

**EFFECT OF INNOVATIVE LOW-COST TEACHING LEARNING
MATERIAL IN TEACHING OF BASIC SCIENCE CONCEPT AT
UPPER PRIMARY LEVEL IN KRISHNAGIRI DISTRICT**

RESEARCH PROJECT REPORT



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DECLARATION

I **M. Mayilsamy**, Senior Lecturer, District Institute of Education and Training, Krishnagiri, Krishnagiri district declare that the research project entitled **“EFFECT OF INNOVATIVE LOW-COST TEACHING LEARNING MATERIAL IN TEACHING OF BASIC SCIENCE CONCEPT AT UPPER PRIMARY LEVEL IN KRISHNAGIRI DISTRICT”** is the bonafide record of the original research work and submitted to in partial fulfillment for the project of District Institute of Education and Training, Krishnagiri, Krishnagiri district is first hand research work carried out by me during the year 2023–2024. This report or part of this report has not been submitted earlier either to this Department or to any other Institution for the fulfillment of the requirement of a course of study or project or published/presented for any other purpose.

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CERTIFICATE

This is to certify that the research project titled “**EFFECT OF INNOVATIVE LOW COST TEACHING LEARNING MATERIAL IN TEACHING OF BASIC SCIENCE CONCEPT AT UPPER PRIMARY LEVEL IN KRISHNAGIRI DISTRICT**” is the bonafide record of the original research work carried out by **M.MAYILSAM Y** during the year 2023– 2024 and it has not been submitted earlier either to this Department or to any other Institution for the fulfillment of the requirement of a course of study or project or published/presented for any other purpose.

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M.Mayilsamy

Research Project Abstract

2023-2024

1. Name of the Investigator : **M.MAYILSAMY,**
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3. Title :

**EFFECTS OF INNOVATIVE LOW-COST TEACHING LEARNING
MATERIAL (ILCTLM) IN TEACHING OF BASIC SCIENCE CONCEPTS
AT UPPER PRIMARY LEVEL IN KRISHNAGIRI DISTRICT**

4. OBJECTIVES :

1. To identify the locally available resources that are available related to the science concepts.
2. To plan and develop suitable innovative low cost teaching learning material for Science teaching and learning.
3. To orient the teachers about the importance of innovative low cost materials preparation.
4. To find out the effect of innovative low cost material on students' performance after the training programme.
5. To compare performance of teachers before and after intervention.
6. To assess the impact of Innovative Low-Cost Teaching Learning Materials (ILCTLM) on students' academic performance
7. To examine the effectiveness of ILCTLM in enhancing students' understanding of basic science concepts
8. To gauge the level of engagement and interest among students using ILCTLM
9. To assess the perceptions and experiences of teachers regarding the use of ILCTLM

10. To identify any disparities in learning outcomes based on demographic factors

5. HYPOTHESES OF THE STUDY

1. The use of Innovative Low-Cost Teaching Learning Materials (ILCTLM) significantly enhances the comprehension and retention of basic science concepts among upper primary level in Krishnagiri District.
2. Teachers who incorporate ILCTLM in their instructional practices will report a positive perception of its effectiveness in facilitating better understanding of basic science concepts.
3. The introduction of ILCTLM in teaching basic science at the upper primary level will result in increased student engagement and interest in the learning process.
4. Students exposed to ILCTLM will demonstrate higher academic performance in basic science compared to those taught through traditional methods at the upper primary level in Krishnagiri District.
5. There is no significant difference in teaching effectiveness, student engagement, and learning outcomes between teachers who use ILTCM and those who do not use ILTCM in teaching Basic Science concepts at the upper primary level in Krishnagiri District.

6. METHODOLOGY

The researcher adopted to employ an experimental method to conduct the research.

Sample:

The researcher selected 50 teachers for the experimental group This assignment took place at the VII Science from 10 blocks in Krishnagiri district, where the

experimental groups were established. The researcher utilized purposive sampling techniques to carefully select the sample for this study.

Tool:

- Module
- Pre test post test questionnaire (Based on ILTCM) was used in this study

Data Analysis

The following statistical techniques are used in the present study

- Descriptive Analysis
- Differential Analysis
- ANOVA
- Effect Size

7. FINDINGS

- ❖ The post-test scores (79.56) were significantly higher than the pre-test scores (54.08) for ILTCM in teaching basic science concepts, showing a clear improvement in students' understanding.
- ❖ The effect size ($d=2.75$) indicates a large difference between pre-test and post-test scores, suggesting a substantial positive impact of ILTCM on students' learning outcomes.
- ❖ There's no significant difference in pre-test scores between male and female teachers regarding ILTCM in teaching basic science concepts.
- ❖ There's also no significant difference in post-test scores between male and female teachers regarding ILTCM in teaching basic science concepts.
- ❖ There's no significant difference in pre-test scores between rural and urban teachers regarding ILTCM in teaching basic science concepts.

❖ Similarly, there's no significant difference in post-test scores between rural and urban teachers regarding ILTCM in teaching basic science concepts.

❖ Teaching experience does not significantly affect pre-test scores for ILTCM in teaching basic science concepts.

Teaching experience also does not significantly affect post-test scores for ILTCM in teaching basic science concepts.

8. EDUCATIONAL IMPLICATIONS OF THE STUDY

▶ The study shows a significant difference between pre-test and post-test scores, indicating the effectiveness of using innovative and low-cost teaching materials in enhancing students' comprehension and learning outcomes in Basic Science at the upper primary level.

▶ Educators and policymakers are encouraged to integrate similar innovative teaching approaches and materials into the curriculum to improve the quality of science education at the primary level, based on the observed effectiveness of ILTCM.

▶ The calculated effect size ($d=2.75$) suggests a substantial impact of ILTCM on students' understanding, highlighting the potential of such interventions to bring about significant improvements in student learning.

9. SUGGESTION FOR FURTHER RESEARCH

1. Conduct longitudinal studies to assess the long-term impact of ILTCM on students' retention of Basic Science concepts.
2. Investigate the specific teaching strategies and instructional techniques associated with ILTCM that contribute significantly to improved learning outcomes.

3. Compare the effectiveness of ILTCM with other teaching methods or materials in teaching Basic Science concepts at the upper primary level.
4. Consider qualitative research methods such as interviews or observations to gain deeper insights into effective pedagogical practices related to ILTCM implementation.
5. Examine the scalability and sustainability of ILTCM implementation in larger educational contexts to inform policy and practice.

10. CONCLUSION:

- ▶ The study shows that ILTCM effectively enhances students' understanding of Basic Science concepts, as seen in the significant improvement in post-test scores compared to pre-test scores.
- ▶ Integrating innovative and cost-effective teaching materials like ILTCM is crucial for improving the quality of science education at the primary level.
- ▶ ILTCM is versatile and inclusive, benefiting students across different demographic backgrounds and teacher characteristics, as evidenced by non-significant differences based on gender, locality, and teaching experience.
- ▶ The study's findings have implications for educational practice and policy, suggesting that ILTCM can bridge learning gaps and enhance educational outcomes among primary school students.
- ▶ This study contributes to discussions on effective teaching strategies and emphasizes the importance of innovative approaches like ILTCM in enhancing education quality.



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CHAPTER-I

INTRODUCTION

1.1 INTRODUCTION

Indian Education Commission (1964-66) defined that education should be related to the life, needs, and aspirations of the people, thereby making it a powerful instrument of social, economic, and cultural transformation. Teacher is a very important part of education. Teacher is the custodian and architect of students' future. The future of every country is in the hand of teacher. Teachers play a vital role in fostering the intellectual and social development of children during their formative years. The education that teachers impart plays a key role in determining the future prospects of their students, whether in pre-schools or high schools or in private or public schools, teachers provide the tools and the environment for their students to develop into responsible adults. Teachers act as facilitators or coaches, using classroom presentations or individual instruction to help students learn and apply concepts in subjects such as science, mathematics, or English. They plan, evaluate, and assign lessons; prepare, administer, and grade tests; listen to oral presentations; and maintain classroom discipline. Teachers observe and evaluate students' performance and potential and increasingly are asked to use new assessment methods. For example, teachers may examine a portfolio of a student's artwork or writing in order to judge the student's overall progress. They then can provide additional assistance in areas in which a student needs help. Teachers also grade papers, prepare report cards, and meet with parents and school staff to discuss a student's academic progress or

personal problems. Many teachers use a “hands-on” approach that uses “props” or “manipulative” to help children understand abstract concepts solve problems, and develop critical thought processes. For example, they teach the concepts of numbers or of addition and subtraction by playing board games. As the children get older, teachers use more sophisticated materials, such as science apparatus, cameras, or computers. They also encourage collaboration in solving problems by having students work in groups to discuss and solve problems together. To be prepared for success later in life, students must be able to interact with others, adapt to new technology, and think through problems logically. It is the teacher, who has the privilege of shaping and mouldings the habits, interests, attitudes, sentiments, behaviour, and character of pupil.

