote student responsibility for learning.

Enhanced material strategies

The ability to teach science well depends on strong content knowledge combined with knowledge of the methods and strategies that have been proven to work. Effective science teachers have a large array of instructional strategies and methods available to produce successful learning. Recognition of suitable methods for teaching certain concepts or skills in different situations enables the teacher to provide appropriate instruction. Instructional materials purchased to support science often do not meet the needs of the classroom or students and must be modified before they can be used. The teacher can modify or enhance instructional materials in a variety of ways to increase student learning.

Experiment

Experiment is core of doing investigation in science classroom. Teachers tend carry out experiment as it encourages students' interest in learning science via provision. Students often find the opportunities to manipulate objects, test

hypothesis, and work together to solve or prove something exciting. Also, through experiments, students are usually able to ‘see’ or ‘relate’ concepts better, hence contributing to sound science conceptions.

Deductive reasoning

Deductive reasoning is a basic form of valid reasoning. Deductive reasoning, or deduction, starts out with a general statement, or hypothesis, and examines the possibilities to reach a specific, logical conclusion, according to the University of California. The scientific method uses deduction to test hypotheses and theories. "In deductive inference, we hold a theory and based on it we make a prediction of its consequences. That is, we predict what the observations should be if the theory were correct. We go from the general — the theory — to the specific — the observations," said Dr. Sylvia Wassertheil-Smoller, a researcher and professor emerita at Albert Einstein College of Medicine. In deductive reasoning, if something is true of a class of things in general, it is also true for all members of that class. For example, "All men are mortal. Harold is a man. Therefore, Harold is mortal." For deductive reasoning to be sound, the hypothesis must be correct. It is assumed that the premises, "All men are mortal" and "Harold is a man" are true. Therefore, the conclusion is logical and true.

Inductive reasoning

Inductive reasoning is the opposite of deductive reasoning. Inductive reasoning makes broad generalizations from specific observations. "In inductive inference, we go from the specific to the general. We make many observations,

discern a pattern, make a generalization, and infer an explanation or a theory," Wassertheil-Smoller told Live Science. "In science there is a constant interplay between inductive inference (based on observations) and deductive inference (based on theory), until we get closer and closer to the 'truth,' which we can only approach but not ascertain with complete certainty". Even if all of the premises are true in a statement, inductive reasoning allows for the conclusion to be false. Inductive reasoning has its place in the scientific method. Scientists use it to form hypotheses and theories. Deductive reasoning allows them to apply the theories to specific situations.

Studies related to Strategic instruction in Science

For the purpose of the study, the investigator conducted a detailed survey of related studies on variable, episodic conceptualization strategy in physics. There are some studies conducted on these variables and reported to have remarkable effects on education. Some of the studies have investigated the relationship between episodic conceptualization strategy and achievement in physics subject in a wide array of variables and different contexts. And some studies focused on the relationship between strategic instruction in science subject and achievement in physics.

Soare and Teresa (2006) conducted a study on Using concept maps as a strategy to teach physics, in particular the topic of acoustics. This poster is the outcome of a thinking-acting research on teaching strategies developed in a constructivist learning environment in the classroom. The methodological work was done during Acoustics lessons in the subject of Physics and Chemistry in a

Portuguese basic school. In this study collecting data was based upon the combination of a qualitative method, consisting of a participating observation, distant and direct, with a quantitative method, based on a quasi-experimental plan. Although different tools for collecting data have been used, here only mention the ones that concern the concept mapping. The results obtained of the conceptual maps analysis before teaching Acoustic show the efficiency of concept mapping in the classroom, when the maps are made in a constructivist and investigative environment. Obviously the generalization of the obtained results is not legitimate, owing to the nature and the dimensions of the sample in this research; so a similar research with other students from other countries is desirable.

Minner, Levy and Century (2009) conducted a study on Inquiry-Based Science Instruction- What Is It and Does It Matter? Results from a Research Synthesis Years 1984 to 2002. The goal of the Inquiry Synthesis Project was to synthesize findings from research conducted between 1984 and 2002 to address the research question, What is the impact of inquiry science instruction on K–12 student outcomes? The research question for the project was addressed by developing a conceptual framework that clarifies and specifies what is meant by ‘‘inquiry-based science instruction,’’ and by using a mixed-methodology approach to analyze both numerical and text data describing the impact of instruction on K–12 student science conceptual learning. Various findings across 138 analyzed studies indicate a clear, positive trend favoring inquiry-based instructional practices, particularly instruction that emphasizes student active thinking and drawing conclusions from data. Teaching strategies that actively engage students in the learning process through

scientific investigations are more likely to increase conceptual understanding than are strategies that rely on more passive techniques, which are often necessary in the current standardized-assessment laden educational environment.

Shamsudin, Abdullah and Yaamat (2012) conducted a study on Strategies of Teaching Science Using an Inquiry Based Science Education (IBSE) by Novice Chemistry Teachers. This study specifically examines how meaningful science learning could be achieved via the introduction of an inquiry-based Science teaching approach. Three trainee teachers who underwent their teaching practice In Semester 2 2011/2012 session participated in the study. The study employed qualitative research design whereby data were mainly obtained through interview and document analysis in the form of lesson plans and reflective journal. Occasional observations on the way the trainee teachers apply the inquiry-based teaching strategies and model exposed to and taught in the Science Teaching Method course they took in the previous semester were also noted. The findings revealed that the inquiry-based teaching strategies employed were able to stimulate excitement among students when learning science. The ZYL teaching model was also proposed at the end of the study. This proposed teaching model summarizes the strategies of inquiry discovery in Science Education that can be adapted in science teaching process.

Wambugu, Changeiywo and Ndiritu (2013) conducted a study on Investigations of Experiential Cooperative Concept Mapping Instructional Approach on Secondary School Girls' Achievement in Physics in Nyeri County, Kenya. This study investigated the effects of Experiential Cooperative Concept Mapping Instructional Approach (ECCA) on girls' achievement in Physics in secondary

schools. The study employed Quasi- Experimental Research Design represented by Solomon Four Non-equivalent Control Group Design. Stratified sampling technique was used to select 8 Secondary Schools from girls' alone and co- educational schools strata drawn from Nyeri County. A total of 334 Form Two students were involved in the study. A validated Students Physics Achievement Test (PAT) with a reliability coefficient of 0.80 was administered. The results of the study revealed significant effect on achievement of girls when ECCA was used. However there was a significant effect in achievement on school type in favour of girls' alone class performing better than girls in co-educational class when ECCA was used. The investigations concludes that ECCA is an effective learning strategy which physics teachers should be encouraged to use in their teaching/ learning process in order to address the current low girls performance. This may create an increased pool of scientific and technical female workers in the area where Physics is a requirement.

Chinyere and Angela (2013) conducted a study on Secondary school student's assessment of innovative teaching strategies in enhancing achievement in physics and mathematics. This study employed a descriptive survey to investigate senior school student's assessment of innovative teaching strategies in enhancing achievement in physics and mathematics. The investigator suggested that for effective and successful physics and mathematics teaching, teachers must understand how students think and construct scientific and mathematical knowledge. The study concluded that, the job of the teacher requires that he assist the learner to learn. The teacher can do this by effectively by making the teaching environment stimulating, challenging and dynamic. Investigator also suggested that the aim of the

teaching is not only to transmit information but also to transform passive students in to active receptors of knowledge and constructor of their own knowledge.

Mohammed (2013) conducted a study on effectiveness of blended learning strategy on achievement in physics of standard VIII students. The major aim of this research is to study the effectiveness of blended learning strategy on achievement in physics and also to compare the pre-test, post-test and gain scores of experimental and control group for total sample and subsample based on gender. The findings of the study investigated the students learning outcome from blended learning has made a change in achievement and attitude towards three approaches. The result showed significant differences in the achievement test scores in favor of blended learning. The result indicated that there is a significant difference student's achievement in favor of blended learning over the conventional method of teaching.

Mehdiratta and Kaur (2013) conducted a study the use and practice of audio-visual aids in teaching of science at high school level. The major aim of the research is to study the use and practice of audio-visual aids in teaching of science at high school level. The main purpose is to find out the views of science teachers towards the use and practice of audio visual aids in schools. The researcher used descriptive survey method. The sample used for this study includes all the science teachers of the X class of 25 schools in Panipat city. Questionnaire, interview and checklist technique were used to collect the data. From this collection of data result was the schools are either sufficiently or moderately equipped with audio-visual aids. But they were not being used to a large extent. It was also observed that science teachers are facing problems in using of audio-visual aids. The reason are lack of teachers

training, headmaster co-operation and problems of technical handling, mechanical defects etc.

Reena (2013) conducted a research on a study of scientific attitude and academic achievement of high school students. This study was planned to find male and female relationship in scientific attitude and academic achievement in science among IX class students. The data were collected by administrating scientific attitude and academic achievement in science among IX class students of Kangra district of Himajal Pradhesh by adopting purposive sampling technique. Student's aggregate academic achievement and academic achievement in science were assured by in terms of their VIII class board examination scores taken from their school records. The major purpose of the study is to find out the relationship between scientific attitude, academic achievement and academic achievement in science. Pearson's product moment correlation used for analyzing the relationship. The findings of the study revealed that there is significant and positive relationship between scores on science attitude, aggregate academic achievement and aggregate academic achievement in science of high school boys and girls.

Sameera (2013) conducted a study on Effectiveness of Metacognitive learning strategies on the achievement in physics of standard IX pupils. This study was to find out the effectiveness of metacognitive learning strategies over the existing method of teaching on the achievement in physics of IX standard pupils. Quasi- experimental design was used to compare the pre-test, post-test and gain scores of experimental and control group for total sample. The sample of the study consists of 54 pupils in the experimental group and 49 in the control group. And the

groups were two divisions of IX students. The investigator developed three tools for this study. Lesson transcript based on metacognitive learning strategies, Lesson transcript based on existing method and achievement test in physics. The major findings of the study are that metacognitive learning strategy is more effective than the existing method. And it also finds that both boys and girls have improved in their studies with better increment in the case of boys. In case of both low achievers and high achievers metacognitive learning strategies have raised their level of achievement with considerable improvement in the case of high achievers. Hence the study concludes that metacognitive learning strategies have helped the students to improve their performance in studies to a great extent.

Sajitha (2015) conducted a study on effectiveness of whole brain teaching strategy on process outcomes in basic science among upper primary school students. This study was to find out the effectiveness of whole brain teaching strategy on process outcomes in basic science among upper primary school students. Quasi experimental design was used to compare the pre-test, post-test and gain scores of experimental and control group for total sample and subsample. The sample of the study consists of 32 pupils in the experimental group and 28 in the control group. And the groups were two divisions of VII students. The investigator developed three tools for this study. Lesson transcripts for teaching through whole brain teaching strategy, lesson transcript for teaching through existing strategy and standardized process outcome test. The major findings of this study is that the pupil thought through the new method of teaching – whole brain teaching strategy have process outcomes more than that of the control group. The result of the analysis of

covariance also indicates the high performance of experimental group. Hence based on the analysis the study concluded that whole brain teaching strategy is an effective method of teaching on process outcomes in basic science.

Alpaslan,Yalvac, Loving and Willson (2015) conducted a study on Exploring the Relationship Between High School Students' Physics-Related Personal Epistemologies and Self-regulated Learning in Turkey. This article reports on an empirical exploration of the relations and strengths among Turkish grades 9–11 students' (n = 209) personal epistemologies (justification of knowledge, certainty of knowledge, source of knowledge, development of knowledge), self-regulated learning (extrinsic motivation, intrinsic motivation, rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation), and achievement in physics (course grades). Established instruments were used to collect data on these students 'beliefs about knowledge and components of self-regulated learning (SRL) such as goal orientations (extrinsic and intrinsic motivation) and learning strategies, critical thinking, and metacognitive regulation. The purpose of this study was to use structural equation modeling (SEM) to examine the relationships among personal epistemology, SRL, and high school physics achievement. The Muis (2007) theoretical model (Fig. 1) was used to focus the SEM. The solid lines in the model specify the direct relationships, and the dashed lines display the indirect relationships. Results from structural equation modeling revealed that students' personal epistemologies directly influenced their motivation (extrinsic and intrinsic goal orientations), rehearsal and organization strategies, and metacognitive self-regulation to learn physics. Furthermore, students personal epistemologies indirectly

(mediated through motivation beliefs) influenced rehearsal, elaboration and organization strategies, critical thinking, and metacognitive self-regulation to learn physics. Student's ideas about knowledge and knowing about the source and development of knowledge significantly contributed to students' self-regulatory skills and physics course grade.

Renjith and Joshith (2015) conducted a study on effectiveness of episodic conceptualization strategy on achievement in physics among secondary school students. The main aim of the study is to find out the impact of episodic conceptualization strategy for the enhancement of achievement of secondary school students. The sample consists of 80 secondary school students of IX standard. The pre-test and post-test equivalent group design was followed for the study. The data was analyzed by using t-test. In this study, the findings was episodic conceptualization based instructional strategy could significantly enhance the achievement of IX standard students. Traditional method of teaching could not attribute anything in enhancing the achievement of IX standard students.

Mehar and Sanwal (2015) conducted a study on effect of constructive learning approach on achievement in mathematics. The study investigates the effect of constructive learning approach on achievement in mathematics. A pre-test and post-test factorial design has been employed on the gain achievement scores in mathematics between male and female of experimental and control group. The total sample of the study was 60 students 0f Harizon model school, New Delhi. It was selected randomly. The findings of the study revealed that the constructive learning approach was more effective than the traditional teaching approach on achievement

in mathematics. The study suggested that constructive learning approach was also used in other science subjects.

Gambari and Yusuf (2015) conducted a study on Effectiveness of Computer-Assisted Stad Cooperative Learning Strategy on Physics Problem Solving, Achievement. This study investigated the effectiveness of computer-assisted Students' Team Achievement Division (STAD) cooperative learning strategy on physics problem solving on students' achievement and retention. It also examined if the performance of the students would vary with gender. Purposive sampling technique was used to select two senior secondary schools year two physics students (SS II). Findings indicated that students taught physics with computer-supported STAD performed and better than their counterparts in ICI group. In addition, they had better retention than those in ICI group. However, gender has no influence on students' performance. Based on the findings, it was recommended among others that physics teacher should be encouraged to use computer-assisted cooperative instructional to enhance students' performance.

Wang and Buck (2016) conducted a study on Understanding a High School Physics Teacher's Pedagogical Content Knowledge of Argumentation. In this case study, investigators closely examine a high school physics teacher's argumentation-related pedagogic content knowledge (PCK) in the context of dialogic argumentation. Researcher synthesize the teacher's performed PCK from his argumentation practices and narrated PCK from his reflection on the argumentation practices, from which they summarize his PCK of argumentation from the perspectives of orientation, instructional strategies, students, curriculum, and

assessment. Finally, investigator describes the teacher's perception and adaption of argumentation in his class. And also identity the barriers to argumentation implementation in this particular case and suggest solutions to overcome these barriers.

Lin, Chang, Liew and Chu (2016) conducted a study on Effects of concept map extraction and a test-based diagnostic environment on learning achievement and learners' perceptions. This paper proposes a more effective method for analyzing test results by providing a concept map (CM) to facilitate learners' understanding of their learning performance. This study examined 90 students from two classes at a university and assigned one class to be the experimental group and another class to be the control group. The results indicated that the students who used the CM-SEED learning system had superior perceptions regarding their learning; furthermore, they accomplished superior learning achievement that displayed statistical significance. Consequently, the study concluded that CM extraction in a test-based diagnostic environment can lead learners to enhanced learning performance.

Kumar and Chored (2016) conducted a research on study of scientific attitude and achievement in science of senior school students. This study was to find out the scientific attitude and achievement in science. Around 100 students of senior secondary school of Rohtak district were taken as a sample on the basis of random sampling method. The major objective of this study to determine the significance of difference between means of different groups, for this scientific attitude scale and achievement test in science was used. The findings of the study is to reveal that

significant difference has been found in scientific attitude of male and female of secondary school students. And no significant difference has been found in achievement of science of male and female students. Hence a positive relationship has been found between scientific attitude and achievement in science of senior secondary school students.

Prayekti (2016) conducted a study on Effects of Problem-Based Learning Model Versus Expository Model and Motivation to Achieve for Student's Physic Learning Result of Senior High School at Class XI. This research is aimed to know: (1) differences of physic learning result for student group which taught by PBL versus expository learning; (2) differences of physic learning result for student who has a different motivation to achieve; (3) interaction effect of PBL strategy versus learning strategy and motivation to achieve toward physic learning result. For knowing motivation effect and learning model toward improvement of physic learning result for student class XI is using research method by doing Analysis Path. The result research showed that early capability of student in physic science is insignificant influenced for student's physic learning result and the examination conducted has evidenced that giving PBL model can improve significantly the physic learning result for student class XI. The research concluded that giving PBL model is able to improve the learning motivation of student in class XI significantly.