Science plays an ever increasing role in the modern civilization. It is our primary duty to see that every individual should have at least an elementary knowledge of the scientific principles involved in everyday life. Teaching of science is not mere transaction of science based knowledge so as to load students’ mind with facts and figures. At elementary level, science is taught through theory as well as practical. All though, at higher education a part of science tends towards more abstract and theoretical, but at lower stage, experimentation and demonstrations are essential components for explaining many of the concepts. So often we say „Science is doing” because it is highly desirable to incorporate activities, supporting the theoretical teaching so as to leave a permanent impression of understanding. While teaching the topic, if the phenomenon is explained by doing an actual experiment makes teaching more

effective. Science has played a tremendous role in our lives during the last century and it now changing our entire existence in such important aspects of health/ communication, transformation power. To visualize what science has done for man, it is simply necessary to sit in a modern room and look around. Science is universal and so can be its benefits. Its material benefits are immense and far reaching industrialization of agriculture and release of nuclear energy, mention two examples- but even more profound is its contribution to culture.

Modern world is witnessing most revolutionary changes in science and technology. The meaning of education is given as bringing up or leading out or making manifest the inherent potentialities in a pupil. John Dewey speaking of education as that reconstruction or organization of experience which adds to the meaning of experience and which increases ability to direct the course of subsequent experience. Education proceeds from birth to death and the school is not the only agency that imparts education. Though the school exerts greater influence in educating the child, other social agencies like home, religion, press, radio, library, television etc, supplement its work. Education lays emphasis on the inculcation and fostering of scientific spirit, knowledge of scientific principles and factor and also framing scientific methods.

Innovative Low-Cost Teaching Learning Materials (ILCTLM) refer to educational resources and tools designed to facilitate effective teaching and learning experiences while maintaining affordability and accessibility. These materials aim to provide educators with innovative resources that enhance the quality of education, especially in contexts where financial constraints may limit

access to traditional teaching aids. ILCTLM encompasses a diverse range of tools, including low-cost experiments, interactive simulations, multimedia content, and hands-on activities that cater to the specific needs of learners at various educational levels. The development and implementation of ILCTLM represent a significant stride towards democratizing education, ensuring that even resource-constrained environments can benefit from engaging and effective teaching methods. These materials not only make learning more enjoyable and relatable but also contribute to fostering a deeper understanding of fundamental concepts, such as those in basic science, at the upper primary level.

In recent years, the integration of technology and innovative teaching methods has become pivotal in enhancing educational outcomes, particularly at the upper primary level where foundational concepts are laid for further academic pursuits. One notable development in this realm is the advent of Innovative Low-Cost Teaching Learning Materials (ILCTLM), which has emerged as a transformative tool in the teaching of basic science concepts. These materials, characterized by their affordability and ingenuity, offer a promising avenue for educators to engage students more effectively, fostering a dynamic and interactive learning environment. This introduction sets the stage for an exploration of the effects of ILCTLM on the teaching of basic science concepts, delving into its potential to revolutionize pedagogical approaches and contribute to the overall improvement of educational experiences at the upper primary level.

1.2 SCIENCE EDUCATION

Science education is a dynamic and essential component of a well-rounded academic curriculum, aiming to cultivate a deep understanding of the natural world, scientific processes, and critical thinking skills. Rooted in inquiry-based learning, science education encourages students to explore, question, and discover through hands-on experiments and real-world applications. It encompasses various disciplines such as biology, chemistry, physics, and earth sciences, fostering scientific literacy and equipping learners with the skills needed to analyze and solve complex problems. Beyond imparting foundational knowledge, effective science education instills a sense of wonder and curiosity about the world, preparing students for informed decision-making and engagement with the challenges and opportunities presented by an increasingly scientific and technological society. Moreover, science education plays a pivotal role in nurturing future scientists, innovators, and informed citizens who can contribute to the advancements and sustainability of our global community.

1.3 IMPORTANCE OF LEARNING BY DOING

Learning by doing, also known as experiential learning, holds immense importance in education across various levels. This pedagogical approach emphasizes active engagement and practical application of knowledge, offering a dynamic and effective learning experience. Several key aspects highlight the importance of learning by doing:

1. Active Engagement: Learning by doing encourages active participation in the learning process. Instead of passively receiving information, students engage with the subject matter through hands-on activities, experiments, and real-world applications. This active engagement enhances understanding and retention of concepts.

2. Practical Application: The approach emphasizes the practical application of knowledge in real-life situations. By applying theoretical concepts in practical scenarios, learners can bridge the gap between theory and practice, gaining a deeper and more meaningful understanding of the subject matter.

3. Critical Thinking Skills: Learning by doing fosters the development of critical thinking skills. Through problem-solving activities and hands-on projects, students learn to analyze situations, make decisions, and creatively solve problems. This skill set is invaluable in various aspects of life and future careers.

4. Retention of Information: Studies have shown that actively engaging with learning materials leads to better retention of information. When individuals participate in activities related to the subject matter, they are more likely to remember and understand the concepts over the long term.

5. Motivation and Interest: Learning by doing often sparks curiosity and interest in the subject matter. Hands-on activities make learning enjoyable and relevant, motivating students to explore topics further and take ownership of their education.

6. Skill Development: Beyond academic knowledge, learning by doing promotes the development of practical skills. Whether it's in the sciences, arts, or other

disciplines, hands-on experiences help students acquire skills that are applicable in real-world settings.

7. Teamwork and Collaboration: Many experiential learning activities involve collaboration with peers. Students learn to work effectively in teams, share ideas, and leverage each other's strengths. These interpersonal skills are crucial for success in both academic and professional environments.

8. Preparation for the Real World: Learning by doing prepares individuals for real-world challenges and situations. This approach aligns with the demands of a rapidly changing world, where adaptability and practical skills are often as important as theoretical knowledge.

In essence, learning by doing not only enhances academic learning but also cultivates skills and qualities that are essential for personal and professional success. It transforms education into a dynamic, interactive, and meaningful experience, laying the foundation for a lifelong love of learning.

1.4 THE AIMS AND OBJECTIVES OF SCIENCE TEACHING

Science teaching encompass a broad spectrum of goals that educators strive to achieve in the process of imparting scientific knowledge and fostering scientific literacy. These aims and objectives contribute to the overall development of students and their ability to understand, apply, and appreciate scientific principles. Here are some common aims and objectives of science teaching:

1. Cultivating Scientific Inquiry:

To foster a sense of curiosity, exploration, and inquiry in students.

Encourage students to ask questions, form hypotheses, and conduct investigations. Develop critical thinking skills and the ability to analyze and solve problems.

2. Developing Scientific Literacy:

To equip students with a foundational understanding of key scientific concepts.

Ensure students grasp fundamental principles in various branches of science.

Promote the ability to interpret scientific information, including graphs, charts, and scientific literature.

3. Encouraging Practical Skills:

To develop hands-on skills and the ability to apply scientific methods.

Provide opportunities for practical experiments and demonstrations. Enable students to use laboratory equipment, make observations, and draw conclusions from experimental data.

4. Fostering a Sense of Wonder and Appreciation:

To instill an appreciation for the natural world and the wonders of science.

Engage students with awe-inspiring phenomena. Connect scientific principles to real-world examples to highlight the relevance of science in everyday life.

5. Promoting Scientific Communication:

To develop effective communication skills in conveying scientific ideas.

Encourage students to articulate their thoughts, findings, and conclusions clearly and concisely. Emphasize the importance of written and oral communication in the scientific community.

6. Nurturing Ethical and Responsible Conduct:

To instill ethical values and responsible behavior in scientific practices.

Discuss the ethical implications of scientific research. Emphasize honesty, integrity, and responsible use of scientific knowledge.

7. Enhancing Problem-Solving Skills:

To equip students with the ability to solve problems using scientific methods.

Provide challenging problems that require critical thinking and application of scientific principles. Develop the capacity to approach complex issues systematically.

8. Facilitating Interdisciplinary Connections:

To help students recognize the interconnectedness of scientific disciplines.

Integrate concepts from different branches of science. Illustrate how scientific knowledge can be applied collaboratively to address multifaceted challenges.

9. Building a Foundation for Lifelong Learning:

To lay the groundwork for a continued interest in and pursuit of scientific knowledge.

Inspire a love for learning by demonstrating the dynamic and evolving nature of science. Encourage students to stay curious and open-minded throughout their lives.

In summary, the aims and objectives of science teaching encompass not only the transfer of scientific knowledge but also the development of critical skills, ethical values, and a lifelong appreciation for the scientific method and its applications.

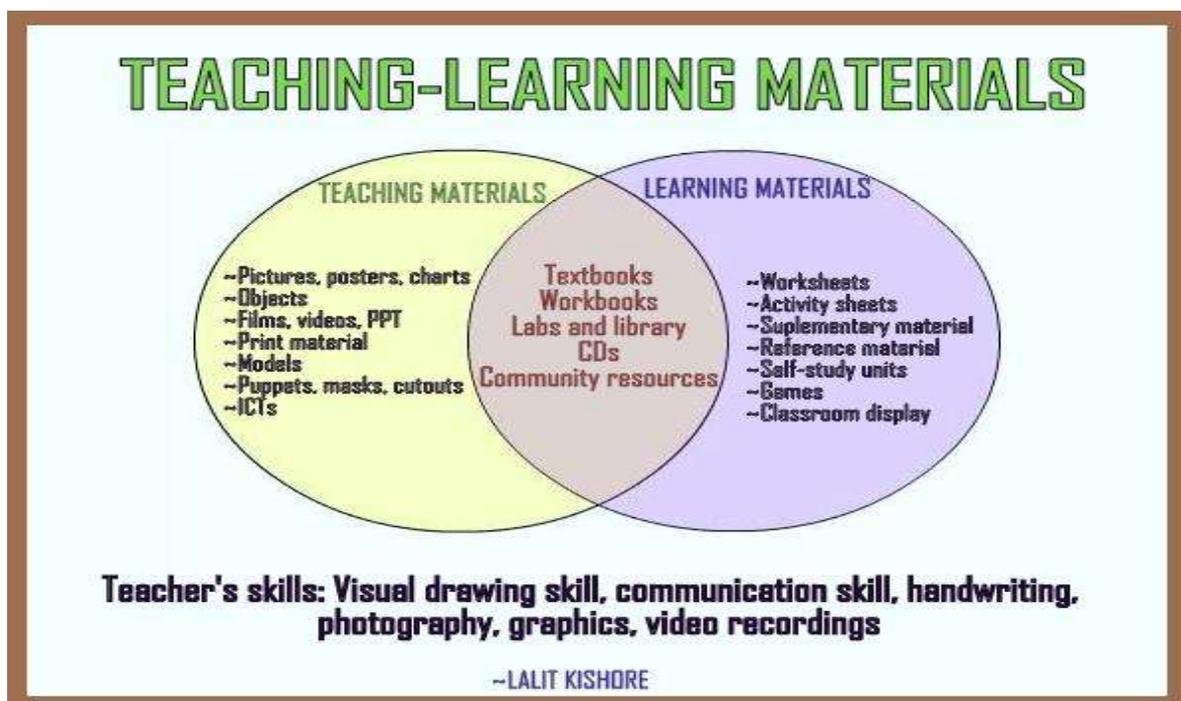
1.5 TEACHING LEARNING MATERIAL

Teachers can make their classes really intriguing and more significant for the students by utilizing a few articles or materials to help their verbal depictions. Utilizing an enormous assortment of materials is found to improve comprehension of ideas and to make learning seriously fascinating. Teaching-learning material is also called Instructional material or Teaching Aids.

Today, with the emphasis on learning in a student-focused methodology, students need an ever-increasing number of materials to improve their ability to learn together or independently. 'TLM' becomes fundamental to having a superior comprehension of the nature of the subject matter.

1.6 TYPES OF TEACHING-LEARNING MATERIAL

Here are the types of teaching-learning material and aids to facilitate learning for kids:



Source: U4Uvoice.com

- **Visuals Aids:** Blackboard, Posters, Flashcards, Presentations, Printed textbooks, Graphs and Infographics
- **Audio Aids:** Radio, Tape-recorder and CDs
- **Audio-visual aids:** Videos, Video recordings, Films and Documentaries, Virtual Classrooms
- **Language Laboratory**
- **Computer-Assisted Learning:** Pre-recorded DVDs, CDs, online quizzes, ebooks, podcasts and blogs

1.7 NEED TEACHING-LEARNING MATERIAL

Given below are reasons why Teaching-Learning Material is crucial to learning:

- Learning new ideas becomes simpler if the student is given recognizable materials linked with the subject matter
- Typically little children are drawn to objects of various tones and measures and show their interest in controlling these in different manners which when fed cautiously assists with fostering a propensity for playing with an assortment of articles. This aids in upgrading their creativity.
- TLMs are required for compelling self-learning. With the utilization of proper materials, one can learn on their own with absolute power over their speed of learning.
- By utilizing Teaching Learning Materials, teachers turn amicable; a cordial environment is constructed which significantly helps in learning.

1.8 CHARACTERISTICS OF GOOD TLM

Given below are a few attributes of good Teaching Learning Material:

- The TLMs should be appealing to the kids. Size, shading (multicolour or splendid or engaging shading blend), development (like moving toys) and in a few cases the smell or/and taste or sound are a portion of the properties of the materials that allure students.
- Familiarity with TLMs will assist with presenting new ideas. The kids can likewise control these materials easily for significant learning of new ideas.
- The novelty of the material additionally draws in the kids. Surprising materials or novel use of natural materials are the appealing highlights of good TLMs.
- The material ought to have utilitarian worth. It is the appropriate utilization that makes the material positive or negative.
- Materials of numerous utilities like dice, sticks, marbles, 3D shapes and blaze cards can have numerous utilizations in practically all branches of knowledge of primary school educational plans and are subsequently more popular as TLMs in the schools.
- The simplicity of taking care of the materials which incorporate toughness, lightweight, and well-being (innocuous for use by kids) is a significant trademark for which such materials are liked in the educating learning measure.

1.9 PURPOSE OF USING TLMS

TLMS are used to enhance the learning of students in classrooms. A teacher uses it to make teaching-learning effective. TLMS also help learners achieve the learning outcomes after classroom teaching and learning. Some of reasons to use TLMS in classroom are of various types as described below:

- i) **Motivate learners** – Capturing attention is the first step to any learning and TLMS help in capturing the attention of learner in classroom. Once motivated to look at TLMS, the children are curious to learn new things. TLMS provide a variety of stimuli, which helps in making classroom teaching most effective.
- ii) **Help in longer retention of information** – The more the number of sensory channels involved in interacting with TLMS, the longer will be the retention of information. Therefore, the learning will be effective and will last long.
- iii) **Facilitate holistic learning** – You have read about Blooms –Taxonomy of Objectives. Learning objectives to be achieved through classroom teaching are in all domains- cognitive, affective and psychomotor. Therefore, to achieve varied objectives, varied learning experiences need to be provided, which can be done through the use of TLMS.
- iv) **Help in organizing classroom teaching** –As a teacher you need to organize learning experiences, making them as realistic as possible. You can use visual or verbal TLMS to present accurate data in sequentially

organized manner. This helps teacher to verbal and visual communication in classroom

- v) **Facilitate change in attitude** – TLMs also help in changing attitude of learners towards learning in general and subject content in particular. Pictures, models and other TLMs help in inculcation of positive attitude of learners.
- vi) **Practical applications** – TLMs show application of theoretical knowledge into practical applications. The theoretical knowledge studied in class is shown in concrete form through TLMs for effective learning.
- vii) **Making learning fun** – TLMs help in making learning fun in the classroom. Students enjoy the novelty of handling new objects and learn new concepts through them.
- viii) **Concept formation** – TLMs facilitate the formation and attainment of concepts among children. They concretize the abstract concepts; thus children are able to understand them and not resort to rote learning.

1.10 LOW COST TEACHING AIDS

Low cost teaching aid refers to aid prepared with simple materials costing very little by involving teacher and student. In expensive aid could be prepared easily with little or no money to make learning effective, comprehensive and fascinating. The science teacher with a certain amount of skill and enthusiasm can replace many pieces of apparatus by an adequate if unconventional, improvised substitutes. Low cost teaching aids have an advantage of offering learning by doing approach to the teaching learning process. When teachers and

students plan, produce or create their own educational materials, they invariably manifest pride and pleasure in utilizing them to the maximum. Effective science teaching depends on three factors, teacher, equipments and materials. Locally produced low cost equipment, teaching aids or models can serve the needs of the teacher, the student and the curriculum more effectively and is easier to maintain.

1.11 THE IMPORTANCE OF LOW-COST TEACHING MATERIALS

The importance of low-cost teaching materials in education is significant, particularly in environments where financial constraints may limit access to traditional, more expensive resources. Here are several reasons highlighting the importance of low-cost teaching materials:

1. Accessibility and Inclusivity:

Low-cost teaching materials make educational resources more accessible to a wider audience, promoting inclusivity. This is especially crucial in regions or communities with limited financial resources, ensuring that quality education is available to all.

2. Equitable Education:

By reducing the economic barriers to access, low-cost teaching materials contribute to a more equitable education system. Students from diverse socio-economic backgrounds can benefit equally, fostering a more level playing field in the learning environment.

3. Sustainability:

Low-cost teaching materials often leverage readily available and sustainable resources, contributing to environmental sustainability. This aligns with the principles of responsible resource management and encourages a more eco-friendly approach to education.

4. Innovation and Creativity:

Limited budgets necessitate creative solutions, prompting educators to innovate with low-cost materials. This fosters a culture of creativity and resourcefulness, encouraging educators to find novel ways to engage students without relying solely on expensive resources.