Conclusion

In this chapter investigator tried to present a brief account of theoretical overview and related studies of variables. The above referenced studies helped the investigator to have wide perspective about the present problem. Since effectiveness of a research is based on past knowledge, review of related studies provides helpful suggestions for significant investigation. A number of studies are conducted within the country and as well as in outside the country but the majority of the studies have been conducted in foreign countries such as USA, UK, China, and Japan. Though the studies are of different forms such as survey type, experimental or quasi-experimental types, they are providing valuable information about different variables that the investigator considered as relevant. Some studies are empirical and some are conducted by research teams. All the reviews given above are based on misconceptions of science subjects and instructional strategies used to improve the achievement of science learning. More experiments are needed in this area. Further, the number of studies conducted in India is limited in this area and there is further scope for study regarding misconception in physics and an innovative strategic method of physics. This shows the importance and relevance of this study.

Chapter 3

METHODOLOGY

- *Variables of the study*
- *Objectives of the study*
- *Hypotheses of the study*
- *Design of the study*
- *Sample selected for the study*
- *Tools used for data collection*
- *Data collection procedure*
- *Scoring and consolidation of data*
- *Statistical techniques used for analysis*

METHODOLOGY

A Research method is a systematic plan for doing research. Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. The success of the research work depends largely upon the suitability of the methods, tools and techniques followed by the researcher in collecting and processing data and suitable method helps the researcher to carry out work in a scientific and valid manner.

The present study entitled "Effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics among IXth standard students" attempts to find out the effect of episodic conceptualization strategy over the existing method of teaching.

The methodology adopted for the study is described under the following major headings.

- Objective of the study
- Hypotheses of the study
- Design of the study
- Tools used for the study
- Sample used for the study
- Data collection procedure, scoring and consolidation of data
- Statistical techniques used for analysis

Objectives of the study

The main objectives of study are,

1. To find out whether there exist any significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
2. To find out whether there exist any significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.
3. To find out whether there exist any significant difference in the mean gain score of test of misconception in Physics of pupils in experimental and control group.
4. To compare the adjusted mean score of test of misconception in Physics of pupils in experimental and control group by taking pretest scores as covariant.
5. To investigate the effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics.

Hypotheses of the study

Based on the objectives given above the following hypotheses are formulated.

1. There exists significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.

2. There exists significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.
3. There exists significant difference in the mean gain score of test of misconception in Physics of pupil in experimental and control group.
4. There exists significant difference in the adjusted mean score of test of misconception in Physics of pupils in experiment and control group by taking pretest score and covariant.
5. Episodic conceptualization strategy is effective on reducing misconception in select concepts of physics.

Design of the study

The present study has been conducted by employing an experimental design. A design is the blue print of the procedure that enables the researcher to test the hypotheses by reaching valid conclusion about relationship between independent and dependent variables (Best & Kahn 1999).

Design selected

The design selected for the present study was the Quasi Experimental with Pre-test—Post-test nonequivalent group design. Due to the inconvenience in random assignment of subjects in the experimental and control groups, intact classroom groups were selected for the study. The design of the study is illustrated as follows.

O1 X O2

O3 C O4

Where,

O1, O3 –Pre-tests

O2, O4 –Post-tests

X –Application of Experimental treatment

C –Application of Control treatment

Two class divisions from same school were treated as experimental and control groups. Experimental group was taught by Episodic Conceptualization Strategy for 15 periods and each period has duration of 40 minutes. The control group was taught by the conventional method of teaching (constructivist method) for 15 periods of the same duration.

Since the design selected for the present study was pre-test—post-test nonequivalent group design, prior to introduction of two teaching methods, both groups were administered the same test of misconception in physics.

Variables of the study

The experimental study consists of manipulating levels or amount of selected independent variables to examine their influence on dependent variables. The independent variable, dependent variable for the present study is as follows.

Independent Variables

The independent variable selected for the study was two methods of teaching – Episodic Conceptualization strategy and existing method of teaching.

Dependent Variable

Misconceptions of select concepts of physics among IXth standard pupil was treated as the dependent variable.

Tools used for the Study

The tools used for the present study and the description of them are presented in this session. With the help of the supervising teacher the investigator constructed the following tools to collect relevant data from the samples.

Tools used for the present study are as follows:

1. Lesson Transcript Based on Episodic Conceptualization Strategy.(Nowfal and Shana, 2017)
2. Lesson Transcript Based on Existing method.(Nowfal and Shana, 2017)
3. Test of Misconception in Physics.(Nowfal and Shana, 2017)

Description of tools

Steps involved in the construction of tools are given below.

Lesson Transcript Based on Episodic Conceptualization Strategy

The Episodic Conceptualization strategy was introduced as a new method of instruction. Based on the Episodic Conceptualization Strategy the investigator prepared 15 lesson transcripts. The duration of each lesson transcript was expected to be 40-45 minutes. Each lesson was prepared by using the following format.

Starter:

Introducing the theme of the lesson and all the important topics which will be explained systematically.

Orientation:

Here the term facts are discussed widely. Teacher explains the topics in all aspects. A proper orientation is given to the child based on concept clarity.

Development of the lesson:

After the thorough orientation of the lesson, investigator focused the development of the lesson in an effective way, through activities, experiments and presentation of video related to the principle behind the content. Here discussion, questioning and preparation of pointed notes are illustrated for the proper learning outcomes in a concept.

Concept formation:

After the discussion of the content, teacher correlates the previous concept in an episodic way. Teacher explains the relation and differences of the concepts which is already studied in the previous lesson. It helps to reduce the misconceptions of various concepts which similar with facts and theorems.

Consolidation:

Here the topics of the selected concept are discussed in the form of consolidation. Teacher provides students proper consolidation for reducing the misconception.

Lesson Transcript Based on Existing Method (Constructivist Method) of teaching.

The lesson plan for teaching in the control group was prepared on the basis of newly introduced activity curriculum of Kerala (constructivist method). Each lesson plan was prepared by using the following format.

Content Analysis

Here the terms, facts and concepts coming under the topic will be discussed. All the relevant ideas related to the terms, facts and concepts will be discussed.

Learning Objectives

The objectives to be attained by the people by learning the particular lesson will be mentioned in this session. It mentions the learning outcomes which the teacher expects from the students by teaching the particular topic.

Process Skills

The skills used by the students will be discussed here. All the ideas and activities done by the students will be also discussed.

Pre Requisites

The information the student should acquire for understanding the topic.

Learning Materials

Here, the learning materials used will be mentioned

Product

The values which the teacher expects to impart to the students by teaching the particular topic will be discussed here.

Process

The introductory part of the lesson will be given in an interesting way by including some interesting questions which will bring the students to the new topic which the teacher is going to teach. Here some activities will be included in this section. Some thought provoking questions related to each and every activity will be also included. Consolidation will be done for each activity.

Follow up Activities

Some questions will be given for the students so that they will internalize the topic they learned and they will start applying it in their future life.

A model lesson transcript based on existing method of teaching is given as Appendix III.

Test of Misconception in Physics

The test of misconception in physics, used as pre-test and post-test was constructed by the investigator with the help of supervising teacher for the treatment. Main stages in the preparation of the test were as follows:

Planning of the Test

The preparation of any classroom test involves a number of stages. Here first comes the planning stage. Here the decision regarding when to test, what kind of

questions use in the test and how many questions include in test etc. are taken. With regard to the type of questions, the investigator decided to have true or false questions only. The duration of the test was fixed as one hour.

Weightage to the Objectives

Objectives are broad goals and are stated in terms of desired change in student behavior. Items were prepared on the basis of Bloom's revised taxonomy of educational objectives (Anderson and Karthwohl, 2001). The weightage of each question is equal marks.

Weightage to form of Questions

Here the investigator included only object type questions as shown in given table. 1

Table 1

Weightage to form of Questions

Form of Questions	No. of items	marks	Percentage
Objective Type	50	50	100
Total		50	100

Item Writing

A pilot study is conducted in hundred IXth standard students based on the physics contents. 63 items are included in the test. It helped to obtain a list of misconceptions. Based on the test 15 contents are selected for the study and items were converted to 50 items. The test was named as test of misconception in physics and is based on statements regarding true or false questions. The time duration of the test was 1 hour. The test of misconception in physics is given as Appendix V.

Pilot study

For estimating the time and removing ambiguity in the structure of the question, a pilot study was conducted on 100 students from Farook higher secondary school, Farook college Calicut district and necessary modifications were made accordingly.

Try out of the test

The draft of the Test of misconception of the physics was tried out on the sample of 100 high school students of IXthclasses' ofFarook higher secondary school, Farook college Calicut district. Proper instructions were given to the students before administering the test in the classrooms.

Item analysis was done in order to select items that are acceptable. The following stages were involved in item analysis.

For determining the highest 27 percent and the lowest 27 percent of the total sample of 100 response sheets, the scores obtained after the preliminary try-out was

noticed. The scripts were arranged in the descending order of the total score, and the highest 27 percent and the lowest 27 percent with respect to the total score were separated.

As the total number is 100, its 27 percent is 27 and hence top most and lowest 27 scripts were taken the average of score obtained for each items by the upper group as well as the lower group were calculated separately. Discriminating power and Difficulty index of each item was found by calculating Discriminating power and Difficulty index of the each item by using the formula.

Difficulty index = u-l/n

Discriminating power = u+l/2n

Where,

u = upper limit

l = lower limit

n = total number of the sample

Items with discriminating power less than 0.4 and greater than 0.8 is rejected and difficulty index is also concerned with the value of each item in between 0.4 and 0.8.Hence the items with discriminating power and difficulty index in between 0.4 and 0.8 are selected for the final sample. Discriminating power and Difficulty index of each item as given in table 2.

Table 2

Discriminating power and Difficulty index in the each item in misconception test of physics.

Item No	Discriminating Power	Difficulty Index	Remarks
1	0.94	0.11	Rejected
2	0.52	0.59	Accepted
3	0.53	0.62	Accepted
4	0.48	0.40	Accepted
5	0.42	0.61	Accepted
6	0.61	0.48	Accepted
7	0.29	0.21	Rejected
8	0.48	0.14	Rejected
9	0.66	0.44	Accepted
10	0.62	0.69	Accepted
11	0.61	0.51	Accepted
12	0.79	0.45	Accepted
13	0.59	0.74	Accepted
14	0.79	0.77	Accepted
15	0.62	0.65	Accepted
16	0.40	0.60	Accepted
17	0.96	0.07	Rejected
18	0.66	0.75	Accepted
19	0.5	0.48	Accepted
20	0.76	0.63	Accepted
21	0.68	0.44	Accepted
22	0.37	0.07	Rejected
23	0.63	0.52	Accepted
24	0.44	0.29	Accepted
25	0.66	0.59	Accepted
26	0.47	0.29	Rejected
27	0.42	0.41	Accepted
28	0.79	0.46	Accepted
29	0.46	0.51	Accepted
30	0.72	0.43	Accepted

Item No	Discriminating Power	Difficulty Index	Remarks
31	0.79	0.63	Accepted
32	0.77	0.79	Accepted
33	0.52	0.52	Accepted
34	0.83	0.26	Rejected
35	0.37	0.07	Rejected
36	0.63	0.72	Accepted
37	0.55	0.44	Accepted
38	0.59	0.52	Accepted
39	0.48	0.55	Accepted
40	0.48	0.50	Accepted
41	0.62	0.52	Accepted
42	0.48	0.79	Accepted
43	0.27	0.11	Rejected
44	0.68	0.40	Accepted
45	0.42	0.79	Accepted
46	0.75	0.40	Accepted
47	0.62	0.67	Accepted
48	0.42	0.46	Accepted
49	0.74	0.47	Accepted
50	0.42	0.40	Accepted
51	0.68	0.51	Accepted
52	0.40	0.62	Accepted
53	0.72	0.40	Accepted
54	0.61	0.55	Accepted
55	0.61	0.71	Accepted
56	0.68	0.40	Accepted
57	0.46	0.40	Accepted
58	0.79	0.78	Accepted
59	0.75	0.78	Accepted
60	0.83	0.91	Rejected

Selection of final items

Items for the final test were selected on the basis of their difficulty index and discriminating power. Items have both difficulty index and discriminating power was selected for final scale.

The final copy of Test of misconception in physics is given in Appendix VII.

Scoring Key

Scoring key was prepared by the investigator for scoring answer sheets. One mark was given for each correct answer.

Reliability and Validity

Reliability and Validity are essential to the effectiveness of any data gathering procedure. These terms are defined in the most general way.

Reliability

Reliability is the degree of consistency that the instrument or procedure demonstrates: whatever it is measuring (Best& Khan 2012). It does so consistently. Validity is that quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure. Reliability is a necessary but not sufficient condition for validity. That is, a test must be reliable for it to be valid, but a test can be and still not be valid.

Reliability of the present test

A test is said to be reliable when the test scores are stable and trust worthy. The investigator calculated the reliability of the test by test-re-test method. For this purpose the scale was administered on representative sample of 100 secondary school IXth standard students and the scores thus obtained were utilized for studying the reliability of the test. Data collected were scored are consolidated.

The same test was re-administrated to the same group after an interval of one week. The correlation of scores obtained for two administration were calculated by using the formula

$$r = \frac{N\sum XY - \sum X \sum Y}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Where,

$\sum X$=Sum of the X scores

$\sum Y$= Sum of the Y scores

$\sum X^2$= Sum of the squared X scores

$\sum Y^2$ = Sum of the squared Y scores

$\sum XY$ = Sum of the products of the paired X and Y scores

N = Number of paired scores

The coefficient of correlation obtained was 0.8492 which shows that the test was reliable.

Validity

"Validity refer to the degree to which evidence and theory support the interpretation of the test scores entailed by proposed uses of tests" (Joint committee on standard for Educational and Psychological Testing, 1999, P.9). That is validity has to do with both the attributes of the test and the uses to which it is put. When test are used for more than one purpose, there needs to be evidence of validity for each of these uses. Considering the number and variety of tests and their uses, the type of validity evidence needed will vary quite a bit.

Validity of the Present Test

The investigator established the content validity by giving proper weightage to all the area content and objectives. Extreme care was taken to eliminate unnecessary items according to the pilot study results. The investigator established the criterion related validity of the test by taking the external criteria school mark of a unit test in Physics. The test was also subjected for proper analyze and evaluation of experts in the field. Hence the face validity was ensured.

Sample Used For the Study

The investigator considered two IXth standard groups for the experiment. Oneclass division as control group and another as experimental group.Here the investigator selected two class divisions of standard IXth of P.R.M.H.S.S Panoor, Kannur. Details of the sample selected for the study is given below in table 3.

Table 3

Sample selected for the study

	Experimental Group			Control Group		
standard	Boys	Girls	Total	Boys	Girls	Total
IX	16	19	35	20	15	35

Data Collection Procedure, Scoring and Consolidation of Data

The details of the data collection procedure, scoring and consolidation of data are briefly explained in this section.

Data Collection Procedure

Before conducting the experiment, both the experimental and control group were given the same pre-test to measure the initial status of the subject in terms of misconceptions in physics. After the administration of the pre-test the experimental group was taught through Episodic Conceptualization Strategy and control group was taught through existing method (Constructivist Method) of teaching. After the completion of the lesson, both the experimental group and control group were given the same misconception test as post-test. The score on this test was used for determining the effectiveness of two strategies (Effectiveness of Episodic Conceptualization Strategy and Constructivist strategy).

Scoring and Consolidation of Data

All the answer sheets of the pre-test and post-test, which were correct in all respects, were scored according to the scoring key. Scores of pre-test and post-test of

control group and experimental group were tabulated separately. The scores obtained for the selected variables were then consolidated for final analysis.

Statistical Technique Used for Analysis

The present study demanded the use of following statistical technique. Test of significance of difference between means for small independent sample were used to compare the relevant variable between experimental and control groups.

To begin our conversation about inferential statistics, the first step is to develop the ability to determine the appropriate statistical technique to various situations. This decision that is a function of the research question asked and the nature and the level of measurement of the variables involved. That is, we begin with the research question, identify the dependent and independent variables involved, identify the level of measurement of every variable, and go to the accompanying table that will point us to the appropriate technique.

The investigator used the following statistical techniques. They are,

1. Mean

The mean is the most commonly used method of describing central tendency. The mean is found out using the formula.

$$\textbf{Mean} = \mathbf{A} + \frac{\Sigma \mathbf{fx}}{\mathbf{N}} \times \mathbf{c}$$

Where,

A = Assumed mean

c= length of the class interval

f = frequency of the class interval

x = deviation of the score from the assumed divided by class interval

N = total number of scores

2. Median

The median is the score at the middle of the set of values that has many values with a larger value as have a smaller value. The median was calculated using the formula given below

$$\textbf{Median= L} + \frac{\frac{\mathbf{N}}{\mathbf{2}} - \mathbf{cf}}{\mathbf{F}} \times \mathbf{c}$$

Where,

L = exact lower limit of the class interval upon which the median lies

c = width of class interval

f = frequency within the class interval upon which the median class

F = sum of all the frequency below L

N/2 = one half of the total number of scores

3. Mode

The mode is the most frequently occurring value in the set. The mode is the value with the greatest frequency. The mode was calculated using the formula

Mode = 3 median – 2 mean

4. Standard deviation

The standard deviation the most stable index of variability is customarily

employed in experimental and research studies. Standard deviation is calculated by the following formula

$$\mathbf{SD = c\sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2}}$$

Where,

c = class interval

d = deviation of scores from assumed mean

f = frequency of each class

N = total frequency

5. Skewness

A distribution is said to be skewed, if the value of mean, median and mode are different and there is symmetry between the right and the left half of the curve. Such type of curve is inclined more towards the left or right of the center of the curve.

Skewness was calculated by using the formula

$$\mathbf{SK = \frac{3\,(Mean - Median)}{SD}}$$

Where,

SK= Skewness

S.D= Standard deviation

6. Kurtosis

The term 'Kurtosis 'refers to the flatness or peakedness of a frequency

distribution as compared with the normal. The formula for measuring Kurtosis is

$$\mathbf{Ku} = \frac{\mathbf{p75-p25}}{\mathbf{2(p90-p10)}}$$

Where,

P75 = 75^{th} percentile

P25 = 25^{th} percentile

P90 = 90^{th} percentile

P10 = 10^{th} percentile

Major statistical techniques

Test of significant difference between means were applied

1. t-test

Comparison of difference between means for the scores of sub samples was done using the formula.

$$\text{Critical ratio} \quad \mathbf{t} = \frac{\mathbf{M_1 - M_2}}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where,

M_1 – Mean of the first group

M_2 – Mean of the second group

σ_1^2 – Square of Standard deviation of first group

σ_2^2 – Square of Standard deviation of second group

N_1 – Size of the first group

N_2 - Size of the second group

If the obtained critical ratio is greater than the required table value 1.97 at 0.05 or 2.59 at 0.01 levels of significance, the mean difference is considered to be significant.

2. Analysis of Covariance (ANCOVA)

This is an extension of analysis of variance to allow for the correlation between critical and final scores. Through covariance analysis, it is able to effect adjustments in final or terminal scores which will allow for differences in some initial variable.

The procedure of one way ANCOVA is done through the following steps

Step 1 :

Computation of correlation terms (c,s) Cx, Cy and C xy.

Step 2 :

Computation of sums of squares (ss) among the means of the group.

Step 3 :

Computation of sums of squares (ss) within the group.

Ss within groups for x=Total ssx-ss among means for x

Ss within groups for y=Total ssy-ss among means for y

Ss within groups for xy=Total ssxy-ss among means for xy

Step 4

A preliminary analysis of variance of x and y scores, taken separately is calculated to decide whether the scores are closer to significance. The F-test applied to the initial score.

Step 5

Computation of adjusted sum of squares (ss for y ie, SS).

This is done for correcting the final score. Total SSyx are determined. SSyx among mean is calculated by subtracting sum of squares, we can computate the variance by dividing each SS by its degree of freedom.

Step 6

Computation of regression coefficient for within group.

Step 7

Computation of adjusted means: the general formula is

$$t= \frac{M_1 - M_2}{\sqrt{\frac{{\sigma_1}^2}{N_1} + \frac{{\sigma_2}^2}{N_2}}}$$

Where,

My is the adjusted means for y scores

Mx is the unadjusted means for x scores

GMx is the grand means for x scores

Step 8

The testing of significance of difference among adjusted y means.

For this standard error of the difference between tow mean is calculated.

Then t-value is calculated.

T=Difference between adjusted mean / standard error of the difference between means.

Chapter 4

ANALYSIS AND INTERPRETATION

- *Objectives of the study*
- *Hypotheses of the study*
- *Variables of the study*
- *Preliminary analysis*
- *Major analysis*
- *Conclusion*

ANALYSIS AND INTERPRETATION

Analysis is the process of extracting, compiling, and modeling raw data for purposes of obtaining constructive information that can be applied to formulating conclusions, predicting outcomes or supporting decisions in business, scientific and social science settings.it is one of the most important parts. Analysis consists of the data that has been collected as a part of the research and the researcher's analysis of the data.

The main purpose of the present study was to find out the Effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics among IX^{th} standard students. The collected and tabulated data were analyzed using the statistical tests.

The statistical analysis of the consolidated data has been based on the following objectives of the study.

Objectives of the study

- To find out whether there exist any significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
- To find out whether there exist any significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.

- To find out whether there exist any significant difference in the mean gain score of test of misconception in Physics of pupils in experimental and control group.
- To compare the adjusted mean score of test of misconception in Physics of pupils in experimental and control group by taking pretest scores as covariant.
- To investigate the effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics.

Hypotheses of the study

The present study was designed to test the following hypotheses

- There exists significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
- There exists significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.
- There exists significant difference in the mean gain score of test of misconception in Physics of pupil in experimental and control group.
- There exists significant difference in the adjusted mean score of test of misconception in Physics of pupils in experiment and control group by taking pretest score and covariant.
- Episodic conceptualization strategy is effective on reducing misconceptions in select concepts of physics.

Analysis of the data has been done, classified and presented in the following order.

- Preliminary analysis
- Major analysis
- Analysis of Covariance

Preliminary analysis

The statistical properties of the variable in the study and the comparison of the mean scores of the relevant variables for the experimental and control groups were done and presented in this section.

As part of preliminary analysis important statistical constants like mean, median, mode, standard deviation, Skewness and Kurtosis for the pre-test, post-test and gain scores were examined separately for the control and experimental groups and is presented in table 4 and table 5 respectively.

Table 4

Statistical constants of Misconception in Physics for control Group

variables	Mean	Median	Mode	S.D	Skewness	Kurtosis
Pre-test	27.66	28	26	3.85	-0.3	0.46
Post-test	28.54	29	30	3.75	-0.69	0.07
Gain scores	3.97	3	2	3	1.28	1.56

The above table shows that the statistical value mean, median, mode are almost similar. The index of skewness suggests that the distribution of

misconception in physics is negatively skewed. As the values of the mean, median, mode, standard deviation, skewness and kurtosis are almost equal, it is suggested that the scores are normally distributed.

Table 5

Statistical constants of Misconception in Physics for Experimental Group

Variables	Mean	Median	Mode	S.D	Skewness	Kurtosis
Pre-test	26.94	26	25	6.08	0.15	0.08
Post-test	32.11	32	31	4.33	-0.36	0.99
Gain scores	7.97	7	4	4.91	0.58	0.16

The above table shows the statistical values mean, median, mode, standard deviation, skewness and kurtosis of the pre-test, post-test and gain score of the experimental group. As the value of the mean, median, mode, standard deviation, skewness, and kurtosis are almost equal, it is suggested that the scores are normally distributed.

Major Analysis

Comparison of mean scores

In this part of analysis, comparison of the mean scores of Misconception in physics for Experimental and Control group, in the pre-test, post-test and gain scores for total sample were attempted.

Comparison of mean pre-test scores of Misconception in Physics for Experimental and Control group

The mean scores of experimental and control groups on the pre-test were studied and compared using the test of significance of difference between means of small independent sample. The comparison was done for the sample in each of the experimental and control group.

The mean and standard deviation of pre-test scores of both of the group were found out and subjected to the test of significance of difference between means. The data and results of the t-test are presented in the table 6.

Table 6

The test of Significance of the Mean scores of pre-test between experimental and control groups.

Control Group			Experimental Group			t- value	Level of significance
X1	Σ_1	N1	X2	Σ2	N2		
27.66	3.85	35	26.94	6.08	35	0.59	Not significant at any level

It can be seen from the table that the obtained t-value 0.59 is found to be not significant even at 0.05 levels. So it can be noted that there is no significant difference in mean scores of misconception in physics for control and experimental groups. This indicates the two's almost identical with regard to misconception in physics.

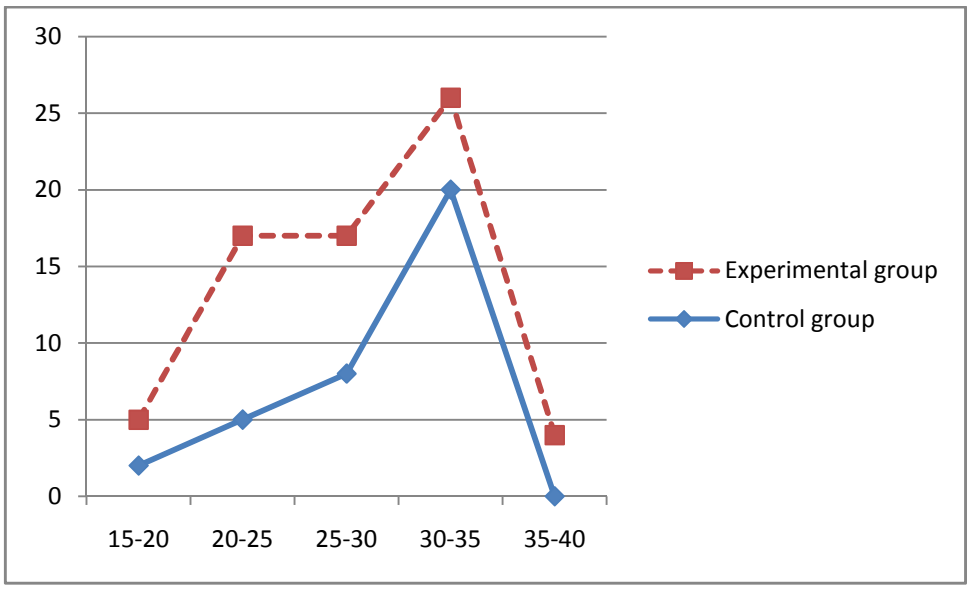

Figure 3: Bar graph representing Pre-test scores of misconception in physics of Experimental and Control group.

As per the above figure, there is no significant difference in the pre-test scores of experimental and control groups on their misconception in physics. This is the indication of the equality of the two groups with respect to their concept clarity of the physics subject.

Comparison of Mean Post-test scores of Misconception in Physics for Experimental and Control Groups

The mean performance of experimental and control groups on the post-test scores were studied and compared using the test of significance of difference between means of small independent sample. The comparison was done for the total sample in the experimental and control groups.

The mean and standard deviation of the post-test of both the groups were found out and subjected to the test of significance of difference between means. The data and results of t-test are presented in table 7

Table 7

The test of Significance of the Mean scores of post-test between experimental and control groups.

Control Group			Experimental Group			t- value	Level of significance
X1	Σ_1	N1	X2	Σ2	N2		
28.54	3.75	35	32.11	4.33	35	3.69	Significant at both level

It can be understood from the table that the obtained t-value 3.69 is above 2.58, the limit set for 0.01 level of significance. So it can be noted that there is significant difference in the mean scores of misconception in physics of control and experimental groups. It can be inferred from the t-test that the performance of the experimental and control group are not similar in case of their post experimental status of misconception test.

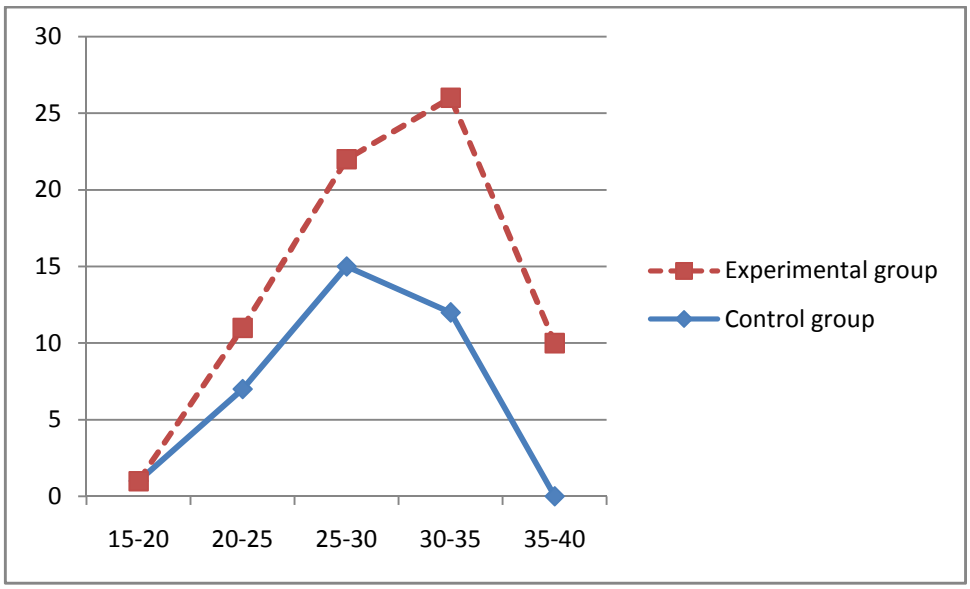

*Figure 4:*Bar graph representing post test score of misconception in physics of experimental and control group.

As per the figure, it can be understood that there exists difference in the post-test scores of misconception in physics of experimental and control groups. The results of the t-test confirmed the features in the graphical representation of the comparison of the post-test scores. This is the indication of the effectiveness of episodic conceptualization strategy to reduce the misconception in physics.

Comparison of Mean Gain Scores of Misconception in Physics for Experimental and Control Groups

The mean scores of experimental and control groups on the gain scores were studied and compared using the test of significance of difference between means of small independent sample. The comparison was done for the total sample in the experimental and control groups.

The mean and standard deviation of the gain scores of both the groups were found out and subjected to the test of significance of difference between means. The data and results of t-test are presented below table 8

Table 8

The test of Significance of the Mean scores of misconception in physics of Gain Scores between experimental and control groups

Control Group			Experimental Group			t- value	Level of significance
X1	Σ_1	N1	X2	Σ2	N2		
3.97	3.00	35	7.97	4.91	35	4.12	Significant at both level

In order to find out gain scores of each student the investigator subtracted pre-test scores form corresponding post test scores. Experimental and control groups were compared for their gain scores using the test of significance between means. The comparison was done for the total sample in the experimental and control groups. The means and standard deviation of gain scores of both groups were found and subjected the test of significance of difference between means at the detail is given in the above table.

The result of the t-test conducted for the comparison of the pre-test, post-test, gain scores for the total sample between experimental and control group is presented in table 9.

Table 9

Summary of the t-values of pre-test, post-test and gain scores for the experimental and control group

Variables	t-value
Pre-test	0.59
Post-test	3.69
Gain scores	4.12

Summary of the t-values in table indicates that the t-value obtained for pre-test is not significant. This implies that the experimental and control groups were similar in case their performance in their pre-test.

The t-value obtained for post-test is found to be significant. From these results obtained it can be inferred that the misconception in physics differentiates the experimental group and control groups. From the comparison the advantage of experimental group is evident. Table also suggests that the obtained t-value for the gain scores for the total samples found be significant.

Analysis of Covariance

The analysis of the pre-test scores of the experimental and control groups showed that they do not differ significantly in the misconception in physics test. After the experimental treatment was given, it was found that experimental group was better that the control group on their misconception test. The higher post-test scores of the pupils in the experimental group than that of the pupils in the control group cannot be attributed to the application of the experimental variables to the

experiment group. In this context it became necessary of analyses that data using the statistical technique called Analysis of co-variance (ANCOVA) by which the difference in the initial status of the two groups can be removed statistically, that they can be compared as though their initial status had been equated.

ANCOVA adjusts post-test scores for initial differences on some variable and compare adjusted scores. In other words, the groups are equalized with respect to the control variable and then compared. By using co-variance the investigator is attempting to reduce variation in post-test scores, which is attributable to another variable.

Comparison of effectiveness of Episodic conceptualization strategy to reduce Misconception in physics.

For determining the effectiveness of episodic conceptualization strategy to reduce the misconception in physics, the pre-test and post-test scores of the experimental and control group were subjected to the statistical analysis of co-variance.

Analysis of Co-Variance

The final (Y) scores were corrected for difference in initial (X) scores. The SSy has been adjusted for any variability in Y, contributed by X. The adjusted sum of squares for Y, that is SSyx were computed and the (Fyx) was calculated. The summary of Analysis of co-variance of pre-test and post-test scores of pupils in experimental and control groups are given table 10.

Table 10

The summary of ANCOVA of pre-test (X) and post-test (Y) scores of pupils in experimental and control groups.

Sources	Df	SSx	SSy	SS xy	SS yx	MS(yx)V(yx)	SDyx	Fyx
AM	1.00	8.93	223.2	-44.64	220.51	220.51		
WG	67.00	1759.77	1116.2	-31.26	1115.67	16.65	4.08	13.24
T	68.00	1768.70	1339.4	-75.90	1336.19	-		

It is clear from the significant Fyx ratio that the two final means of the experimental and control group differ significantly, after they have been adjusted for initial differences. The adjusted means of post-test scores (Y means) of pupils in the experimental and control groups were computed. The difference between the adjusted Y mean was tested for significance. The data for adjusted means post-test scores of pupil in experimental control group is given in the table 11.

Table 11

Data and results of adjusted means of post-test scores of pupil in experimental and control groups.

Groups	N	Mx	My	My.x	SEm	T
Experimental	35.00	26.94	32.1	32.11		
Control	35.00	27.66	28.5	28.55	0.98	3.65
General means of total	70.00	27.30	30.33			

Table value of t.

‘t’ at 0.05 level – 1.96

‘t’ at 0.01 level – 2.58

The table value of 't' is 1.96 at 0.05 level and 2.58 at 0.01 level. The calculated value is 3.65 which is significantly greater that the table value. Adjusted Y means of Experimental group than the Control group indicates that experimental group is superior to control group. It may therefore be interpreted that the pupils taught through episodic conceptualization strategy have better concept clarity in physics than the group taught by conventional method.