5. Adaptability to Local Contexts:

Low-cost teaching materials can be designed to cater to the specific needs and contexts of local communities. They can incorporate culturally relevant examples, making the learning experience more relatable and meaningful for students.

6. Encourages Teacher Ingenuity:

Teachers are often prompted to develop their own teaching materials when faced with budget constraints. This encourages teacher ingenuity, as they tailor materials to suit the unique needs and learning styles of their students.

7. Affordability for Institutions:

Educational institutions benefit from cost savings when utilizing low-cost teaching materials. This allows for the allocation of resources to other critical

aspects of education, such as teacher training, infrastructure development, and technology integration.

8. Scalability:

Low-cost teaching materials are often scalable, meaning they can be replicated and implemented on a larger scale without incurring significant financial burdens. This scalability contributes to the widespread dissemination of effective teaching resources.

9. Promotion of Lifelong Learning:

The use of affordable teaching materials can instill a mindset of resourcefulness and adaptability in students. It teaches them that learning doesn't require expensive tools, fostering a lifelong love for learning regardless of available resources.

10. Global Education Initiatives:

In the context of global education initiatives and outreach programs, low-cost teaching materials become essential in reaching remote or underserved communities. They enable educational interventions even in areas with limited infrastructure and resources.

The importance of low-cost teaching materials lies in their ability to democratize education, making it more accessible, sustainable, and adaptable to diverse learning environments. These materials empower educators and learners to thrive even in resource-constrained settings, reinforcing the notion that quality education should be a fundamental right for all.

1.12 ADVANTAGES OF LOW COST TEACHING AIDS

Improvisation and experimentation play a major role in the success of science teaching.

- ❖ It helps to have more knowledge and understanding
- ❖ Improvisation makes science doing instead of talking
- ❖ It promotes pupils maximum participation in the learning process
- ❖ Improvisation ensures longer retention of the information gained
- ❖ It provides firsthand experience in a variety of ways
- ❖ Develops scientific attitude in children
- ❖ Cultivates research mindedness in children
- ❖ Promotes interaction between teachers and students
- ❖ Promotes interaction among students
- ❖ Improvisation generally add an interest and involvement in the lesson
- ❖ Encourage co-operative attitude in children
- ❖ Develops self confidence of pupils
- ❖ Helps the students to make use of their leisure time
- ❖ Helps the school to become self sufficient
- ❖ With the help of the improvised aids the presentation of the content will also be attractive and stimulating
- ❖ It also facilitates the propagation of new curricular ideas
- ❖ It helps to improve efficiency
- ❖ It accelerates the rate of learning and increases the span of retention

- ❖ Learning experiences appealing to the senses are far more effective than abstract learning experiences.

1.13 CLASSIFICATION OF LOW-COST MATERIALS

There are different ways of classifying and categorizing low-cost materials. For instance, UNESCO (1) identified the following five ways: i. The available materials in the natural environment as well as scraps/discards from commercial and domestic use. They may be freely and easily available. Typical examples are seeds, shells, bottle caps, packing materials, fused bulbs, etc

The available materials which are easily accessible in the environment but the purchase of which could be within the reach of the schools. Examples in this category could be battery, bulb, wire, etc. iii. The available examples of prototype materials prepared by teachers and specialist for possible wider dissemination. Examples are charts, periodic tables, simple models or kits which are either distributed by government agencies or sold commercially. iv. Educational materials which need the use of machines. Films, slides and film-strips require projectors. Audio tape requires a tape recorder. v. Materials such as radio programs, television programs, videotapes and films which most often are made for wider utilization to justify the high cost. The use of these materials in the classroom depends largely on the teacher's skill and competence.

1.14 INNOVATIVE LOW-COST TEACHING LEARNING MATERIAL (ILCTLM) IN TEACHING

In the realm of education, Innovative Low-Cost Teaching Learning Materials (ILCTLM) represent a transformative approach to teaching that combines innovation and affordability. These materials encompass a wide array of tools and resources designed to enhance the learning experience without imposing financial burdens on educators or institutions. ILCTLM includes inventive solutions such as low-cost experiments, interactive simulations, digital platforms, and repurposed everyday materials that engage students in active learning. By leveraging creative and cost-effective teaching methods, ILCTLM addresses accessibility challenges, particularly in resource-constrained environments, fostering a dynamic and inclusive educational experience. This approach not only stimulates student interest through hands-on and interactive activities but also underscores the adaptability and resourcefulness of educators in delivering effective and impactful lessons. Ultimately, ILCTLM embodies a commitment to making quality education more accessible and innovative, laying the foundation for a more equitable and engaging learning environment.

1.15 DEVELOPING LOW-COST TEACHING MATERIALS

Main task of the teacher is to develop low cost teaching materials by using locally available materials. The teacher should be the active participant in preparing the low cost teaching aids. Teacher by himself or with the help of students may carry out the process.

To design the effective low cost teaching material, teacher should have thorough knowledge of the objectives and science concepts. The teachers should have adequate knowledge to provide learning experiences, locally available resources and environmental conditions.

To enhance the learning process, the science teachers who have real interest in the field prepare their own teaching aids with the help of available resources. By sufficient encouragement from the superiors, parents and the community, the quality and effectiveness of these low cost teaching aids may be improved.

1.16 NEED AND SIGNIFICANCE OF THE STUDY

The study on the effects of Innovative Low-Cost Teaching Learning Materials (ILCTLM) in the teaching of basic science concepts at the upper primary level addresses a critical need in the field of education. The use of innovative and cost-effective teaching materials is essential to enhance the learning experience of students, especially in resource-constrained environments. Traditional teaching methods often rely on conventional materials that may not capture the attention of students or facilitate a deeper understanding of scientific concepts. By exploring the impact of ILCTLM on the teaching of basic science, the study aims to contribute valuable insights into effective and economical strategies for improving science education at the upper primary level.

The significance of this study lies in its potential to inform educational practices and policies, particularly in regions where financial constraints limit the availability of high-quality teaching materials. If the research demonstrates

positive outcomes associated with the use of ILCTLM, it could advocate for the wider adoption of such materials, promoting a more interactive and engaging learning environment for students. Additionally, the study's findings may serve as a basis for curriculum development and teacher training programs, helping educators integrate innovative and cost-effective teaching materials into their instructional strategies. Ultimately, the research contributes to the ongoing efforts to enhance the quality of science education at the upper primary level, fostering a foundation for students to develop a strong interest and proficiency in scientific concepts.

1.17 SCOPE OF THE STUDY

The scope of the study on the Effect of Innovative Low-cost Teaching Learning Materials (ILTCM) in Teaching of Basic Science concepts at upper primary level teachers in Krishnagiri District encompasses several key aspects. Firstly, it involves assessing the impact of ILTCM on teaching methods, student engagement, and learning outcomes in Basic Science. Secondly, the study aims to explore the experiences, perceptions, and challenges faced by teachers in integrating ILTCM into their instructional practices. Additionally, it seeks to identify the effectiveness, scalability, and sustainability of ILTCM as a cost-effective approach in improving science education. The scope also includes providing practical recommendations and insights for policymakers, educators, and stakeholders to enhance the implementation of ILTCM in science classrooms at the upper primary level in Krishnagiri District.

1.18 STATEMENT OF THE PROBLEM

The study addresses the critical problem of the inadequacy of teaching materials in the context of basic science education at the upper primary level. In many educational settings, there is a notable scarcity of engaging and affordable teaching learning materials, hindering the effective communication and comprehension of fundamental science concepts. Traditional methods often rely on standard textbooks and minimal visual aids, failing to cater to diverse learning styles and impeding students' ability to grasp abstract scientific ideas. This lack of resources can contribute to disinterest and a limited understanding of basic science, potentially hindering students' academic progress and inhibiting their pursuit of scientific knowledge. Consequently, the study seeks to investigate the potential alleviation of this problem through the introduction of Innovative Low-Cost Teaching Learning Materials (ILCTLM), aiming to determine their efficacy in enhancing the teaching and learning of basic science concepts at the upper primary level.

1.19 OPERATIONAL DEFINITION OF KEY TERMS

Innovative Low-Cost Teaching Learning Materials (ILCTLM):

For the purpose of this study in Krishnagiri District, ILCTLM refers to creative, novel, and economically viable instructional resources specifically designed to facilitate the teaching and learning of basic science concepts at the upper primary level. These materials may include but are not limited to interactive modules, visual aids, educational games, and low-cost technological

tools tailored to enhance the delivery of science education in a resource-efficient manner.

Teaching of Basic Science Concepts at Upper Primary Level:

In the context of this study, teaching of basic science concepts at the upper primary level pertains to the educational activities, strategies, and methodologies employed by educators to impart fundamental scientific principles and knowledge to students in grades five through eight. It encompasses the instructional techniques used to convey concepts in subjects such as physics, chemistry, biology, and environmental science, with a focus on the foundational understanding of scientific principles applicable to the upper primary curriculum.