The analysis of co-variance and adjusted means comparison of data revealed that after controlling of the extraneous variables by statistical techniques and the difference still exists. The adjusted Y means significantly differ after the comparison of adjusted Y. Hence it can be inferred that the higher achievement in the experimental group is the result of experimental treatment given the group using the episodic conceptualization strategy. Therefore the group with episodic conceptualization method can be considered to be superior over the conventional method of learning group on reducing the misconception in physics subject.

Conclusion

The present study shows that the level of misconception of physics at secondary school students decreases with the application of episodic conceptualization strategy of teaching. This study shows that there exists a significant difference in the pre-test, post-test scores of misconception tests among secondary school students when the episodic conceptualization strategy applied for the total sample. In order to have a higher level of concept clarity of physics subject for the science learners, it is advisable to apply the new innovative strategy which is episodic conceptualization strategy in the classrooms.

Chapter 5

SUMMARY, FINDINGS AND SUGGESTIONS

- *Study In Retrospect*
- *Variables of the study*
- *Objectives of the study*
- *Hypotheses of the study*
- *Methodology of the study*
- *Major Findings*
- *Tenability of Hypotheses*
- *Educational Implication*
- *Suggestions for Further Research*

SUMMARY, FINDINGS AND SUGGESTIONS

This chapter includes an overview of the significant aspects of the study viz., Study in Retrospect, Major Findings, Tenability of Hypotheses, Educational Implications and Suggestions for further research in this area.

Study in Retrospect

The present study entitled as **"EFFECTIVENESS OF EPISODIC CONCEPTUALIZATION STRATEGY ON REDUCING MISCONCEPTION IN SELECT CONCEPTS OF PHYSICS AMONG IXth STANDARD STUDENTS".**

Variable of the Study

The present study demands the following independent and dependent variables.

Independent Variable

An independent variable is a factor which is measured, manipulated or selected by the investigator to determine its relationship to an observed phenomenon.

The independent variable of the study is the Episodic conceptualization strategy.

Dependent Variable

A dependent variable is the one which is measured and observed by the researcher/investigator to determine the effect of independent variable on it.

The dependent variable of the study is Misconception in Physics.

Objective of the Study

The objectives framed for the study are the following:

1. To find out whether there exist any significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
2. To find out whether there exist any significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.
3. To find out whether there exist any significant difference in the mean gain score of test of misconception in Physics of pupils in experimental and control group.
4. To compare the adjusted mean score of test of misconception in Physics of pupils in experimental and control group by taking pretest scores as covariant.
5. To investigate the effectiveness of episodic conceptualization strategy on reducing misconception in select concepts of physics.

Hypotheses of the study

Based on the objectives given above the following hypotheses can be stated.

1. There exists significant difference in the mean pre-test score of test of misconception in Physics of pupils in experimental and control group.
2. There exists significant difference in the mean post-test score of test of misconception in Physics of pupils in experimental and control group.
3. There exists significant difference in the mean gain score of test of misconception in Physics of pupil in experimental and control group.
4. There exists significant difference in the adjusted mean score of test of misconception in Physics of pupils in experiment and control group by taking pretest score and covariant.
5. Episodic conceptualization strategy is effective on reducing misconception in select concepts of physics.

Methodology of the Study

It deals with the precise description of the sample selected for the study, tools and statistical techniques used by the investigator.

Design of the Study

The present study was designed as a Quasi experimental study in which pre-test, post-test, non-equivalent two groups were used for experiment. The experiment group was taught through the Episodic conceptualization strategy and the control group was taught through the conventional method of teaching.

The design of the study is as follows.

O1 X O2

O3 C O4

Where,

O1, O3 –Pre-tests

O2, O4 –Post-tests

X –Application of Experimental treatment

C –Application of Control treatment

Population and Sample

The population for the study is IXth standard Secondary School pupils of Kerala state. The Sample for the study constitutes two divisions of IXth standard Secondary School pupils from P.R.M.H.S.S Panoor, Kannur. Each class consists of 35 students.

Tools employed for the data collection

With the help of the supervising teacher the investigator constructed the following tools to collect relevant data from the samples.

1. Lesson Transcript Based on Episodic Conceptualization Strategy.(Nowfal and Shana, 2017)
2. Lesson Transcript Based on Existing method.(Nowfal and Shana, 2017)
3. Test of Misconception in Physics.(Nowfal and Shana, 2017)

Statistical techniques used for the study

The important statistical constants mean, median, mode, standard deviation, skewness, kurtosis for total sample was calculated to check whether the score are normally distributed. The following techniques were used for analyzing the data.

Mean difference analysis (test of significance)

Test of significance of difference between means was used to compare the relevant variables between the experimental and control groups.

Analysis of Covariance (ANCOVA)

Analysis covariance serves the purpose of statistically removing the effects of extraneous variable from the dependent variable.

Major findings

Result of the comparison of mean pre-test score of Misconception in physics of the experimental and control groups.

The mean score of the experimental and control group were compared using test of significance between mean scores. The critical ratio obtained for pre-test score was 0.59, which is below the tabled value and it was found to be not significant even at 0.05 levels.

Result of the comparison of mean post-test score of Misconception in physics of the experimental and control groups.

The mean score of the experimental and control group were compared using test of significance between mean scores for the post-tests. The critical ratio

obtained for pre-test score was 3.69, which is higher than the tabled value and it was found to be significant even at 0.01 level of significance. This means that there exists significant difference in the post-tests scores of experimental and control group.

Result of the comparison of mean gain scores of Misconception in physics of the experimental and control groups.

The mean gain score of the experimental and control group were compared using test of significance between mean scores and the critical ratio obtained for was 4.12, which is higher than the tabled value and it was found to be significant even at 0.01 level of significance. This means that there exists significant difference in the gain scores of experimental and control group.

Result of the analysis of co-variance for the Misconception in physics of the experimental and control groups.

Single factor ANCOVA was used to study the effectiveness of Episodic conceptualization strategy among IXth standard secondary school students. From the co-variance analyzed it can be understood that when linear adjustment is made for the effect of variation due to difference in the pre-experimental status of the pupils, there is statistically significant difference between the two groups.

Result of the comparison of adjusted means of the pupils in experimental and control groups

In order to examine the effectiveness of episodic conceptualization strategy after the significant t-value is obtained, adjusted mean comparison was used. From

the adjusted mean it can be concluded that there exists a significant difference between two methods of teaching and the experimental group, taught by Episodic conceptualization strategy was found to have higher level of concept clarity in Physics and it causes decreasing the level of misconception in physics when compared to the control group taught by conventional mode of teaching. So it can be inferred that episodic conceptualization strategy is effective for reducing misconception in physics among IXth standard secondary school students.

Tenability of hypotheses

Hypothesis 1 "There exists significant difference in the mean pre-test score of misconception test of pupils in experimental and control group".

The t-value obtained for the test of significance of the difference between the means of pre-test score of misconception in physics of experimental and control group is 0.59. This result shows that there is no significant difference between the experimental and control group in their initial status. Hence the **Hypothesis is rejected.**

Hypothesis 2 "There exists significant difference in the mean post test score of misconception test of pupils in experimental and control group"

The obtained t value is 3.69 for the comparison of mean pot-test score of the misconception test of the experimental and control group which is significant even at 0.01 level. Thus the **Hypothesis is accepted.**

Hypothesis 3 "There exists significant difference in the mean gain score of misconception test of pupils in experimental and control group".

Since the t value 4.12 is higher than the tabled value at both levels, it can be understood that there exists significant difference in the mean gain scores on misconception in physics of IXth standard secondary school students of experimental and control groups. . Hence the **Hypothesis is retained.**

Hypothesis 4 "There exists significant difference in the adjusted mean score of misconception test of pupils in experiment and control group by taking pretest score and covariant".

For the test of significance of adjusted means of post-test scores of pupils in misconception in physics of the experimental and control group, the t value obtained is 3.65. It is significant at both levels. Hence the **Hypothesis is retained**.

Hypothesis 5 "Episodic conceptualization strategy is effective on reducing misconception in select concepts of physics".

For the test of significance of adjusted mean scores on misconception in physics among experimental and control group, the obtained t value is 3.65. It is significant at both levels. Hence the **Hypothesis is retained**.

Educational implications of the study

The major objective the study was to find out the effectiveness of Episodic conceptualization strategy to reduce the misconception in select concepts of physics among IXth standard secondary school students. The present study revealed that

learning Physics through Episodic conceptualization strategy helps to reduce the misconception in physics among secondary section pupils.

Science is the subject which deals with the living materials in the world. Physics subjects deals the scientific aspects of living things based on the facts, principles and theories. That's why the teaching learning process of this subject is the combinations of theories and practical's. And also experiments are very important in classrooms. The concepts of physics subject are connected each other. So the subject demands a continuous way of teaching learning process.

The conventional methods used by the teachers were to use the experiments and practicals in physics strategy for the continuity of the concepts. But teachers are failed to apply the experiments in classroom. Hence it causes the limitations of the concept clarity in physics. Hence misconception of the subject increases.

The major reason of misconceptions in physics subject of class IXth standard students is lack of basic knowledge in primary level, lack of time, lack of proper implementation of the content in constructivist method. So there is an emergent need to bring change in the teaching learning strategy. Episodic conceptualization strategy is an innovative method to overcome this misconception in physics. By using this method, the teacher will able to bring continuity in the teaching learning process of physics, by using teaching learning aid such as concept map, video lessons, experiments. In this method the teacher have to teach the basic knowledge by clarifying each and every concept about a particular topic, before teaching the topic. This will help the child to acquire knowledge without any misconception in it.

Suggestion for further research

The investigator has found out some suggestions in the light of the major findings of the study. The following suggestions are put forwarded for the same.

1. A comparative study can be taken upon the effectiveness of episodic conceptualization strategy to increase the achievement of physics and to reduce the misconception in physics among secondary school students.
2. The same study can changed to another classes. A study can be taken up by the effectiveness of episodic conceptualization strategy on reducing the misconception among X^{th} standard students.
3. The study can be changed in another way, to find out the effectiveness of episodic conceptualization strategy on achievement in physics among higher secondary school students.
4. The present study is limited to the two classes of the secondary level. It can be replicated with other classes of secondary sections.
5. The study can be extended in to large samples, taking different types of strategies and innovative methods to reduce the misconception in physics among secondary and senior secondary students.
6. The study can be conducted in the other subjects also.

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APPENDICES

Appendix I

Lesson Transcript Based On Episodic Conceptualization Strategy (Malayalam)

Name of the Teacher	:- Shana.p.v	Class	:- IX
Name of the school	:- P.R.M.H.S.S Panoor	Div	:- B
Subject :-	Physics	Date	:- 18/11/2016
Unit :-	ദ്രവബലങ്ങൾ	Stength	:- 35

Topic :-പ്ലവക്ഷമബലം, അവയെ സ്വാധീനിക്കുന്ന ഘടകങ്ങൾ Duration:- 40 Mint

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Starter

Good morning, നിങ്ങൾ ദ്രവങ്ങളെ കുറിച്ച് പഠിച്ചട്ടില്ലേ? എന്താണ് ദ്രവങ്ങൾ? ദ്രാവകങ്ങൾ ആണോ ദ്രവങ്ങൾ, ഇവ രണ്ടും ഒരേ അവസ്ഥകൾ ആണോ. ദ്രവങ്ങളെ കുറിച്ച് കുട്ടികൾക്ക് അറിവ് നൽകാൻ അധ്യാപിക ശ്രമിക്കുന്നു. ഖരം,ദ്രാവകം,വാതകം എന്നിവ പദാർത്ഥത്തിന്റെ വത്യസ്ത അവസ്ഥകളാണ് ഈ അവസ്ഥകളെ ദ്രവങ്ങൾ എന്നാണ് അറിയപ്പെടുന്നത്. അതുകൊണ്ടു തന്നെ ദ്രവബലങ്ങൾ എന്നത് കേവലം ദ്രാവക ങ്ങളിൽ അനുഭവപ്പെടുന്ന പ്രതിഭാസം മാത്രമല്ല ഖരാവസ്ഥയിൽ അനുഭവപ്പെടുന്നതും വാതകാവസ്ഥയിൽ അനുഭവപ്പെടുന്നതുമായ ബലങ്ങളാണ്. അത്തരം ബലങ്ങളെ ഈ പാഠഭാഗത്തിലൂടെ ഇന്ന് പരിചയപ്പെടുന്നത്.

Orientation

നിങ്ങൾ കഴിഞ്ഞ ക്ലാസിൽ പ്രതലബലം പഠിച്ചിട്ടുണ്ടല്ലോ! എന്താണ് പ്രതലബലം? നിങ്ങൾ പഠിച്ചതു പ്രകാരം തന്മാത്രകളെ 3 അവസ്ഥകളായി ക്രമീകരിച്ചിട്ടുണ്ട് അവയിൽ ദ്രാവക തന്മാത്രകൾ, ഖര തന്മാത്രകളെ അപേക്ഷിച്ച് തന്മാത്രകൾ അകന്നു നിൽക്കുന്നു. അതുകൊണ്ടു തന്നെ ദ്രാവകങ്ങളിൽ തന്മാത്രകൾ തമ്മിലുള്ള ആകർഷണ ബലം കുറവാ യിരിക്കുംയ. ഈ അവസ്ഥയിൽ തന്മാത്രകൾ വശങ്ങളിലേക്കും ദ്രാവക പ്രതല ങ്ങളിലേക്കും ഒരു ബലം പ്രയോഗിക്കുന്നു. ഈ ബലമാണ് പ്രതല ബലം എന്നറിയപ്പെടു ന്നത്.ഇത്തരം ബലം കൊണ്ടാണ് ബ്ലേഡ് ജലത്തിന് മുകളിൽ പൊങ്ങിക്കിടക്കുന്നത്. എന്നാൽ കപ്പൽ ജലത്തിന് മുകളിൽ പൊങ്ങിക്കിടക്കുവാൻ പ്രതല ബലം കാരണമാകു ന്നുണ്ടോ? പരസ്പരം ചർച്ച ചെയ്ത് ഉത്തരം കണ്ടെത്തുവാൻ കുട്ടികളോട് ആവശ്യ

പ്പെടുന്നു. കുട്ടികളുടെ വ്യതസ്ത ചർച്ചാ ഫലങ്ങളിൽ നിന്നും അധ്യാപിക ഒരു വിഡിയോ പ്രദർശനത്തിലൂടെ കപ്പൽ ജലത്തിൽ ഉയർന്നു നിൽക്കുന്നതിന്റെ തത്ത്വം വിശദീകരിക്കുന്നു.

മാസ് കൂടുമ്പോൾ ഒരു വസ്തു ദ്രവത്തിനുള്ളിലേക്ക് പോവാനുള്ള സാധ്യതയുണ്ട് എന്നിട്ടും വലിയ മാസ്സുള്ള കപ്പൽ വെള്ളത്തിൽ താഴ്ന്നു പോവാതെ ഒഴുകികിടക്കുന്നു. അപ്പോൾ ജലത്തിനു വസ്തക്കളുടെ മുകളിൽ ചില ബലങ്ങൾ പ്രയോഗിക്കുവാനുള്ള കഴിവുകളുണ്ട് അല്ലേ? ജലത്തിന് മാത്രമല്ല ദ്രാവകങ്ങൾക്കെല്ലാം ഇത്തരത്തിലുള്ള ബലങ്ങൾ ഉണ്ട്. ഈ ബലങ്ങളെ കുറിച്ചാണ് പരീക്ഷണങ്ങളിലൂടെയും ചർച്ചകളിലൂടെയും നമ്മൾ പഠിക്കുന്നത്.

Development of the lesson

ഇതുവരെ നിങ്ങൾ മനസിലാക്കിയത് ദ്രവബലങ്ങൾ എങ്ങിനെയാണ് പഠിക്കേണ്ടത് എന്നതിനെ പറ്റിയാണ്. അതായത് ദ്രവബലങ്ങൾ പഠിക്കുന്നതിനായി നിങ്ങൾക്ക് മുന്നറിവുകൾ ആവശ്യമാണ് . ആയതിനാൽ ദ്രവങ്ങൾ എന്താണെന്നും പ്രതലബലം എന്താണെന്നും മനസിലായോ? എങ്കിൽ അവയെ കുറിച്ച് നിങ്ങൾക്ക് അറിയാവുന്ന രീതിയിൽ science diary യിൽ നോട്ട് തയ്യാറാക്കുക.

ശേഷം പാഠഭാഗം വികസിപ്പിക്കുന്നതിന് വേണ്ടി രണ്ട് പരീക്ഷണങ്ങൾ കുട്ടികൾക്ക് മുന്നിൽ അവതരിക്കുന്നു.

Activity. No.1

ഒരു ബക്കറ്റിൽ ജലമെടുക്കുന്നു. ഒരു പ്ലാസറ്റിക്ക് കുപ്പി നന്നായി അടച്ച ശേഷം ജലൊപരിതലത്തിൽ വയ്ക്കുന്നു. പ്ലാസറ്റിക്ക് കുപ്പി ജലത്തിലേക്ക് കൈ ഉപയോഗിച്ചു കൊണ്ട് താഴ്ത്തുന്നു. അവിടെ നമ്മൾ ബലം പ്രയോഗിക്കുന്നുണ്ടോ? കുട്ടികളോട് നിരീക്ഷണങ്ങൾ കണ്ടെത്താൻ ആവഷ്യപ്പെടുന്നു. അതിനായി ടീച്ചർ കുട്ടികളോട് ചോദ്യാവലി നടത്തുന്നു.

- ജലത്തിനുള്ളിൽ നിന്ന് പ്ലാസ്റ്റിക്ക് കുപ്പിയെ സ്വതന്ത്രമാക്കുമ്പോൾ എന്താണ് മാറ്റമുണ്ടാവുന്നത്? കുപ്പി ഉയർന്നതെങ്ങനെ
- ഭരമുള്ള വസ്തുക്കൾ താഴേക്ക് പോവാതെ മുകളിലേക്ക് ഉയരുന്നതിന്റെ കാരണങ്ങൾ എന്തൊക്കെ?
- നമ്മൾ കുപ്പിക്ക് മുകളിൽ കൊടുത്ത ഭാരത്തേക്കാൾ കൂടിയ ഭാരം അനുഭവപ്പെട്ടത് എന്തുകൊണ്ടായിരിക്കും?

- ദ്രവങ്ങൽ മുകളിലേക്ക് ഒരു ഭാരം പ്രയോഗിക്കുന്നു.

ചോദ്യാവലിയുടെയും ചർച്ചകളുടെയും അടിസാഥാനത്തിൽ ദ്രവബലങ്ങൾ എന്താണെന്ന് അധ്യാപിക വിശദീകരിക്കുന്നു. അത് പ്ലഖക്ഷമബലം എന്ന പേരിൽ അറിയപ്പെടുന്നു. എന്നാൽ പ്ലഖക്ഷമബലം പ്രതലബലം ആവുകയില്ല. കൂടുതൽ അറിവ് പകരാനായി മറ്റൊരു പരീക്ഷണം നടത്തുന്നു.

Activity No.2

കുട്ടികളിൽ ഒരാളെ പരീക്ഷണത്തിനായി വിളിപ്പിക്കുന്നു. ജലം നിറച്ച ബക്കറ്റിൽ 10 kg ഭാരമുള്ള തൂക്കു കട്ട നിക്ഷേപിക്കുന്നു. ശേഷം ജലത്തിൽ നിന്ന് ആ തൂക്കുകട്ടയെ ഉയർത്താൻ ആവശ്യപ്പെടുന്നു. 2 സന്ദർഭത്തിലും അനുഭവിച്ച വ്യത്യാസങ്ങളെ ക്ലാസിൽ അവതരിപ്പിക്കുവാൻ കുട്ടിയോട് ആവശ്യപ്പെടുന്നു. ശേഷം അധ്യാപിക തത്ത്വം വിശദീകരിക്കുന്നു.

ഒരു ദ്രവത്തിൽ സ്ഥിതി ചെയ്യുന്ന വസ്തുവിൽ അനുഭവപ്പെടുന്നത് 2 തരത്തിലുള്ള ബലങ്ങളാണ്.

1. വസ്തുവിന്റെ ഭാരം താഴേക്ക് അനുഭവപ്പെടുന്നത്.
2. വസ്തുവിൻമേൽ മുകളിലേക്ക് അനുഭവപ്പടുന്ന ബലം. ഈ ബലത്തെ പ്ലവക്ഷമ ബലം എന്നറിയപ്പെടുന്നു.

Concept Formation

ഇപ്പോൾ നമ്മൾ ദ്രവബലങ്ങളിലെ പ്ലവക്ഷമബലം എന്താണെന്ന് പഠിച്ചു. കഴിഞ്ഞ ക്ലാസ്സിൽ നിങ്ങൾ പ്രതലബലം പഠിച്ചു. വസ്തുവിന്റെ പ്രതലബലം എന്താണ്? തന്മാത്രകൾ വശങ്ങളിലേക്കും ദ്രവ പ്രതലങ്ങളിലേക്കും പ്രയോഗിക്കുന്ന ബലമാണ് പ്രതലബലം. ഇത് പ്ലവക്ഷമബലവുമായി ബന്ധപ്പെട്ടു കിടക്കുന്നുണ്ടോ?

പ്രതലബലവും പ്ലവക്ഷമബലവും തുല്ല്യബലങ്ങൾ അല്ല. ഇവിടെയാണ് പല തരത്തിലുള്ള സംശയങ്ങളും രൂപപ്പെടുന്നത്. ആയതിനാൽ പ്ലവക്ഷമബലം എന്നത് ദ്രവങ്ങൾ വസ്തുവിന് മുകളിലേക്ക് പ്രയോഗിക്കുന്ന ഒരു ബലമാണ്. കുട്ടികൾക്ക് കൂടുതൽ വ്യക്തത ലഭിക്കുന്നതിന് വേണ്ടി പ്ലവക്ഷമബലത്തിന്റെ തത്ത്വം വിശദീകരിക്കുന്ന ഒരു വീഡിയോ പ്രദർശിപ്പിക്കുന്നു.

Video - Principles of Buoyancy

Consolidation

ഇന്ന് പഠിച്ച കാര്യങ്ങളും കുട്ടികളിലെ മുന്നറിവുകളും ക്രോഡീകരിച്ചുകൊണ്ട് അധ്യാപിക വിശദീകരിക്കുന്നു.

പ്ലവക്ഷമം എന്നത് എല്ലാ ദ്രവാവസ്ഥയിലും അനുഭവപ്പെടുന്ന ബലമാണ്. കേവലം ദ്രാവകങ്ങളിൽ മാത്രമല്ല, ഖരം, വാതകം എന്നീ അവസ്ഥകളിലും പ്ലവക്ഷമബലം കാണപ്പെടുന്ന കപ്പലുകൾ ജലത്തിൽ ഉയർന്നു നിൽക്കാനുള്ള കാരണം പ്ലവക്ഷമബലമാണ്. ജലത്തിൽ ആദേശം ചെയ്യുന്ന വസ്തുവിന്റെ ഭാരത്തിന് തുല്യമായ ഭാരമാണ് ദ്രവത്തിന്റെ പ്ലവക്ഷമബലം. അതുകൊണ്ട് തന്നെ കപ്പലിന് എത്രയാണോ ഭാരം ജലത്തിൽ അനുഭവപ്പെടുന്നത് അത്രയും ബലം ജലം മുകളിലേക്ക് പ്രയോഗിക്കുന്നു. ഇതാണ് പ്ലവക്ഷമബലം. ആയതിനാൽ വസ്തുവിന്റെ വ്യാപ്തം ദ്രവത്തിലനുഭവപ്പെടുന്ന സാന്ദ്രത എന്നിവ പ്ലവക്ഷമ ബലത്തെ സ്വാധീനിക്കുന്നു. അതുകൊണ്ടാണ് ഉപ്പ് ഏറ്റവും കൂടുതൽ അടങ്ങിയ ചാവുകടലിൽ വസ്തുക്കൾ പൊങ്ങിനിൽക്കുന്നത്. അതായത് ചാവുകടലിന് സാന്ദ്രത കൂടുതലാണ്. പ്ലവക്ഷമബലത്തിന്റെ Concept Map chartൽ പ്രദർശിപ്പിക്കുന്നു.

Follow up Activity

Assignment

പ്ലവക്ഷമബലം അനുഭവപ്പെടുന്ന വ്യത്യസ്ത സന്ദർഭങ്ങൾ കണ്ടുപിടിച്ച് ഓരോ ദ്രവാവസ്ഥയിലും അനുഭവപ്പെടുന്ന മാറ്റങ്ങൾ പരീക്ഷണത്തിലൂടെ കണ്ടെത്തി കുറിപ്പ് തയ്യാറാക്കുക

Appendix II

Lesson Transcript Based on Episodic Conceptualization Strategy (English)

Name of the Teacher	:	Shana P V	Class	: IX
Name of the School	:	P.R.M.H.S.S	Div.	: B
Subject	:	Physics	Date	: 18/11/2016
Unit	:	Forces of Fluids	Duration	: 40 minute
Topic	:	Buoyancy and factors influencing Buoyancy.		

Starter

Good morning,

Have you studied about fluid? What is fluid? Are liquids known as fluids? Are both of them in same state? Teacher tries to impart knowledge related to fluid, liquid. Solid, liquid, gaseous are different matter of states. This states are named as fluid; therefore fluid force is a force that not only seen in liquid, but also seen in solid state. Let us become familiar with these type of force in this chapter.

Orientation

So you have learned surface tension in the previous class. What is surface tension? You already know that matter is classified into three; in which water molecules are loosely packed when compared to solid state. Thus, the attractive force between the molecules will be less. So, in this state molecules creates a tension towards downwards and the sides. This tension is called surface tension. This is why the blade floats on the surface of the water. Is it for the same reason that a ship floats on water. Teacher asks the students to discuss and reflect on it. After the discussion teacher explains the principle through a video lesson.

When mass of an object increases, there is a chance to sink in to the fluid. However the ship with large mass is floating on water. Hence liquid has an ability to apply a upward force on the body. We will study these forces of fluids through the experiment and discussion.

Development of the lesson

To study forces of liquid you need pre requisite knowledge. thus do you understand about fluids and surface tension. Then prepare a note about this topic in your science diary.

Teacher demonstrates two experiments to develop the concept.

Activity 1

Take water in a bucket then take a plastic bottle, tighten the cap and keep it on the surface of water. Write the observation in your science diary.

Press the bottle downward into the water. Do you need to exert pressure on it. Write

Answer after discussion on the given question.

Indicators

1. What do you observe when the bottle is set free from inside the water?
2. Why the bottle rises upward?
3. What will be the reason for rising of heavier object instead of sinking or drowning?
4. How will be the upward weight which is greater than bottles weight?
5. Which force is exerted on the fluid?

Inferences are read in classroom, after that teacher demonstrates another experiment.

Activity no. 2

Teacher calls a child to demonstrate an experiment. Take a beaker full of water.

Place weighing block of 10kg in water. And asks the child to take it out from water

Teacher asks him to keep it on water. The teacher asks students to explain the differences

In two situations. Teacher consolidates.

The two forces experienced by a single object in same fluid

1. The weight of object experienced downward

2. The force experienced by an object in upward is called buoyant force.

When a body is immersed completely or partially in liquid, the liquid exerts an upward force on the body, this force is the buoyancy.

Concept Formation

Now you studied about the buoyancy on fluids. In the previous classes you have studied surface tension. What is the surface tension of a liquid? Is it related with buoyancy? Buoyancy and surface are not same. Here start different types of misconcepts. That's why, buoyancy is an upward external force acting upon a body in liquid. To give more clarification to students teacher shows a video lesson

Video- Principle of buoyancy.

Consolidation

The teacher explains by consolidating the lesson that they have already learnt.

Buoyancy is experienced all states of fluids. Buoyancy is not only seen in water but also in solid, gases state of matter. The floating of ship is due to buoyancy.

When an immersed partially or completely in a liquid, the buoyancy experienced by it will be equal to the weight of the liquid displaced by it. The buoyancy that a liquid exerts on a ship is equal to the weight of the liquid displaced by it. This is buoyancy force. So density and volume are the major factors influencing buoyancy. Therefore this is the reason of floating objects on the Dead Sea.

Teacher displays a concept map on a chart.

Follow up Activities

Assignment: find out the different situation of buoyancy and find out the changes of each state of fluid by experiments and prepare a note.

Appendix III

Lesson transcript based on Existing Teaching Strategy

Name of the Teacher : Shana. P.V Class : IX

School :P.R.M.H.S.S Div : C

Subject : Physics Date : 18/11/2016

unit : ദ്രവബലങ്ങൾ Duration : 40 minute

Topic : പ്ലവക്ഷമബലം അവയെ സ്വാധീനിക്കുന്ന ഘടകങ്ങൾ.

ContentAnalysis	
Term	-പ്ലവക്ഷമബലം, പ്ലവക്ഷമബലം എങ്ങിനെ അളക്കാം. പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്ന ഘടകങ്ങൾ.
Fact	- ഒരു വസ്തു ദ്രവത്തിൽ ഭാഗികമായോ പൂർണ്ണമായോ മുങ്ങിയിരിക്കുമ്പോൾ ആ ദ്രവം വസ്തുവിന് മുകളിലേക്ക് ഒരു ബലം പ്രയോഗിക്കുന്നു. ഈ ബലമാണ് പ്ലവക്ഷമബലം. -പ്ലവക്ഷമബലത്തെ അളക്കാൻ ഒരു വസ്തുവിന് വായുവിൽ ലഭിക്കുന്ന ഭാരത്തിൽ നിന്ന് ജലത്തിന്റെ ഭാരം കുറച്ചാൽ മതിയാകും. - വായുവിലെ ഭാരം W_1, ജലത്തിലെ ഭാരം W_2ആയും കണക്കാക്കിയാൽ പ്ലവക്ഷമബലം ഭാരക്കുറവ്= $W_1 - W_2$ആയിരിക്കും -മാസ്, സാന്ദ്രത, എന്നിവ പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്ന ഘടകങ്ങൾ ആണ്. - പ്ലവക്ഷമബലം ദ്രവബലങ്ങൾ ആകുന്നു.
Concept	-ദ്രവങ്ങൾക്ക് വസ്തുവിന് മുകളിൽ അനുഭവപ്പെടുന്ന ബലമാണ് പ്ലവക്ഷമബലം. -വായുവിലെ വസ്തുവിന്റെ ഭാരത്തിൽ നിന്ന് ജലത്തിലെ വസ്തുവിന്റെ ഭാരം കുറക്കുമ്പോൾ കിട്ടുന്ന അളവാണ് പ്ലവക്ഷമബലം. - സാന്ദ്രത, വ്യാപ്തം എന്നീ ഘടകങ്ങളാണ് പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്നത്.
LearningOutcomes	
	- ദ്രാവകങ്ങൾക്ക് ബലമുണ്ടെന്നും അവ ദ്രാവകങ്ങളിൽ ഭാഗികമായോ പൂർണ്ണമായോ മുങ്ങിയിരിക്കുമ്പോൾ വസ്തുക്കളിൽ ബലം പ്രയോഗിക്കുന്നുണ്ടെന്നും തിരിച്ചറിയാൻ കഴിയുന്നു. - വിവിധ ദ്രാവകങ്ങളിലും പ്രവർത്തനങ്ങളിലും ദ്രവങ്ങൾക്ക് വ്യത്യസ്തതരത്തിലുള്ള പ്ലവക്ഷമബലമാണെന്ന് നിഗമനത്തിലെത്തിക്കുന്നു
Process Skills	-പരീക്ഷണം, നിരീക്ഷണം നടത്തൽ - നിഗമനത്തിലെത്തിച്ചേരൽ

PreviousKnowledge	- ദ്രാവകങ്ങളെ കുറിച്ചും അവയുടെ തന്മാത്രാക്രമീകരണത്തെകുറിച്ചും ഉള്ള മുന്നറിവ്.
LearningMaterials	- ജലം, കല്ല്, കുപ്പി, മണ്ണെണ്ണ, ഉപ്പുവെള്ളം, Blackboard

Process	**Responce**

Good Morning

ഇപ്പോൾ നല്ല മഴയാണല്ലോ നാട്ടിൽ ?

എല്ലാവരും വെള്ളത്തിൽ കളിക്കാറുണ്ടോ ? നീന്താൻ അറിയുന്ന എത്രപേരുണ്ട് നിങ്ങളുടെ ക്ലാസ്സിൽ ?കൈ ഉയർത്തൂ. നിങ്ങൾ വെള്ളത്തിൽ മുങ്ങിയിരിക്കുമ്പോഴോ പാതി പൊങ്ങിയിരിക്കുമ്പോഴോ വെള്ളത്തിനടിയിൽ നിന്ന് എന്തെങ്കിലും പ്രത്യേകതകൾ അനുഭവപ്പെടാറുണ്ടോ ? അതെന്തായിരിക്കാം. ?

അത്പോലെതന്നെ ബ്ലേഡ് ജലോപരിതലത്തിൽ പൊങ്ങികിടക്കാറുണ്ട്. അതിന്റെ കാരണം നിങ്ങൾ കഴിഞ്ഞ ക്ലാസ്സുകളിൽ പഠിച്ചിട്ടില്ലേ? പ്രതലബലമാണ് ഇതിന്കാരണം അങ്ങിനെയെങ്കിൽ കപ്പലുകൾ ജലത്തിന് മുകളിൽ ഉയർന്നു നിൽക്കുന്നത് പ്രതലബലം കാരണമാണോ? നമുക്ക് നോക്കാം.

Activity 1

ഒരു ബക്കറ്റിൽ ജലമെടുക്കുക. പ്ലാസ്റ്റിക്ക് കുപ്പി നന്നായി അടച്ച ശേഷം ജലോപരിതലത്തിൽ വെക്കുക.നിരീക്ഷമങ്ങൾ **science diary** യിൽ കുറിച്ചുവെക്കുക.

പ്ലാസ്റ്റിക്ക് കുപ്പി കൈകൊണ്ട് ജലത്തിനടിയിലേക്ക് താഴ്ത്തൂ. അവിടെ ബലം പ്രയോഗിക്കേണ്ടി വരുന്നുണ്ടോ? ചർച്ച ചെയ്ത് താവെ കൊടുത്തിരിക്കുന്ന ചോദ്യങ്ങൾക്ക് ഉത്തരം കണ്ടെത്തുക.