Krishnagiri District:

In this study, Krishnagiri District refers to the specific geographical region located in the Indian state of Tamil Nadu. The operational definition includes all schools, teachers, and students within the administrative boundaries of Krishnagiri District, ensuring a localized and context-specific examination of the effects of ILCTLM on the teaching of basic science concepts at the upper primary level.

1.20 OBJECTIVES OF THE STUDY

1. To identify the locally available resources that are available related to the science concepts.
2. To plan and develop suitable innovative low cost teaching learning material for Science teaching and learning.

3. To orient the teachers about the importance of innovative low cost materials preparation.
4. To find out the effect of innovative low cost material on students' performance after the training programme.
5. To compare performance of teachers before and after intervention.
6. To assess the impact of Innovative Low-Cost Teaching Learning Materials (ILCTLM) on students' academic performance
7. To examine the effectiveness of ILCTLM in enhancing students' understanding of basic science concepts
8. To gauge the level of engagement and interest among students using ILCTLM
9. To assess the perceptions and experiences of teachers regarding the use of ILCTLM
10. To identify any disparities in learning outcomes based on demographic factors

1.21 CHAPTERISATION

The study's report has been organized into five chapters, each focusing on specific aspects of the research.

Chapter One serves as an introduction, addressing the study's need, significance, statement of the problem, key term definitions, objectives and the report's overall structure.

Chapter Two delves into related literature and studies, encompassing Low-Cost Teaching Learning Material (**ILCTLM**)

Chapter three outlines the methodology employed in the study, research method, sample of the study, tools used, description, tool administration, procedure, and statistical techniques used.

Chapter Four is dedicated to data organization, compilation, analysis, and interpretation.

Chapter five summarizes the findings of the study and draws conclusions. It also addresses the educational implications of the research and suggests avenues for further studies.

1.22 CONCLUSION

In conclusion, the first chapter has laid the foundation for a comprehensive exploration into the effects of Innovative Low-Cost Teaching Learning Materials (ILCTLM) on the teaching of basic science concepts at the upper primary level in Krishnagiri District. The identification of the problem underscores the pressing need for enhanced teaching materials in the region, particularly those that are both innovative and cost-effective. The operational definitions have clarified the key terms, ensuring a precise understanding of ILCTLM, the teaching of basic science concepts, and the specific context of Krishnagiri District. The objectives established for this study provide a roadmap for investigating the impact, effectiveness, and perceptions surrounding the integration of ILCTLM, laying the groundwork for subsequent chapters to delve into the empirical research and analysis. As the study progresses, it will contribute valuable insights to the field of science education and inform potential

strategies for improving the quality of teaching and learning in upper primary schools within Krishnagiri District.

CHAPTER-II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

A review of relevant studies provides the theoretical basis and analytical framework underpinning the study. An important part of any research is thorough knowledge of the field of study and familiarity with other research in the same or related fields. Knowledge of relevant research helps researchers understand which aspects of a chosen problem domain have been previously studied and how much work has been done in that area. It helps researchers identify methodological techniques used to examine similar phenomena and identify conflicting results.

A review of related studies is an essential part of any research. Knowledge of relevant research helps the investigator define the boundaries of research. A review of relevant literature puts the researcher in a better position to interpret the significance of his own results. According to Best and Kahn (2007), "recognized authoritative works and summaries of prior research provide evidence that researchers are familiar with the known as well as the unknown and unexplored."

In this chapter, an attempt is made to review academic encyclopaedias, academic studies, academic journals, academic year books, research articles and all research abstracts related to the present study.

2.2 PURPOSE OF REVIEW OF LITERATURE

1. It is the basis of most research projects in various sciences and humanities.
It forms the foundation upon which all future work is built.
2. It presents ideas, theories, explanations, hypotheses or research methods, valuable and formulating and studying the problem.
3. It enables him to know the means of reaching the frontier in his field of research, it provides him with indispensable suggestions of comparative data, good practices, possible methods and tried techniques.
4. It helps to find comparative data useful in interpretation of results.
5. It helps to know in detail about all related research projects which are in progress but not yet completed or announced.
6. It contributes to the general scholarship of the investigator.

2.3 RELATED STUDIES

Emery Ncutinamagara (2023) investigated Impact of Using Low-cost Materials for Effective Teaching and Learning Chemistry at Lower Secondary Schools in Rwanda. The purpose of the study was to assess the impact of using low-cost materials for effective teaching and learning chemistry in lower secondary schools. The study was guided by one objective which was: To determine the effectiveness of using low-cost materials on learners' academic performance in teaching and learning Acids, Bases, and pH at lower secondary schools. The study included a sample of Senior One chemistry students from four schools and four teachers from Ngoma District of Rwanda.

Using a quasi-experimental research design, these students were divided into control group (n = 58) and experimental groups (n = 56). Students in the experimental group received treatment utilizing low-cost materials in chemistry lessons. In contrast, in the control group, students were taught via traditional methods, where they utilized textbooks. The data were analysed using the Statistical Package for Social Sciences (SPSS). The results showed that students in the experimental group who were given instruction utilizing low-cost materials in lessons outperformed those in the control group in the academic achievement test with a high effect size. Therefore, using low-cost materials may improve students' achievement.

O'Donoghue, J.; Fitzsimmons, L.(2022) conducted a study on Simplified Low-Cost LED Nephelometer and Turbidity Experiments for Practical Teaching This work describes the design and testing of a low-cost light-emitting diode (LED)-based nephelometer for turbidity analysis. It also describes the use of this nephelometer for context-based learning (CBL) experiments designed for teaching laboratories. The LED nephelometer is simple, low-cost, and robust, providing similar results as a commercial device. Data collection and analysis is quick and intuitive, allowing time and opportunity for discussion about the analytical process and the chemistry involved. The experiments described here are based on real-world applications to emphasize the usefulness of chemical analysis and quantification of turbidity in everyday life.

Dr. Wajiha Kanwal, Sidra Shahid, Dr. Farkhanda Jabeen (2022)

investigated Effectiveness of Low Cost Material to Teach Science at Primary Level The main objective of the study was to develop the interest and conceptual knowledge about science in students. For this purpose, the ‘Low-Cost Material’ concept was taught to the students using different instructional aids. The study was quantitative in nature. Experimental research design was used to check the effectiveness of low-cost material to teach science at the primary level, which were measured through pre and post-test. An action research was conducted in a public sector high school in Rawalpindi. Students of 4th grade were selected to conduct the study. Intervention was carried for one whole week. Pre-test and post-test were taken to collect data, and the collected data was analyzed using mean and t-test. The study found a significant difference between teaching of science through use of “low-cost material” and without using it. The students, when taught science by using “low-cost material, “performed significantly high on the post-test. It was concluded that using low-cost material to teach science positively affected students’ learning. The study will act as a model and guideline for science teachers at primary level to make their teaching more effective by using “low-cost material” as AV aids during science lessons. This will contribute to better science teaching in schools with low or no resources for science teaching

Reynolds, Olivia May; Khan, Aminul Islam; et.al. (2022) made a research on Development and Implementation of a Low-Cost Desktop Learning Module for Double Pipe Heat Exchange The development, testing,

and classroom implementation of a low-cost, reproducible, desktop sized, highly visual double-pipe heat exchanger are presented. Quantitative measurements with the module reveal its usefulness for demonstrating basic and advanced convective heat transfer theory while worksheet-guided inquiries promote student engagement. Results from students' conceptual and motivational assessments show the module and associated activities improve student conceptual understanding and student confidence and engagement.

Kok, Renee; Bonk, Curtis; Woo, Mei Teng; Lee, Jimmy (2022)
caried out Actionable Framework in Producing High-Impact, Low-Cost Instructor-Made-Videos for E-Learning Instructor-made-videos (IMVs) are often used to foster learning in higher education. However, there is a dearth of studies on IMVs for any instructor to understand and replicate the success. In response, to better inform practice, the impact of IMVs on learning effectiveness and satisfaction was evaluated. Thereafter, an actionable framework describing the pedagogical innovation was produced. In this study, an experimental research design was employed to determine the impact of IMVs by comparing three lessons on health, ethics, and law; with and without IMVs, followed by a survey questionnaire. This study was conducted with 121 polytechnic students who were randomly assigned to a control group (N=50) or an experimental group (N=71) of five classes. Students exposed to IMVs outperformed the control group on quiz scores when IMVs were used to scaffold learning and were more satisfied. These findings validate the

actionable 6Ps IMVs design framework in producing high pedagogical value IMVs in a nimble manner.

Aranguren, Patricia; Sánchez, Daniel; Casi, Álvaro; Araiz, Miguel; Catalán, Leyre (2022) conducted a study on Gamification and a Low-Cost Laboratory Equipment Aimed to Boost Vapor Compression Refrigeration Learning. The nowadays European educational framework boosts applying the learned theoretical concepts to real situations. Hence, practice sessions are key resources to present students direct applications of the theoretical concepts shown in class. Thus, developing new educational equipment and practice sessions oriented to bringing theoretical knowledge closer to practice should be one of the objectives of teachers. The present work describes a solution proposed by lectures of two Spanish universities looking to increase the knowledge of their engineering students. Along the years, these docents have noticed the lack of connection between the theoretical and practical knowledge among their students, drastically harming their learning procedure. Thus, in order to deepen into practical learning, a teaching methodology involving low-cost prototypes of vapor compression systems and a gamification method to help the students understand the concepts is proposed. The proposed methodology is expected to make a big positive impact on the results obtained by the students, taking into account the preliminary results reached.