ചർച്ചാസൂചകം

- ജലത്തിനുള്ളിൽ നിന്ന് പ്ലാസ്റ്റിക്ക് കുപ്പിയെ സ്വതന്ത്രമാക്കുമ്പോൾ എന്ത് മാറ്റമാണ് നിരീക്ഷിക്കുന്നത്.
- കുപ്പി മുകളിലേക്ക് ഉയരുന്നത് എന്തുകൊണ്ട്?
- ഭാരമുള്ള വസ്തുക്കൾ താഴേക്ക് പോവാതെ മുകളിലേക്ക് ഉയരുന്നത് എന്തുകൊണ്ട് ?
- കുപ്പിയുടെ ഭാരത്തേക്കാൾ കൂടിയ ഭാരം മുകളിലേക്ക് ഉയരുന്നത് എന്തകൊണ്ട് ?

- ദ്രവങ്ങൾക്ക് മുകളിലേക്ക് ബലം പ്രയോഗിക്കാൻ സാധിക്കുമോ ? നിഗമനങ്ങൾ ക്ലാസ്സ് മുറിയിൽ വായിക്കുന്നു. ശേഷം ടീച്ചർ മറ്റൊരു പരീക്ഷണംനടത്തുന്നു.

പരീക്ഷണം ചെയ്യുന്നതിനായി ഒരു കുട്ടിയെ വിളിക്കുന്നു.

ഒരു ബക്കറ്റിൽ നിറയെ ജലമെടുക്കുക. 10 kg ഭാരമുള്ള തൂക്കുകട്ട ജലത്തിലേക്ക് നിക്ഷേപിച്ചതിന് ശേഷം കുട്ടിയോട് ജലത്തിൽ നിന്ന് ആ തൂക്കുകട്ടയെ ഉയർത്താൻ പറയുന്നു. ശേഷം വെള്ളത്തിന് മുക ളിൽവെച്ചും പരീക്ഷണം ആവർത്തിക്കാൻ ആവശ്യപ്പെടുന്നു. 2 സന്ദർഭങ്ങളിലും ഉണ്ടായ വ്യത്യാസം ക്ലാസ്സിൽ വിവരിക്കാൻ ആവശ്യപ്പെടുന്നു.

ശേഷം ടീച്ചർ ക്രോഡീകരിക്കുന്നു.

ദ്രവത്തിൽ സ്ഥിതിചെയ്യുന്ന ഒരു വസ്തുവിൻ അനുഭവപ്പെടുന്നത് രണ്ടു ബലങ്ങളാണ്.

1. വസ്തുവിന്റെ ഭാരം താഴേക്ക് അനുബവപ്പെടുന്നത്.
2. വസ്തുവിന്റെമേൽ മുകളിലേക്ക് അനുബവപ്പെടുന്ന ബലമാണ് പ്ലവക്ഷ മബലം ഒരു വസ്തു ദ്രവത്തിൽ പൂർണ്ണമായോ ഭാഗികമായോ മുങ്ങിയിരി ക്കുമ്പോൾ ആ ദ്രവം വസ്തുവിന് മുകളിലേക്ക് ഒരു ബലം പ്രയോഗിക്കു ന്നു. ആ ബലമാണ് പ്ലവക്ഷമബലം.

ഇനി പ്ലവക്ഷമബലം അളക്കുന്നത് എങ്ങിനെയാണെന്ന് നോക്കാം

Activity 3

ഏകദേശം ഒരേ വലിപ്പമുള്ള ഒരു കല്ലും ലോഹകഷ്ണവുമെടു ക്കുക. ഒരു സ്പ്രിംഗ് ബാലൻസ് (ന്യൂട്ടൻ അളവിൽ അങ്കനം ചെയ്തത്.) ഉപയോഗിച്ച് ഇവ ഓരോന്നിന്റെയും വായുവിലുള്ള ഭാരം കണക്കാക്കുക. തുടർന്ന് ഓരോന്നിനെയും ജലത്തിൽ താഴ്ത്തി ജലത്തിൽ അനുഭവപ്പെ ടുന്ന ഭാരവും കണ്ടെത്തുക. ലഭിച്ച വിവരങ്ങളെ അടിസ്ഥാനപ്പെടുത്തി പട്ടിക പൂർത്തിയാക്കുക.

വസ്തു	വായുവിലെ ഭാരം W_1	ജലത്തിലെ ഭാരം W_2	ഭാരക്കുറവ് = W_1-W_2
കല്ല്			
ലോഹ കഷ്ണം			

പട്ടിക വിശകലനം ചെയ്ത് ടീച്ചർ ക്രോഡീകരിക്കുന്നു.

കല്ലിനും ലോഹകഷ്ണത്തിനും ജലത്തിൽ ഭാരക്കുറവ് അനുഭവപ്പെടുന്നതിന്റെ കാരണം ജലത്തിലുണ്ടാവുന്ന പ്ലവക്ഷമബലമാണ്. പട്ടിക പ്രകാരം ഒരു വസ്തുവിന് ജലത്തിൽ അനുഭവപ്പെട്ട ഭാരക്കുരവാണ് പ്ലവക്ഷമബലം.

Activity 4

അടുത്തതായി പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്ന ഘടകങ്ങൾ ഏതൊക്കെയാണെന്ന് കണ്ടെത്തുന്നതിനായി ഒരു പരീക്ഷണം ചെയ്തുനോക്കാം.

ജലം, മണ്ണെണ്ണ, ഉപ്പുവെള്ളം, എന്നിവ മൂന്നു ബക്കറ്റുകളിലായി എടുക്കുക.സ്പ്രിംങ്ങ് ത്രാസ് ഉപയോഗിച്ച് കൊണ്ട് ഈ ദ്രാവകങ്ങൾ ഓരോന്നും കല്ലിൽ പ്രയോഗിക്കുന്ന പ്ലവക്ഷമബലം കണ്ടെത്തുക. ആയതിനാൽ ദ്രാവകങ്ങളുടെ സാന്ദ്രത പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്നു.

Activity 5

ഒരേ ഭാരമുള്ള ചെമ്പകട്ടയും ഇരുമ്പ്കട്ടയും എടുക്കുക. ഓരോന്നിലും ജലംപ്രയോഗിക്കുന്ന പ്ലവക്ഷമബലം ഒരു സ്പ്രിംഗ് ത്രാസ് ഉപയോഗിച്ച് കണ്ടെത്തിപട്ടികപ്പെടുത്തുക.

വസ്തു	വായുവിലെ ഭാരം	ജലത്തിലെ ഭാരം	പ്ലവക്ഷമബലം
ചെമ്പുകട്ട			
ഇരുമ്പുകട്ട			

പട്ടികയുടെ അടിസ്ഥാനത്തിൽ ചർച്ചാസൂചകം നൽകുന്നു.

- ഓരോന്നിലും അനുഭവപ്പെട്ട പ്ലവക്ഷമബലം എത്ര ?
- അവ വ്യത്യസ്തമായത് എന്തുകൊണ്ട് ?
- ചെമ്പ്കട്ടയുടെയും ഇരുമ്പ് കട്ടയുടെയും ഭാരം ഒന്നുതന്നെ ആയതിനാൽ മാസും ഒരുപോലെയായിരിക്കുമല്ലോ.എന്നാൽ അവയുടെ വ്യാപ്തം ഒരു പോലെയാണോ ?
- ചെമ്പുകട്ടയ്ക്കും ഇരുമ്പ്കട്ടയ്ക്കും അനുഭവപ്പെട്ട പ്ലവക്ഷമബലം വ്യത്യസ്തപ്പെട്ടത് എന്തുകൊണ്ടായിരിക്കും. ?

കുട്ടികളുടെ ഉത്തരങ്ങളുടെ അടിസ്ഥാനത്തിൽ ടീച്ചർ ക്രോഡീകരിക്കുന്നു.

തുല്ല്യ മാസുള്ള രണ്ട് വസ്തുക്കളിൽ ആ വസ്തുവിന്റെ വ്യാപ്തം വ്യത്യാസപ്പെടുമ്പോൾ പ്ലവക്ഷബലം വ്യത്യാസപ്പെടുന്നു. ആയതിനാൽ വസ്തുവിൽ അനുഭവപ്പെടുന്ന പ്ലവക്ഷമബലം വസ്തുവിന്റെ വ്യാപ്തത്തെ ആശ്രയിച്ചിരിക്കുന്നു.

Assignment

നിത്യജീവിതത്തിൽ വാതകങ്ങളിൽ അനുഭവപ്പെടുന്ന പ്ലവക്ഷമബലം ഏതൊക്കെ സാഹചര്യങ്ങളിലാണെന്ന് കണ്ടെത്തി എഴുതുക.

Appendix IV

Lesson Transcript Based on Existing Teaching Strategy

(English)

Name of the Teacher	:	Shana P V	Class: IX
Name of the School	:	P.R.M.H.S.S	Div. : C
Subject	:	Physics	Date: 18/11/2016
Unit	:	Forces of Fluids	Duration: 40 minute

Topic: Buoyancy and factors influencing Buoyancy.

Content Analysis	
Term	- Buoyancy, how to measure buoyancy, factors effecting buoyancy.
Fact	- Whenan object partially or completely immersed in a liquid, the liquid exerts an upward force on the body. This force is the buoyancy. - To measure buoyancy weight of an object in air as subtracted from weight in water. - When W1 is considered weight in water, W2 is weight in air, then **Buoyancy = W2-W1** **-** Volume**,** density are the factors influencing buoyancy. **-** Buoyancy is considered as fluid forces.
Concept	**-** Theupward force of fluid acting on a body is called buoyancy. - Buoyancy experienced by a substance immersed in a fluid, it is enough to find out the loss of weight on the substance in that fluid. - Density and Volume are the two factors influencing the effect of buoyancy.
Learning Outcome	- To understand that liquid has forces and it exerts an upward force on the bodyOutcomeswhich is immersed in liquid either partially or completely. - To infer that buoyancy has different forms in various activities and fluids.

Process Skill	- Conduct Experiment and observation, to reach inferences.
Previous Knowledge	- Awareness about liquids and their molecular arrangement.
Learning Materials	- Spring balance, beaker, water, kerosene, stone, saline water, black board

Process	Response
Good morning, Now a days it's too rainy here. Do you all paly in water? How many of you knowSwimming? Do you feel anything different, when you sink completely or partially inWater? Similarly the blade will also afloat on water, isn't it? Do the coins float likethis? The reason for this was studied by you in last class. Do the ship afloat on waterbecause of surface tension? Let us see? **Activity 1** Take water in a bucket then take a plastic bottle, tighten the cap and keep it onthe surface of water. Write the observation in your science diary.Press the bottle downward into the water. Do you need to exert pressure on it? Writeanswer after discussion on the given question. Indicators • What do you observe when the bottle is set free from inside the water? • Why the bottle rises upward? • What will be the reason for rising of heavier object instead of sinking ordrowning? • How will be the upward weight which is greater than bottles weight? • Which force is exerted on the fluid? Inferences are read in classroom, after that teacher demonstrates anotherexperiment.	

Activity no. 2

Teacher calls a child to demonstrate an experiment. Take a beaker fullof water. Place weighing block of 10kg in water. Teacher asks the child totake it out from water. Then asks him to keep it on water. The teacherasks students to explain the differences In the towsituations.

Teacher consolidates.

The two forces experienced by a single object in same fluid.

- The weight of object experienced downward
- The force experienced by an object in upward is calledbuoyant force.

When a body is immersed completely or Partially in liquid,the liquid exerts an upward force on the body,this force is the buoyancy.

Let us see how to measure buoyancy.

Activity 3.

Take a stone and a piece of metal of similar size.Using spring balance measure the weight of eachin air then immerse each in water and measure theweight of each in water. Based on the result complete the table.

Body	Weight in air W1	Weight in water W2	Loss of Weight = W2-W1
Stone			
Metal Piece			

After analyzing the table teacher consolidates, The weight of stone and metal piece in water is low due to buoyancy.

According to the table the force experienced by an object in water is buoyancy. That means, to measure the buoyancy experienced by an object in water , the weight loss

of an object in that fluid should be found.

Activity 4

Let us do an experiment to identify the factors influencing the buoyancy.

Water, kerosene, saline water is taken in three beakers. Using spring balance identify and tabulate that the buoyancyexperienced by each of there on a stone which is immersed in them.

liquid	Wight of stone	buoyancy
Kerosine Water Saline water		

Based on the table it is inferred that buoyancy experiencedby stone in each fluid is different.

It is based on the difference of density of fluid.

Activity 5

Take an iron block and copper block pieces of same weight. Measure the buoyancy exerted by each using spring balance.

And tabulate it.

Object	Weight in air	Weight in water	buoyancy
Copper stone			
Iron stone			

Discuss based on the table
Indicators

1. How much is the buoyancy experienced by each?
2. Why there was difference?
3. Weight of copper block and iron block are same, then mass will also be the same, then what about the volume?
4. Why there would be a difference in the buoyancy of iron block andcopper block?

Based on the answers teachers consolidatethough the mass of each block are same, and if the volume changes,then the buoyancy changes respectively.

Hence volume is influenced by change in buoyancy.

Assignment

Tabulate the situations of daily life activities when buoyancy is experienced in liquid and gases.

Appendix V

TEST OF MISCONCEPTION IN PHYSICS

(Draft)

FAROOK TRAINING COLLEGE

Mr. Nowfal. C
Assistant Professor

Shana P.V
M.Ed Student

നിർദ്ദേശങ്ങൾ

ചുവടെ കൊടുത്തിരിക്കുന്നപ്രസ്താവനകളെ ശ്രദ്ധയോടുകൂടി വായിച്ച് ശരിയായ പ്രസ്താവനയ്ക്ക് നേരെ ✓ മാർക്കും തെറ്റായ പ്രസ്താവനയ്ക്ക് നേരെ Xമാർക്കും രേഖപ്പെടുത്തുക.

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1. ജലത്തിന് മുകളിൽ കപ്പൽ പൊങ്ങിക്കിടക്കു൦തിന് കാരണം പ്ലവക്ഷമബല മാണ്

2. കാന്തിക മണ്ഡലത്തിൽ അനുഭവപ്പെടു൦ ബലം കാന്തിക മണ്ഡലത്തിന്റെ ദിശയുമായി ബന്ധപ്പെടി൯.

3. കൂളോം കറന്റിന്റെ യൂണിറ്റാണ്.

4. ഗ്ലാസിന്റെ അപവർത്തനാങ്കം 1.5 ആകുന്നു.

5. ഇലക്ട്രിക്ക് പൊട്ടൻഷ്യൽ കുറഞ്ഞ ഭാഗത്ത് നിന്ന് കൂടിയ ഭാഗത്തേക്കാണ് കറന്റ് ഒഴുകുന്നത്.

6. ഒരു വസ്തു സ്ഥിരാവസ്ഥയിൽ ആയിരിക്കണമെങ്കി൯ ആ വസ്തുവിന്റെ സ്ഥിതികോർജം കൂടുതലായിരിക്കണം.

7. സ്പ്രിംഗ് ത്രാസ് ഉപയോഗിച്ചാണ് മാസ് അളക്കു൦ത്.

8. ജയന്റ് വീലിൽ വസ്തുവിന് നിർബാധപതനം സംഭവിക്കുന്നത് വസ്തുവി ന്റെ ആക്കവ്യതിയാനം കാരണമാണ്.

9. ബാഹ്യബലം പ്രയോഗിക്കപ്പെടുന്നില്ല എങ്കിൽ വസ്തുവിന്റെ ആക്കം എപ്പോഴും സ്ഥിരമായിരിക്കും.

10. ജലത്തേക്കാൾ വിസ്ക്കസ് ബലം കുറഞ്ഞ വസ്തുവാണ് തേൻ.

11. ഹൈഡ്രജൻ നിറച്ച ബലൂൺ വായുവിൽ ഉയർന്നുപോകുന്നത് വാതകങ്ങളിൽ അനുഭവപ്പെടുന്നപ്ലവക്ഷമബലം മൂലമാണ്.

12. ഒരു വസ്തു ദ്രവത്തിൽ മുങ്ങിയിരിക്കുമ്പോൾ അനുഭവപ്പെടുന്ന ബലമാണ് വിസ്ക്കസ് ബലം.

13. റോക്കറ്റ് വായുവിൽ ഉയർന്നുപോകുന്നതിന് പ്ലവക്ഷമബലം കാരണമാകു. ന്നു.

14. ഒരു വസ്തുവിന് സ്വയം അതിന്റെ നിശ്ചലാവസ്ഥയ്ക്കോ നേർരേഖാ സമ ചല നത്തിനോ മാറ്റം വരുത്താനുള്ള കഴിവല്ലായ്മയാണ് ജഡത്വം.

15. വിസ്കോസിറ്റി കൂടിയ പദാർത്ഥങ്ങളിൽ ഒന്നാണ് മണ്ണെണ്ണ.

16. പ്രകാശം സഞ്ചരിക്കുന്നത്ഒരു മാധ്യമത്തിൽ കൂടെയാണ്

17. നിർബാധപതനം കാരണം ലിഫ്റ്റിൽകൂടി താഴേക്ക് വരുമ്പോൾ ഭാരക്കുറവ് അനുഭവപ്പെടുന്നു.

18. ഒരു വസ്തുവിൽ അടങ്ങിയിരിക്കുന്ന പിണ്ഡത്തിന്റെ അളവാണ് മാസ്.

19. ഫ്ളെമിംങ്ങിന്റെ ഇടതുകൈ നിയമപ്രകാരം ചൂണ്ടുവിരൽ വൈദ്യുതപ്രവാ ഹ ദിശയും നടുവിരൽ കാന്തിക മണ്ഡലത്തിന്റെ ദിശയും തള്ളവിരൽ ചല നദിശയും ആയിരിക്കും.

20. μA എന്നതും mA എന്നതും വലിയ യൂണിറ്റുകളാണ്.

21. ഒരു മധ്യമത്തിലേക്ക് ലംബമായി പതിക്കുന്ന പകാശത്തിന്റെ പാതയ്ക്ക് വ്യതിയാനം സംഭവിക്കുന്നില്ല.

22. അപവർത്തന കോൺ 90^0 ആവുമ്പോൾ ഉള്ള ജലത്തിന്റെ പതനകോണളവ് 40^0 ആണ്.

23. ഭൂമധ്യരേഖയ്ക്കടുത്ത് വച്ച് മാസും ഭാരവും നിർണ്ണയിച്ച ഒരു വസ്തു ഭൂമി യുടെ ധ്രുവപ്രദേശത്ത് വച്ചപ്പോൾ വസ്തുവിന്റെ മാസ് മാറുന്നു, എന്നാൽ ഭാരം ഏറ്റവും കൂടുതലായി കാണപ്പെടുന്നു.

24. ഒരു ബാർകാന്തത്തിന്റെ ചുറ്റും കവചിത കമ്പിച്ചുരുൾ ചുറ്റിയെടുത്ത ഉപക രണമാണ് സോളിനോയിഡ്.

25. മുങ്ങിക്കിടക്കുന്ന ഒരു വസ്തുവിനെ ജലത്തിനുള്ളിൽ നിന്നും ഉയർത്തുമ്പോൾ അനുഭവപ്പെടുന്ന ബലമാണ് പ്രതലബലം.

26. മർദ്ദം പ്രയോഗിക്കുമ്പോൾ ദ്രാവകങ്ങളുടെ വ്യാപ്തം കുറയുന്നു.

27. ചലിക്കുന്ന വസ്തുക്കൾക്ക് മാസും പ്രവേഗവും സ്വാധീനിക്കുന്നത് കൊണ്ടാണ് പരസ്പരം ആഘാതമുണ്ടായാലും മാറ്റമില്ലാതെ തുടരുന്നത്.

28. തേനിനേക്കാൾ വേഗത്തിൽജലം ഒഴുകുന്നതിന്റെ കാരണം തേനിന് വിസ്കോസിറ്റി കൂടിയതുകൊണ്ടാണ്.

29. ഒരു വസ്തു ഭൂമിയുടെ പ്രതലത്തിൽ ആരം കൂടിയ ഭാഗത്ത് സ്ഥിതി ചെയ്യുമ്പോഴാണ് ആകർഷണബലം ഏറ്റവും കൂടുതൽ അനുഭവപ്പെടുന്നത്.

30. ഭൂമിയുടെ കേന്ദ്രത്തിൽ വസ്തുവിന് കുറഞ്ഞ ഭാരം അനുഭവപ്പെടുന്നു.

31. തഞ്ചാവൂർ പാവയെ എത്ര ചരിച്ചുകിടത്തിയാലും അത് നിവർന്നു വരുന്നത് ആ പാവ തുലനം ചെയ്ത് ഭാരം മുഴുവൻ കേന്ദ്രത്തിലേക്ക് കേന്ദ്രീകരിക്കുന്നത് കൊണ്ടാണ്.

32. പരസ്പരം ആകർഷിക്കപ്പെടുന്ന 2 വസ്തുക്കൾ തമ്മിലുള്ള ദൂരം രണ്ട് മടങ്ങാക്കിയാൽആകർഷണം നാലിലൊന്ന് മടങ്ങായി ലഭിക്കുന്നു.

33. ഒരു വസ്തു സ്ഥിരതുലനാവസ്ഥയിലായിരിക്കുമ്പോൾ വസ്തുവിന്റെ സ്ഥിതികോർജം കുറവായിരിക്കും.

34. പ്രകാശം ഒരു മാധ്യമത്തിലൂടെ കടന്നു പോകുമ്പോൾ ആ മാധ്യമം പ്രകാശത്തിന്റെ വേഗത്തെ എത്രത്തോളം സ്വാധീനിക്കുന്നു എന്നുള്ള അവസ്ഥയാണ് പ്രകാശിക സാന്ദ്രത.

35. പൊട്ടൻഷ്യൽ വ്യത്യാസം അളക്കുíതിനായി അമ്മീറ്റർ ഉപയോഗിക്കുന്നു.

36. കാന്തിക മണ്ഡലത്തിൽ സ്ഥിതിചെയ്യുന്ന വൈദ്യുത പ്രവാഹമുള്ള ചാലകത്തിനുമേൽ ഒരു ബലം അനുഭവപ്പെടുന്നു.

37. റോക്കറ്റ് വായുവിൽ ഉയർന്നു പൊങ്ങുന്നതിന് കേശികത്വം കാരണമാകുന്നു.

38. ഒരു വസ്തുവിനുണ്ടാകുന്ന ആക്കവ്യതിയാനത്തിന്റെ നിരക്ക് ആ വസ്തുവിൽ പ്രയോഗിക്കുന്ന അസന്തുലിത ബാഹ്യബലത്തിന് നേർഅനുപാതത്തിലായിരിക്കുന്ന അവസ്ഥയാണ് ജഡത്വം.

39. ദ്വാരമുള്ള ട്യൂബിനകത്ത് ജലം നിറച്ച് മർദ്ദം പ്രയോഗിക്കുമ്പോൾ ജലം എല്ലാ ദ്വാരങ്ങളിലൂടെയും ഒരുപോലെ പുറത്തേക്ക് ഒഴുകുന്നു.

40. ഭൂമിയുടെ ആരം കൂടിയ ഭാഗത്തെ ധ്രുവപ്രദേശം എന്നറിയപ്പെടുന്നു.

41. ഒരു വസ്തുവിലടങ്ങിയിരിക്കുന്ന ദ്രവത്തിന്റെ അളവാണ് ഭാരം.

42. പരസ്പരം ആകർഷിക്കുന്ന 2 വസ്തുക്കൾ തമ്മിലുള്ള ദൂരം രണ്ട് മടങ്ങാക്കിയാൽ ആകർഷണബലം 4 മടങ്ങായി മാറുന്നു.

43. പ്രകാശിക സാന്ദ്രത കുറഞ്ഞ മാധ്യമത്തിൽനിന്നും കൂടിയ മാധ്യമത്തിലേക്ക് പ്രകാശം ചരിഞ്ഞു പതിക്കുകയാണെങ്കിൽ അപവർത്തന രശ്മി ലംബത്തോട് അകലുന്നു.

44. ഒരു സെക്കന്റിൽ ചാലകത്തിൽ കൂടി ഒഴുകുന്ന വൈദ്യുതചാർജ്ജിന്റെ അളവാണ് കറന്റ്.

45. സോളിനോയിഡിന്റെ ദക്ഷിണധ്രുവം പ്രദക്ഷിണദിശയിൽ വൈദ്യുതി പ്രവഹിക്കുന്ന അഗ്രമായിരിക്കും.

46. ചോക്ക് ഉപയോഗിച്ച് ബ്ലാക്ക്ബോർഡിൽ വരയ്ക്കുമ്പോൾ ചോക്ക് കണങ്ങൾ ബ്ലാക്ക്ബോർഡിൽ പറ്റിപ്പിടിക്കുന്നത് പ്രതലബലം കാരണമാണ്.

47. വസ്തുവിന് ദ്രവത്തിലുണ്ടായ ഭാരക്കുറവാണ് പ്ലവക്ഷമബലം.

48. ഗുരുത്വാകർഷണം മൂലം ഉണ്ടാകുന്ന ത്വരണം വസ്തുവിന്റെ മാസിനെ ആശ്രയിച്ചിരിക്കുന്നു.

49. ഭാരം അളക്കുന്നതിന് ഏറ്റവും അനുയോജ്യമായ ഉപകരണമാണ് പൈക്നോമീറ്റർ.

50. ഗുരുത്വകേന്ദ്രത്തിൽ കൂടിയുള്ള ലംബരേഖ വസ്തുവിന്റെ കേന്ദ്രത്തിലൂടെ കടന്നു പോവുമ്പോൾ ഒരു സ്ഥിരതുലനാവസ്ഥ ഉണ്ടാവുന്നു.

51. പ്രകാശിക സാന്ദ്രത കൂടിയ മാധ്യമത്തിൽ നിന്ന് കുറഞ്ഞ മാധ്യമത്തിലേക്ക് ക്രിട്ടിക്കൽ കോണിനേക്കാൾ കൂടിയ പതനകോണിൽ പ്രകാശരശ്മി പതിക്കുമ്പോൾ ആ രശ്മി അപവർത്തനത്തിന് വിധേയമാകാതെ അതേ മാധ്യമത്തിലേക്ക് പതിക്കുന്നതാണ് അപവർത്തനം.

52. ദ്രാവകത്തിന്റെ സാന്ദ്രത കൂടുമ്പോൾ ആ ദ്രാവകത്തിന്റെ പ്ലവക്ഷമബലം കൂടുന്നു.

53. ജലം നിറച്ച ട്യൂബിനകത്ത് ഏതെങ്കിലും ഒരു ഭാഗത്ത് മർദ്ദം പ്രയോഗിക്കുമ്പോൾ ആ മർദ്ദം ട്യൂബിന്റെ ഒരു ഭാഗത്ത് മാത്രം അനുഭവപ്പെടുന്നു.

54. gയുടെ മൂല്യം ഭൂമിയിൽ എറ്റായിടത്തും ഒരുപോലെയാണ്.

55. രണ്ട്വസ്തുക്കൾ തമ്മിലുള്ള പരസ്പരാകർഷണ ബലമാണ് ഗുരുത്വാകർഷണ ബലം.

56. ഗുരുത്വകേന്ദ്രത്തിൽ കൂടിയുള്ള ലംബരേഖ വസ്തുവിന്റെ പാദത്തിലൂടെ കടന്നുപോവുമ്പോൾ ആ വസ്തു സ്ഥിര തുലനാവസ്ഥയിൽ നിലനിൽക്കുന്നു.

57. പതനകോൺ ക്രിട്ടിക്കൽകോണിനേക്കാൾ കൂടുതൽ ആവുമ്പോൾ പ്രകാശത്തിന് സംഭവിക്കുന്ന പ്രതിഭാസമാണ് പൂർണ്ണാന്തര പ്രതിഫലനം.

58. ദ്രാവകത്തിന്റെ പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്ന ഘടകങ്ങളാണ് വ്യാപ്തവും സാന്ദ്രതയും.

59. ഒരു ബിന്ദുവിന്റെ തുലനം ചെയ്ത ഭാരം വസ്തുവിൽ കേന്ദ്രീകരിക്കുമ്പോൾ വസ്തു സ്ഥിര തുലനാവസ്ഥയിൽ നിലനിൽക്കുന്നു.

6o. ആർക്കമെഡിസ് തത്ത്വപ്രകാരം, വസ്തു ദ്രവത്തിൽ മുങ്ങിയിരിക്കുമ്പോൾ അതിൽ അനുഭവപ്പെടുന്ന പ്ലവക്ഷമബലം വസ്തു ആദേശം ചെയ്യുന്ന ദ്രവത്തിന്റെ ഭാരത്തിന് തുല്യമായിരിക്കും.

Appendix VI

TEST OF MISCONCEPTION IN PHYSICS

(Draft)

FAROOK TRAINING COLLEGE

Mr. Nowfal. C
Assistant Professor

Shana P.V
M.Ed Student

Instructions

Read the given statements carefully and put a ✓ mark on the correct statement, ***X*** mark in the wrong statement. Each right answer carries one mark.

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1. Buoyancy is a reason that a ship floats on water.
2. The force felt in the electromagnetic field is not relative to the direction of electromagnetic field.
3. The unit of current in coulomb is _____.
4. The refractive index of glass is 1.5.
5. The flow of current is from lower electric potential to higher electric potential.
6. The potential energy should be greater if an object is stable.
7. The mass is measured by spring balance.
8. The rate of change of momentum is affected a body during the rotation of a giant wheel the body experience loss of weight or free fall.
9. The momentum of an object will be constant when the object is not applied an external force.
10. Honey has low viscous force than water.
11. The raising of hydrogen balloon in air is due to the buoyancy.
12. The force felt when a body is immersed in water is called viscous force.
13. The raising of rocket is due to the buoyancy.

14. Inertia is the ability of an object to change its state of rest or uniform motion in a straight line by itself.

15. Kerosene oil is one among which has high viscosity.

16. Light travels through a medium

17. During the rotation of a giant wheel, a body experiences loss of weight because of the free fall.

18. The total amount of matter is called mass.

19. According to Fleming's left hand rule, pointing finger is toward the direction of flow of electric current, middle finger towards the direction of magnetic field, and thumb towards the direction of motion of the conductor.

20. μA, mA are the macro units.

21. There will be no deviation takes place in the case of a light ray falling perpendicular on a medium.

22. The angle of incidence of water is 40º at which the angle of refraction becomes 90º.

23. There will be no change in the mass of an object when it is kept in a polar region whose mass and weight is determined equator region but the weight was more.

24. Solenoid is a cylindrical coil of wire acting as a magnet when electricity is carrying on it.

25. The force felt, when an immersed object is raised out is called surface tension.

26. When a pressure is applied in liquid, the volume will decrease.

27. The moving bodies are stable when they strike each other. It is because of the object depends on their mass and velocity.

28. Honey flows faster than water since the amount of viscosity of honey is greater than water.

29. The attractive force of the earth is greater when an object is placed where the radius of earth surface is large.

30. The weight of an object is less at the Centre of earth.

31. Tanjore doll retains its original position in whatever manner is kept because of the doll has a point at which the whole weight of the body concentrated at a point.

32. When the distance of 2 attracting object is 2 times, then the attracting force will be have 1/4 times.

33. When an object is in constant equilibrium state, then the potential energy will be less.

34. Optical density is a measure which shows how a medium influences the speed of light passing through it.

35. Ammeter is used to measure the potential difference

36. Conductor will have flow of electric current when placed in a magnetic field opposing a pressure in it.

37. The raising of rocket is due to the capillary.

38. Inertia is a condition when rate of change of momentum of an object is directly proportional to the unbalanced external force.

39. When a pressure exerted on a filled tube containing pores, then water flows equally through every pore.

40. The region of earth with greater radius is called polar region.

41. Weight is a measurement of matter containing in an object.

42. When the distance of 2 attracting object is 2 times, then the attracting force will be 4 times.

43. When light incidents obliquely, from a medium of lower optical density to that of higher optical density, the refracted ray deviates away from the normal.

44. The amount of electric charge flowing through a conductor is called current.

45. In solenoid if the current is flowing in clockwise direction, the end will be South Pole.

46. While writing on the blackboard with chalk, the particles of chalk will stick on the blackboard, is due to the surface tension.

47. The weight loss of an object in the matter is called buoyancy.

48. Acceleration formed due to gravitation depends on the mass of an object.

49. Pico meter is most suitable instrument used to measure the weight.

50. State of equilibrium is formed when perpendicular line with Centre of gravity passes through the center of an object.

51. When a ray of light passes from a medium of higher optical density to a medium of lower optical density at an angle of incidence greater than the

critical angle, the ray is reflected back to the same medium without undergoing refraction. This phenomenon is called Refraction.

52. When the density of liquid increases, the buoyancy also increases.

53. When pressure exerted on any side of a tube filled water, that pressure is felt on only one side of the tube.

54. The value of 'g' is constant everywhere on the earth.

55. The attractive force between two objects is called gravitational force.

56. When a perpendicular line of Centre of gravity passes through the base of an object retains its state of equilibrium.

57. When ray of incidence is greater than the critical cone of the light, the phenomenon is called total internal reflection.

58. The buoyancy of a liquid is influenced by volume and density of the liquid.

59. A body is stable when Centre of gravity of a body concentrates with the weight of the body.

60. According to Archimedes principle when an object is immersed in a liquid, the buoyancy experienced by it will be equal to the weight of the liquid displaced by it.

Appendix VII

TEST OF MISCONCEPTION IN PHYSICS

(Final)

FAROOK TRAINING COLLEGE

Mr. Nowfal. C
Assistant Professor

Shana P.V
M.Ed Student

നിർദ്ദേശങ്ങൾ

ചുവടെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകളെ ശ്രദ്ധയോടുകൂടി വായിച്ച് ശരിയായ പ്രസ്താവനയ്ക്ക് നേരെ ✓ മാർക്ക് തെറ്റായ പ്രസ്താവനയ്ക്ക് നേരെ X മാർക്കും രേഖപ്പെടുത്തുക.

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1. കാന്തിക മണ്ഡലത്തിൽ അനുഭവപ്പെടുന്ന ബലം കാന്തിക മണ്ഡല ത്തിന്റെ ദിശയുമായി ബന്ധപ്പെടുന്നില്ല.

2. കൂളോം കറന്റിന്റെ യൂണിറ്റാണ്.