Dr. Wajiha Kanwal (2022) focused on Effectiveness of Low Cost Material to Teach Science at Primary Level. The main objective of the study was to develop the interest and conceptual knowledge about science in students. For this purpose, the ‘Low-Cost Material’ concept was taught to the students using different instructional aids. The study was quantitative in nature. Experimental research design was used to check the effectiveness of low-cost material to teach science at the primary level, which were measured through pre and post-test. An action research was conducted in a public sector high school in Rawalpindi. Students of 4th grade were selected to conduct the study. Intervention was carried for one whole week. Pre-test and post-test were taken to collect data, and the collected data was analyzed using mean and t-test. The study found a significant difference between teaching of science through use of “low-cost material” and without using it. The students, when taught science by using “low-cost material, “performed significantly high on the post-test. It was concluded that using low-cost material to teach science positively affected students’ learning. The study will act as a model and guideline for science teachers at primary level to make their teaching more effective by using “low-cost material” as AV aids during science lessons. This will contribute to better science teaching in schools with low or no resources for science teaching.

Segkulu Lucy1, Gilbert Naa Emmideme, Atibiya Sylvester (2022) a study on Social Studies Student-Teachers’ Preparation for Effective Use of Teaching and Learning Materials: The Case of Northern Colleges of

Education in Ghana Teaching and learning material (TLMs) enhance lesson delivery leading to good academic performance of students. The purpose of this study was to establish the extent to which social studies student-teachers in two northern colleges of education in Ghana are exposed to the use of TLMs in their preparation to teach social studies. Descriptive survey design was adopted for this study. Ten social studies tutors and 140 second year student-teachers in 2 colleges of education were selected for the study. Simple random sampling and purposive sampling techniques were respectively used to select the student-teachers and the tutors. The instrument used for the study was questionnaire for both categories of respondents. The quantitative data obtained was analyzed using frequencies and percentages. The study concluded that student-teachers were not well exposed and adequately prepared for the use of TLMs to teach social studies. Even though the Colleges of Education (CoEs) had quite a number of TLMs that could be adequately used, most of these TLMs were not readily accessible for use. The study therefore recommends that tutors should be innovative to identify the natural environment/resources and use them, and also encourage the student-teachers to use them for effective teaching and learning process.

Valentina Osei-Himah (2021) investigated Teachers' Perspective of Effective Use of Teaching and Learning Materials in Basic School Integrated Science Lessons. Teaching and Learning of science in basic school is recommended to be interactive in enhancing students' conceptual understanding. For science lessons, the importance of teaching and learning

materials (TLM) cannot be overemphasized. This research explored perceived effective use of TLM in science lessons among teachers categorised as; supervisors, mentors, and mentees in teacher education on three factors. Using a cross-sectional survey design, 252 teachers were selected through multi-face sampling techniques to respond to a 40-item questionnaire. The responses obtained were analysed using exploratory factor analysis and one-way ANOVA. It was revealed that there were no differences existed between supervisors, mentees, and mentors on the effective use of TLM in science lessons. Implications of the findings of the research for science teacher preparation and policy are discussed.

Hinterberger, Elizabeth; Ackerly, Erin; Chen, Yingjie; Li, Yuguang C. (2021) made a research on Development of a Low-Cost and Versatile Gas Chromatography System for Teaching Analytical Chemistry This study presents a low-cost Arduino-based gas chromatography system that is suitable for teaching analytical chemistry in an undergraduate laboratory. The gas chromatography system is built with commonly available materials with a total cost less than \$100. A Python code is also provided as a user interface that will record data and display the results in real-time. The functionalities of the gas chromatography system are demonstrated with the detection of in-house natural gas, product gases from a CO₂ reduction, and a noble gas. Step-by-step instructions for building the gas chromatography system and detailed explanation of the Python code are provided in the Supporting Information for this paper. The goal of this project is to provide a low-cost and versatile GC

platform where undergraduate students can modify each individual component of a GC and study the underlying principle of separation science in analytical chemistry.

Samuel Oppong Frimpong (2021) investigated The role of teaching and learning materials and interaction as a tool to quality early childhood education in Agona East District of the Central Region of Ghana Early years experiences in quality thinking and socialization are critical to the optimal development of children, and Quality Early Childhood Education (QECE), is crucial in achieving these quality developments. However, several literatures suggest that there is a general lack of Teaching and Learning Materials (TLMs) in Sub-Saharan Africa, Ghana inclusive. Meanwhile, the constructivists' theory and other researches indicate that to ensure QECE, TLMs should be available and accessible to learners to interact with in advance and during a lesson. Using case study design therefore, data in the form of interview and observation were collected from twelve ECE schools in the Agona East District of the Central Region of Ghana. Participants composed of twelve ECE teachers and twelve headteachers of the schools totalling twenty-four. The findings suggest that participants perceived TLMs as very important factor in ensuring QECE provision. Again, TLMs were not readily available and so the children could not interact with them. The study further revealed that the unavailable nature of the TLMs hindered children's accessibility and active interaction with them. The findings further revealed that interaction could not feature prominently in the provision of the ECE due

to unavailability and inaccessibility of TLMs. Based on the findings, it is suggested that teachers and providers of ECE should ensure that TLMs are made available and accessible to learners to interact with. Teachers should also devise innovative ways of creating and developing TLMs from their locality. Moreover, they should encourage and promote children's active interaction with the TLMs, as this is a sure way of achieving learning.

Alamäki, Ari V.; Dirin, Amir; Suomala, Jyrki; Rhee, Cheul (2021)

a study on Students' Experiences of 2D and 360° Videos with or without a Low-Cost VR Headset: An Experimental Study in Higher Education

Aim/Purpose: This case study examines students' affective responses to and relationships with two-dimensional (2D) and 360° videos that were experienced with or without low-cost virtual reality (VR) headsets.

Background: The prior research on low-cost VR technology is scant. Schools and universities are not financially able to purchase tens or hundreds of expensive inbuilt VR headsets. Therefore, we recommend an alternative, low-cost solution.

Methodology: We conducted the experiment with students' (N=100) responses to videos and VR technologies used in a higher education setting. We also applied a quantitative research approach examined in light of media richness and affective experience theories.

Contribution: This study provides evidence of the integral role that VR technologies and 360° video content play, because using low-cost VR headsets potentially decreases the initial affective experiences of 360° videos among students. Although VR headsets improve media richness, they might simultaneously weaken students'

overall affective experiences if they experience usability challenges. Findings: The results showed that using low-cost VR headsets decreased positive user experiences when they were watching 360° videos. The 360° video experience was noted to be better without low-cost VR headsets. Low-cost VR headsets with a smartphone and 360° videos were found to be complicated to set up and use among first-time users. However, 360° videos created a more positive affect than did 2D videos. We also found that the positive affect of videos enhanced the social sharing intention.

Recommendations for Practitioners: Educational institutes and teachers with limited financial budgets need to plan and manage courses that increases their need to adopt low-cost VR headsets. However, a poor initial user experience of low-cost VR technology usability might create negative student attitudes, which might hinder VR's adoption rate in higher education.

Recommendation for Researchers: This study provides a new understanding about students' affective experiences of 2D videos and 360° videos with and without low-cost VR headsets. The results show that positive user experiences of 2D and 360° videos enhance students' interest in sharing and collaboration in digital learning environments.

Impact on Society: The results help educators to predict possible usability challenges in selecting the proper rich media for different learning situations. Additionally, the results assist educators to design VR assisted courses that motivate students.

Future Research: The experimental comparison of different VR solutions and traditional learning technologies merits further examination. Additionally, more research is

needed to determine the relationship of VR technologies, video content and learning methods, because technological features and content are tightly integrated in VR.

Lee, Eunsang (2020) investigated Developing a Low-Cost Microcontroller-Based Model for Teaching and Learning Recently, as low-cost microcontrollers such as those developed by Arduino and Raspberry Pi have become widely available, the term maker education has emerged as a hot topic in education. Teachers are increasingly using low-cost microcontrollers in their classes, but conducting a class that focuses on using a microcontroller may cause difficulties or problems, for the learner or for the instructor. To solve these problems, it was necessary to design a teaching and learning model for the use of low-cost microcontrollers to be applied at school sites. Accordingly, this study aimed to develop a teaching and learning model for using low-cost microcontrollers. As a result of this study, the author proposes a teaching and learning model that consists of six stages: topic selection, exploration of implementation methods, experimentation, production of teaching and learning materials, implementing lesson plans, and improvement. According to this procedure, teaching and learning materials were created and applied for the subject matter of a middle school unit on "Making Arduino Automobile." The model developed in this study may provide a guideline for teachers who want to apply low-cost microcontrollers in their classes.