3. ഗ്ലാസിന്റെ അപവർത്തനാങ്കം 1.5 ആകുന്നു.

4. ഇലക്ട്രിക്ക് പൊട്ടൻഷ്യൽ കുറഞ്ഞ ഭാഗത്ത് നിന്ന് കൂടിയ ഭാഗത്തേ ക്കാണ് കറന്റ് ഒഴുകുന്നത്.

5. ഒരു വസ്തു സ്ഥിരാവസ്ഥയിൽ ആയിരിക്കണമെങ്കിൽ ആ വസ്തുവി ന്റെ സ്ഥിതികോർജം കൂടുതലായിരിക്കണം.

6. സ്പ്രിംഗ് ത്രാസ് ഉപയോഗിച്ചാണ് മാസ് അളക്കുന്നത്.

7. ബാഹ്യബലം പ്രയോഗിക്കപ്പെടുന്നില്ല എങ്കിൽ വസ്തുവിന്റെ ആക്കം എപ്പോഴും സ്ഥിരമായിരിക്കും.

8. ജലത്തേക്കാൾ വിസ്ക്കസ് ബലം കുറഞ്ഞ വസ്തുവാണ് തേൻ.

9. ഹൈഡ്രജൻ നിറച്ച ബലൂൺ വായുവിൽ ഉയർന്നു പോകുന്നത് വാത കങ്ങളിൽ അനുഭവപ്പെടുന്ന പ്ലവക്ഷമബലം മൂലമാണ്.

10. ഒരു വസ്തു ദ്രവത്തിൽ മുങ്ങിയിരിക്കുമ്പോൾ അനുഭവപ്പെടുന്ന ബല മാണ് വിസ്ക്കസ് ബലം.

11. റോക്കറ്റ് വായുവിൽ ഉയർന്നുപോകുന്നതിന് പ്ലവക്ഷമബലം കാരണ മാകുന്നു.

12. ഒരു വസ്തുവിന് സ്വയം അതിന്റെ നിശ്ചലാവസ്ഥയ്ക്കോ നേർരേഖാ സമചലനത്തിനോ മാറ്റം വരുത്താനുള്ള കഴിവില്ലായ്മയാണ് ജഡത്വം.

13. വിസ്കോസിറ്റി കൂടിയ പദാർത്ഥങ്ങളിൽ ഒന്നാണ് മണ്ണെണ്ണ.

14. ഒരു വസ്തുവിൽ അടങ്ങിയിരിക്കുന്ന പിണ്ഡത്തിന്റെ അളവാണ് മാസ്.

15. ഫ്ളെമിംങ്ങിന്റെ ഇടതുകൈ നിയമപ്രകാരം ചൂണ്ടുവിരൽ വൈദ്യുത പ്രവാഹ ദിശയും നടുവിരൽ കാന്തിക മണ്ഡലത്തിന്റെ ദിശയും തള്ള വിരൽ ചലനദിശയും ആയിരിക്കും.

16. μA എന്നതും mA എന്നതും വലിയ യൂണിറ്റുകളാണ്.

17. ഒരു മധ്യമത്തിലേക്ക് ലംബമായി പതിക്കുന്ന പ്രകാശത്തിന്റെ പാതയ് ക്ക് വ്യതിയാനം സംഭവിക്കുന്നുണ്ട്.

18. ഭൂമധ്യരേഖയ്ക്കടുത്ത് വച്ച് മാസും ഭാരവും നിർണ്ണയിച്ച ഒരു വസ്തു ഭൂമിയുടെ ധ്രുവപ്രദേശത്ത് വച്ചപ്പോൾ വസ്തുവിന്റെ മാസ് മാറുന്നു, എന്നാൽ ഭാരം ഏറ്റവും കൂടുതലായി കാണപ്പെടുന്നു.

19. ഒരു ബാർകാന്തത്തിന്റെ ചുറ്റും കവചിത കമ്പിച്ചുരുൾ ചുറ്റിയെടുത്ത ഉപകരണമാണ് സോളിനോയിഡ്.

20. മുങ്ങിക്കിടക്കുന്ന ഒരു വസ്തുവിനെ ജലത്തിനുള്ളിൽ നിന്നും ഉയർ ത്തുമ്പോൾ അനുഭവപ്പെടുന്ന ബലമാണ് പ്രതലബലം.

21. ചലിക്കുന്ന വസ്തുക്കൾക്ക് മാസും പ്രവേഗവും സ്വാധീനിക്കുന്നത് കൊണ്ടാണ് പരസ്പരം ആഘാതമുണ്ടായാലും മാറ്റമില്ലാതെ തുട രുന്നത്.

22. തേനിനേക്കാൾ വേഗത്തിൽജലം ഒഴുകുന്നതിന്റെ കാരണം തേനിന് വിസ്കോസിറ്റി കൂടിയതുകൊണ്ടാണ്.

23. ഒരു വസ്തു ഭൂമിയുടെ പ്രതലത്തിൽ ആരം കൂടിയ ഭാഗത്ത് സ്ഥിതി ചെയ്യുമ്പോഴാണ് ആകർഷണബലം ഏറ്റവും കൂടുതൽ അനുഭവപ്പെടുന്നത്.

24. ഭൂമിയുടെ കേന്ദ്രത്തിൽ വസ്തുവിന് കുറഞ്ഞ ഭാരം അനുഭവപ്പെടുന്നു.

25. തഞ്ചാവൂർ പാവയെ എത്ര ചരിച്ചുകിടത്തിയാലും അത് നിവർന്നു വരുന്നത് ആ പാവ തുലനം ചെയ്ത് ഭാരം മുഴുവൻ കേന്ദ്രത്തിലേക്ക് കേന്ദ്രീകരിക്കുന്നത് കൊണ്ടാണ്.

26. പരസ്പരം ആകർഷിക്കപ്പെടുന്ന 2 വസ്തുക്കൾ തമ്മിലുള്ള ദൂരം രണ്ട് മടങ്ങാക്കിയാൽ ആകർഷണബലം നാലിലൊന്ന് മടങ്ങായി ലഭിക്കുന്നു.

27. ഒരു വസ്തു സ്ഥിരതുലനാവസ്ഥയിലായിരിക്കുമ്പോൾ വസ്തുവിന്റെ സ്ഥിതികോർജം കുറവായിരിക്കും.

28. കാന്തിക മണ്ഡലത്തിൽ സ്ഥിതിചെയ്യുന്ന വൈദ്യുത പ്രവാഹമുള്ള ചാലകത്തിനുമേൽഒരു ബലം അനുഭവപ്പെടുന്നു.

29. പ്രകാശം സഞ്ചരിക്കുന്നത് ഒരു മാധ്യമത്തിൽ കൂടിയാണ്.

30. ഒരു വസ്തുവിനുണ്ടാകുന്ന ആക്കവ്യതിയാനത്തിന്റെ നിരക്ക് ആ വസ്തുവിൽ പ്രയോഗിക്കുന്ന അസന്തുലിത ബാഹ്യബലത്തിന് നേർ അനുപാതത്തിലായിരിക്കുന്ന അവസ്ഥയാണ് ജഡത്വം.

31. ദ്വാരമുള്ള ട്യൂബിനകത്ത് ജലം നിറച്ച് മർദ്ദം പ്രയോഗിക്കുമ്പോൾ ജലം എല്ലാ ദ്വാരങ്ങളിലൂടെയും ഒരുപോലെ പുറത്തേക്ക് ഒഴുകുന്നു.

32. ഭൂമിയുടെ ആരം കൂടിയ ഭാഗത്തെ ധ്രുവപ്രദേശം എന്നറിയപ്പെടുന്നു.

33. ഒരു വസ്തുവിലടങ്ങിയിരിക്കുന്ന ദ്രവത്തിന്റെ അളവാണ് ഭാരം.

34. പരസ്പരം ആകർഷിക്കുന്ന 2 വസ്തുക്കൾ തമ്മിലുള്ള ദൂരം രണ്ട് മടങ്ങാക്കിയാൽ ആകർഷണബലം 4 മടങ്ങായി മാറുന്നു.

35. ഒരു സെക്കന്റിൽ ചാലകത്തിൽ കൂടി ഒഴുകുന്ന വൈദ്യുതചാർജ്ജിന്റെ അളവാണ് കറന്റ്.

36. സോളിനോയിഡിന്റെ ദക്ഷിണധ്രുവം പ്രദക്ഷിണദിശയിൽ വൈദ്യുതി പ്രവഹിക്കുന്നഅഗ്രമായിരിക്കും.

37. ചോക്ക് ഉപയോഗിച്ച് ബ്ലാക്ക്ബോർഡിൽ വരയ്ക്കുമ്പോൾ ചോക്ക് കണങ്ങൾ ബ്ലാക്ക്ബോർഡിൽ പറ്റിപ്പിടിക്കുന്നത് പ്രതലബലം കാരണമാണ്.

38. വസ്തുവിന് ദ്രവത്തിലുണ്ടായ ഭാരക്കുറവാണ് പ്ലവക്ഷമബലം.

39. ഗുരുത്വാകർഷണം മൂലം ഉണ്ടാകുന്ന ത്വരണം വസ്തുവിന്റെ മാസിനെ ആശ്രയിച്ചിരിക്കുന്നു.

40. ഭാരം അളക്കുന്നതിന് ഏറ്റവും അനുയോജ്യമായ ഉപകരണമാണ് പൈക്കോമീറ്റർ.

41. ഗുരുത്വകേന്ദ്രത്തിൽ കൂടിയുള്ള ലംബരേഖ വസ്തുവിന്റെ കേന്ദ്രത്തിലൂടെ കടന്നുപോവുമ്പോൾ ഒരു സ്ഥിരതുലനാവസ്ഥ ഉണ്ടാവുന്നു.

42. പ്രകാശിക സാന്ദ്രത കൂടിയ മാധ്യമത്തിൽ നിന്ന് കുറഞ്ഞ മാധ്യമത്തിലേക്ക് ക്രിട്ടിക്കൽ കോണിനേക്കാൾ കൂടിയ പതനകോണിൽ പ്രകാശ രശ്മി പതിക്കുമ്പോൾ ആ രശ്മി അപവർത്തനത്തിന് വിധേയമാകാതെ അതേ മാധ്യമത്തിലേക്ക് പതിക്കുന്നതാണ് അപവർത്തനം.

43. ദ്രാവകത്തിന്റെ സാന്ദ്രത കൂടുമ്പോൾ ആ ദ്രാവകത്തിന്റെ പ്ലവക്ഷമബലം കൂടുന്നു.

44. ജലം നിറച്ച ട്യൂബിനകത്ത് ഏതെങ്കിലും ഒരു ഭാഗത്ത് മർദ്ദം പ്രയോഗിക്കുമ്പോൾ ആ മർദ്ദം ട്യൂബിന്റെ ഒരു ഭാഗത്ത് മാത്രം അനുഭവപ്പെടുന്നു.

45. g യുടെ മൂല്യം ഭൂമിയിൽ എല്ലായിടത്തും ഒരുപോലെയാണ്.

46. രണ്ട്വസ്തുക്കൾ തമ്മിലുള്ള പരസ്പരാകർഷണ ബലമാണ് ഗുരുത്വാകർഷണ ബലം.

47. ഗുരുത്വകേന്ദ്രത്തിൽ കൂടിയുള്ള ലംബരേഖ വസ്തുവിന്റെ പാദത്തിലൂടെ കടന്നുപോവുമ്പോൾ ആ വസ്തു സ്ഥിര തുലനാവസ്ഥയിൽ നില നിൽക്കുന്നു.

48. പതനകോൺ ക്രിട്ടിക്കൽകോണിനേക്കാൾ കൂടുതൽ ആവുമ്പോൾ പ്രകാശത്തിന് സംഭവിക്കുന്ന പ്രതിഭാസമാണ് പൂർണ്ണാന്തര പ്രതിഫലനം.

49. ദ്രാവകത്തിന്റെ പ്ലവക്ഷമബലത്തെ സ്വാധീനിക്കുന്ന ഘടകങ്ങളാണ് വ്യാപ്തവും സാന്ദ്രതയും.

50. ഒരു ബിന്ദുവിന്റെ തുലനം ചെയ്ത ഭാരം വസ്തുവിൽ കേന്ദ്രീകരിക്കുമ്പോൾ വസ്തു സ്ഥിര തുലനാവസ്ഥയിൽ നിലനിൽക്കുന്നു.

APPENDIX VIII

TEST OF MISCONCEPTION IN PHYSICS

(Final)

FAROOK TRAINING COLLEGE

Mr. Nowfal. C
Assistant Professor

Shana P.V
M.Ed Student

Instructions

Read the given statements carefully and put a ✓ mark on the correct statement, ***X*** mark in the wrong statement. Each right answer carries one mark.

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1. The force felt in the electromagnetic field is not relative to the direction of electromagnetic field.
2. The unit of current in coulomb is _____.
3. The refractive index of glass is 1.5.
4. The flow of current is from lower electric potential to higher electric potential.
5. The potential energy should be greater if an object is stable.
6. The mass is measured by spring balance.
7. The momentum of an object will be constant when the object is not applied an external force.
8. Honey has low viscous force than water.
9. The raising of hydrogen balloon in air is due to the buoyancy.
10. The force felt when a body is immersed in water is called viscous force.
11. The raising of rocket is due to the buoyancy.
12. Inertia is the ability of an object to change its state of rest or uniform motion in a straight line by itself.
13. Kerosene oil is one among which has high viscosity.
14. The total amount of matter is called mass.

15. According to Fleming's left hand rule, pointing finger is toward the direction of flow of electric current, middle finger towards the direction of magnetic field, and thumb towards the direction of motion of the conductor.

16. μA, mA are the macro units.

17. There will be no deviation takes place in the case of a light ray falling perpendicular on a medium.

18. There will be no change in the mass of an object when it is kept in a polar region whose mass and weight is determined equator region but the weight was more.

19. Solenoid is a cylindrical coil of wire acting as a magnet when electricity is carrying on it.

20. The force felt, when an immersed object is raised out is called surface tension.

21. The moving bodies are stable when they strike each other. It is because of the object is depends on their mass and velocity.

22. Honey flows faster than water since the amount of viscosity of honey is greater than water.

23. The attractive force of the earth is greater when an object is placed where the radius of earth surface is large.

24. The weight of an object is less at the Centre of earth.

25. Tanjore doll retains its original position in whatever manner is kept because of the doll has a point at which the whole weight of the body concentrated at a point.

26. When the distance of 2 attracting object is 2 times, then the attracting force will be have 1/4 times.

27. When an object is in constant equilibrium state, then the potential energy will be less.

28. Conductor will have flow of electric current when placed in a magnetic field, opposing a pressure in it.

29. Light travels through a medium.

30. Inertia is a condition when rate of change of momentum of an object is directly proportional to the unbalanced external force.

31. When a pressure exerted on a filled tube containing pores, then water flows equally through every pore.

32. The region of earth with greater radius is called polar region.

33. Weight is a measurement of matter containing in an object.

34. When the distance of 2 attracting object is 2 times, then the attracting force will be 4 times.

35. The amount of electric charge flowing through a conductor is called current.

36. In solenoid if the current is flowing in clockwise direction, the end will be South Pole.

37. While writing on the blackboard with chalk, the particles of chalk will stick on the blackboard, is due to the surface tension.

38. The weight loss of an object in the matter is called buoyancy.

39. Acceleration formed due to gravitation depends on the mass of an object.

40. Pico meter is most suitable instrument used to measure the weight.

41. State of equilibrium is formed when perpendicular line with Centre of gravity passes through the center of an object.

42. When a ray of light passes from a medium of higher optical density to a medium of lower optical density at an angle of incidence greater than the critical angle, the ray is reflected back to the same medium without undergoing refraction. This phenomenon is called Refraction.

43. When the density of liquid increases, the buoyancy also increases.

44. When pressure exerted on any side of a tube filled water, that pressure is felt on only one side of the tube.

45. The value of ‘g’ is constant everywhere on the earth.

46. The attractive force between two objects is called gravitational force.

47. When a perpendicular line of Centre of gravity passes through the base of an object retains its state of equilibrium.

48. When ray of incidence is greater than the critical cone of the light, the phenomenon is called total internal reflection.

49. The buoyancy of a liquid is influenced by volume and density of the liquid.

50. A body is stable when Centre of gravity of a body concentrate with the weight of the body.

APPENDIX IX

TEST OF MISCONCEPTION IN PHYSICS

RESPONSE SHEET

Name of the student:

Name of the School:

Class :

Question No.	✓ or ×	Question No.	✓ or ×
1	☐	**26**	☐
2	☐	**27**	☐
3	☐	**28**	☐
4	☐	**29**	☐
5	☐	**30**	☐
6	☐	**31**	☐
7	☐	**32**	☐
8	☐	**33**	☐
9	☐	**34**	☐
10	☐	**35**	☐
11	☐	**36**	☐
12	☐	**37**	☐
13	☐	**38**	☐
14	☐	**39**	☐
15	☐	**40**	☐
16	☐	**41**	☐
17	☐	**42**	☐
18	☐	**43**	☐
19	☐	**44**	☐
20	☐	**45**	☐
21	☐	**46**	☐
22	☐	**47**	☐
23	☐	**48**	☐
24	☐	**49**	☐
25	☐	**50**	☐