Bates, Rodger; Young, Karen; LaBrecque, Bryan; Southard, Sheryne (2020) carried out An Open Source Online Based Teaching Template Win The increasing cost of textbooks has created a demand for no cost/low cost learning resources for students. The University System of Georgia, through their Affordable Learning Grants has supported the development of no cost/low cost course transformation activities. Faculty at Clayton State University (CSU) have been engaged in the development of a number of Open Education Resources (OER) courses. This past year, an Open Source Online Based teaching template has been developed for the Introduction to Sociology (SOC1 1101) course. This teaching template provides a model for the development of an economical online learning experience that can serve as a model for similar courses at CSU and other institutions.

Abigail C. Obodo (2020) made a research on Effects of Improvised Teaching-Learning Materials on the Academic Performance of Junior Secondary School Students in Basic Science in Enugu State, Nigeria The study investigated the Effects of Improvised Teaching-Learning Materials (TLMs) on the academic performance of junior secondary school students in Basic Science in Enugu state, Nigeria. The study employed quasi-experimental research design. The population of the study was 33,548 JSS II Basic Science students, comprising of 14,821 male and 18,727 female students. Purposive sampling technique was used to sample a total of 140 JSS II students from four public secondary schools for the study. Two each were purposively assigned to experimental and control group respectively. The 73

students in the experimental group were taught with improvised teaching-learning materials while 67 students in the control group were taught without improvised teaching-learning materials. Two research questions guided the study while two null-hypotheses were formulated and tested at 0.05 level of significance. Data used for the study was collected through the pretest, treatment and post-test using the researchers' made instrument (Improved Basic Science Performance Test- IBSPT), the IBSPT consists of 30 objective test items. Data collected were analyzed statistically through the use of both descriptive statistics of frequencies, mean and standard deviation while Independent sample ttest was used to test the two null hypotheses. Major findings drawn from the study among others revealed a positive significant difference in the performance of students taught Basic Science with the use of improvised teaching-learning when compared with those taught Basic Science without the use of improvised teaching learning materials. Also, finding shows a positive significant difference in the performance of males and females taught Basic Science using improvised teaching aids. It was concluded among others things that since the students taught Basic Science with the use of improvised teaching-learning materials had a better mean score than those taught without the use of improvised teaching-learning materials, there is need for teachers to be trained to improvise teaching-learning materials as this will enable them acquire the appropriate techniques and skills necessary for improvisation. Hence, it was recommended that teachers should be trained and retrained through workshops, seminars and

conferences for the purpose of skill acquisition necessary for effective use of teaching-learning materials

Saifullah Khan (2019) a study on Effectiveness of Low Cost Materials on Diverse Achievers in the Teaching of Physics at Secondary Level The equipment's of science teaching in the most of secondary school is not available in Pakistan. The main purpose of this research is to find the effectiveness of low cost materials on diverse achievers in the physics instructing at secondary level. The nature of the study was experimental. The most suitable design for this experiment was Pre-test, post-test equivalent group design. A sample of 40 pupils was carefully chosen from Government High School No.2 Nowshera Cantt. The experiment continued for six weeks. Independent sample t-test was used for the analysis of data. The group which has been instructed with low cost teaching aids showed successful result scores in the post test and their achievement level further gets improved. It has been suggested that teachers training institutions ought to build up such a training programs, which would enhance the capacities of teachers in the selection and in the development of apparatuses, using low cost materials for practical work

Radhika Kapur (2019) found that Development of Teaching-Learning Materials In educational institutions, the development of teaching-learning materials is regarded as one of the major aspects that would promote student learning and help in the achievement of academic goals and objectives. The educators need to focus upon bringing about developments in the teaching-

learning materials. They need to conduct research and promote modern and innovative methods to enrich the system of education. The advancements in teaching-learning materials are brought about on the basis of number of aspects. These are, grade levels of students, academic goals and objectives and subjects and concepts. When these are introduced, the educators need to ensure that they prove to be beneficial to the students in achieving academic goals. Research has indicated that the introduction of modern and innovative methods and teaching-learning materials have led to developments of the overall system of education. The main aspects that have been taken into account in this research paper are, significance of teaching-learning materials, objectives of teaching-learning materials, types of teaching-learning materials, designing and development of teaching-learning materials, and recommendations.

Schoeddert, Alex; Babooram, Keshwaree; Pelletier, Sarah (2019) conducted a study on Reduction of Water Waste in an Organic Chemistry Laboratory Using a Low-Cost Recirculation System for Condenser Apparatus. A low-cost and easy-to-use water recirculation system for a condenser apparatus was designed and installed in an organic chemistry teaching laboratory. Relying on gravity and a small pump for water circulation, it supplies four stations simultaneously. The water recirculation system works very well with condensers used for distillation and reflux reactions, as well as with rotary evaporators. This innovative idea has led to an annual water savings of more than 14,400 L while running only 2 lab periods per week with

up to 24 students per period. Its low cost and easy installation make it convenient and easily adoptable by any laboratory where the waste of water from condensers needs to be addressed, especially in places where water scarcity is already hindering such significant scientific activities.

Emmanuel Agbenyegah Ayerteye (2019) Examining the use of Teaching and Learning Materials (TLM) methods in Basic School Level by Social Studies teachers in Ghana: A tracer study. A tracer study approaches are often designed to track individual teachers who have undergone the rigorous training so as to examine, evaluate and assess their performance and progress based on the training received. This paper, however, examined the use of Teaching and Learning Materials (TLM) methods in selected Basic Schools level by Social Studies teachers in Ghana in lesson delivery. It employed a tracer and qualitative study approach. In all, 20 Social Studies teachers were purposively selected from 20 basic schools; 12 females and eight males. Ten headmasters were also selected purposively for interview. This study employed unannounced visits for lesson observation as the strategy for data collection. A semi-structured interview was also used to collect information from participants. The results from this study showed that about ninety percent of Social Studies' teachers in the basic school level do not use TLMs in lesson delivery in the Yilo Krobo Municipality in the Eastern Region of Ghana.

Ade Yeti Nuryantini (2017) The Utilization of Low-cost and Simple Materials on Physics Learning Media made from low-cost and simple materials is one solution to overcome the limitations of physics laboratory facilities. This paper aims to describe the use of low-cost and simple media from a teacher's perspective as a learning planner. The results showed that in the utilization of media made from low-cost and simple materials, information literacy skills, the involvement of other experts such as universities as a teacher partner, good English skills, and involvement of learners were all required. Selection of low-cost media is based on consideration of time, cost, availability of tools and materials and conformity with teaching materials. The impact on learning shows an increase in cognitive learning outcomes of learners.

Nurul Hoda, Nargish Bano (2017) investigated Role of ICT as a Teaching: Learning Material (TLM) in the field of education All types of digital technology assistance are included in the term “ICT” but not only computers. It plays a major role in all aspects of countries life; in politics, in economic life as well as in social and cultural development. Information Technology Enabled Services (ITES) policies of a country provide a rationale, a set of goals, and a vision of education systems. India has one of the largest education systems in the world with a network of more than one million of schools and 18000 thousand higher education institutions. More than half of the country’s population falls in the target market for education and related services. India’s online education market size is set to grow to \$40 billion by

2017. Today, the incorporation of technology into teaching is one of the challenges for education. It is the very time to move beyond the walls of our classrooms to assimilate with the global forces, institutions and societies to revitalize education. The use of ICT will greatly contribute to meet student needs for learning anywhere, anytime. Technology has become a huge enabler, for the complete teaching learning process. Using technology to enhance the quality of teaching and learning has always been one of the goals of education. Today's computer-based technologies offer powerful new ways to provide students with direct experience in the classroom curriculum. And, through using teaching and learning resources that can be manipulated electronically, technology can extend the experience of students far beyond the time and space limitations of conventional materials. This paper focuses on the importance of e-content development in the changing education concepts in the country and discussed the importance and benefits of the e-content resources.

R. C. Supakar (2016) A Study on the Utilisation of 'TLM' by Primary School Teachers in Bargarh District of Odisha Teaching is an indispensable part of the process of education. The main task of a teacher is to facilitating learning with using learning materials to attain predetermined objective of education. But, generally the teacher prefer to use "chalk and talk approach" and text-method ignoring the value of utilizing „TLM“ (Teaching-learning materials) in their curricular transaction. So, school children are deprived up getting a meaningful, interesting and joyful learning situation .The traditional

approach of teaching not only creates a boring and tired-zoom feeling in children's mind but it also develops a negative attitude towards the content materials. Hence, SSA emphasizes the proper utilization of TLM in curricular transaction of primary school children to improve their learning outcomes

Shaik. Liyakhath Ali, 2M.Papaiah (2015) research on Theme: Learning by doing Sub theme: Innovative use of low cost/no cost teaching learning materials It is in this context that the Science teaching and learning, use of environment and local resources has been recognised as one of the basic areas of school curriculum in many developing countries including India. Keeping in view the significance and importance of 'learning by doing' this study has analysed the studies of national and international level. The nature of this conference paper is survey type. It consists of three parts. The first part explains the importance of science teaching, learning by doing, adoption of Inquiry based approach and aims and objectives of science teaching. The second part explains the necessity of preparation of 'low cost no cost science material', its importance and utilisation in science teaching, especially in developing countries at grassroots level. The third part discusses the findings of selected research study and put forth the suggestions for effective implementation of ' learning by doing ' with the help of concreting teaching in Science, TLM and low cost/no cost material. It also recommended fixing of well organised Monitoring mechanism for the betterment of science teaching at Elementary school level.

Dr.R.Sivakumar (2014) investigated impact of low cost teaching aids in teaching science The aim of this study was to find out the effectiveness of Low Cost Teaching Aids in Teaching Science. The sample consisted of 40 students in Control group and 40 students in Experimental group. The data were collected using appropriate tools and it was analyzed by t' and F' test. The finding is that the achievement scores of Experimental group Students were higher than the Control group Students

P. Ramara (2014) a study on Impact of Low-Cost Teaching Aids in Teaching Science. This study aimed to evaluate the efficacy of Low-Cost Teaching Aids in Science Education, utilizing a sample of 40 students in the Control group and 40 in the Experimental group. Through the application of t' and F' tests, the collected data indicated higher achievement scores among the Experimental group students compared to their counterparts in the Control group. The backdrop of the study recognizes the transformative changes in science and technology globally, emphasizing the broader concept of education beyond the confines of a school. The need for fostering a scientific spirit and knowledge, along with the importance of various social agencies in supplementing education, sets the stage for understanding the role of Low-Cost Teaching Aids in this context.

Dr. Shri Krishna Mishra (2013) found that Use of Teaching Learning Materials in Science at Upper Primary school in Mandleshwar Khargone, (Madhya Pradesh): An Analysis The prime objective of teaching science is to develop such skills in a student which helps him to know the facts, principles

of science, its applications, identify the objects and to make concept clarity through the use of teaching learning materials. The need of the study is to know the extent of the utilization of teaching learning materials on science by the teacher during teaching science subject. The teachers are only the powerful agents for improving the quality of the student. The other need of this study is to find out those new type of teaching learning materials in Science which are implementing / use in Govt. school or private school and they are easily available, low cost and student can make than himself. An efficient science teacher always needs to better learning of his subject so that the can give his best to his students. Teaching learning materials in science helps a Science teacher in effective realization of his/her teaching objectively by calling upon the auditory and visual sense of his students.

Umar Khitab (2012) a study on It is the age of science and technology. Scientific inventions have done wonders. Scientific knowledge is valued all over the world and great emphasis has been placed on scientific approach in all field of life. Progress and promotion of scientific education in the schools, colleges and universities will lead the nation to compete with the rest of the world. Keeping our students properly on the scientific track, it is necessary that equipment, apparatus, modern devices and training on the part of teacher would be required . So, the main purpose of this study is to find out the present situation of the laboratories, equipment and the construction of low cost materials for the chemistry laboratory. The researcher has prepared relevant material for chemistry laboratory and desires to demonstrate it when

required. Random Sampling Technique was used. The study sample consisted of 63 Government and 37 private high schools of district Dir (L), Dir (U), Malakand and Swat. It was a survey-based research. So, two types of questionnaires were developed. The first questionnaire having twelve items was meant for the science teachers. The second questionnaire containing ten items was meant for science students. Most of the questions were in closed form data were collected and put into different tables. The response was hundred percent because the researcher himself administered and collected the questionnaires. The frequency of the actual responses was added up and percentage was found out. Then findings were drawn on the basis of collected data. Finally recommendations were made on the basis of available data by the researcher to solve the problem and develop low cost learning material for the teaching of chemistry at secondary level and the methods how to fabricate them. It was concluded that majority of the schools had no chemistry laboratory and there was lack of appropriate equipments. The Development of Low Cost Learning Material For The Teaching of Chemistry at Secondary Level.

Temechegn Engida (2012) had study development of low-cost educational materials for chemistry is a practical and experimental science. Various attempts were made worldwide to design and implement Chemistry curricula to reflect this practical nature of Chemistry. In Africa, whereas there had been many donor-supported initiatives to equip Chemistry labs, these initiatives did not succeed in sustaining practical Chemistry in the continent.

One avenue to solve this problem is to engage African chemists, chemistry teachers and their students in designing and developing low-cost educational materials for Chemistry teaching and learning. This paper tries to highlight the principles and approaches towards the development of low-cost Chemistry materials from locally available materials. It finally lists the procedures used to develop low-cost materials for Chemistry teaches in Ethiopia

Sileshi Yitbarek (2012) conducted a study on low-cost apparatus from locally available materials for teaching-learning science Learning science should start with hands on experiences that the child is familiar with and not with abstract definitions about what science is. Low cost apparatus from locally available materials believed to enrich the capacity to observe, explain and do real science in primary schools and increases the quality of learning. Hence the purposes of this action research were twofold: i) to design and produce appropriate low cost apparatus from locally available materials that can be used in teaching-learning science in primary schools, and ii) to compare cost and efficiency of the apparatus constructed using the low cost locally available materials with standard factory produced ones. Comparatively the low cost materials offered an alternative solution to do science in classrooms under difficult financial constraint.

2.4 CONCLUSION

Reviewing relevant research enhances the researcher's ability to gain a clear understanding of the problem chosen for this study. Based on the review of related studies, this study can use appropriate methodology and well-organized approach, which will be discussed in the next chapter. The next chapter deals with the method of study.

CHAPTER III

METHODOLOGY

3.1 INTRODUCTION

Research methodology is the systematic framework employed to guide and structure the process of conducting research. It serves as the blueprint that outlines the methods, procedures, and techniques employed to collect, analyze, and interpret data in a rigorous and organized manner. Essentially, research methodology encompasses the principles and rules that govern the systematic investigation of a problem or question, ensuring the reliability and validity of the findings. It involves a thoughtful and strategic approach to designing the research, selecting appropriate data collection methods, and employing analytical tools to draw meaningful conclusions. The careful application of research methodology is crucial for producing credible and valuable insights, contributing to the advancement of knowledge in various fields. Research methodology can be defined as the systematic and structured process employed to plan, execute, and analyze research, encompassing the methods, techniques, and principles that guide the investigation of a specific subject or problem, with the ultimate goal of producing valid and reliable results.

3.2 RATIONALE OF THE STUDY

The rationale of this study lies in the recognition of the importance of innovative and cost-effective teaching methods in enhancing the quality of education, particularly in the context of Basic Science concepts at the upper primary level in Krishnagiri District. By focusing on the Effect of Innovative Low-cost Teaching Learning Materials (ILTCM), the study aims to address the challenges faced in traditional science education, such as limited access to expensive resources, lack of hands-on learning opportunities, and difficulties in engaging students effectively. By introducing ILTCM, which are designed to be affordable, accessible, and engaging, the study seeks to explore how these materials can positively impact teaching practices, student motivation, understanding of scientific principles, and overall academic achievement in Basic Science. This research is significant as it contributes to the development of practical and sustainable solutions for improving science education, particularly in resource-constrained settings, thereby promoting inclusive and effective learning experiences for students.

3.3 OBJECTIVES OF THE STUDY

1. To identify the locally available resources that are available related to the science concepts.
2. To plan and develop suitable innovative low cost teaching learning material for Science teaching and learning.
3. To orient the teachers about the importance of innovative low cost materials preparation.

4. To find out the effect of innovative low cost material on students' performance after the training programme.
5. To compare performance of teachers before and after intervention.
6. To assess the impact of Innovative Low-Cost Teaching Learning Materials (ILCTLM) on students' academic performance
7. To examine the effectiveness of ILCTLM in enhancing students' understanding of basic science concepts
8. To gauge the level of engagement and interest among students using ILCTLM
9. To assess the perceptions and experiences of teachers regarding the use of ILCTLM
10. To identify any disparities in learning outcomes based on demographic factors

3.4 HYPOTHESES OF THE STUDY

1. The use of Innovative Low-Cost Teaching Learning Materials (ILCTLM) significantly enhances the comprehension and retention of basic science concepts among upper primary level in Krishnagiri District.
2. Teachers who incorporate ILCTLM in their instructional practices will report a positive perception of its effectiveness in facilitating better understanding of basic science concepts.

3. The introduction of ILCTLM in teaching basic science at the upper primary level will result in increased student engagement and interest in the learning process.
4. Students exposed to ILCTLM will demonstrate higher academic performance in basic science compared to those taught through traditional methods at the upper primary level in Krishnagiri District.
5. There is no significant difference in teaching effectiveness, student engagement, and learning outcomes between teachers who use ILTCM and those who do not use ILTCM in teaching Basic Science concepts at the upper primary level in Krishnagiri District.

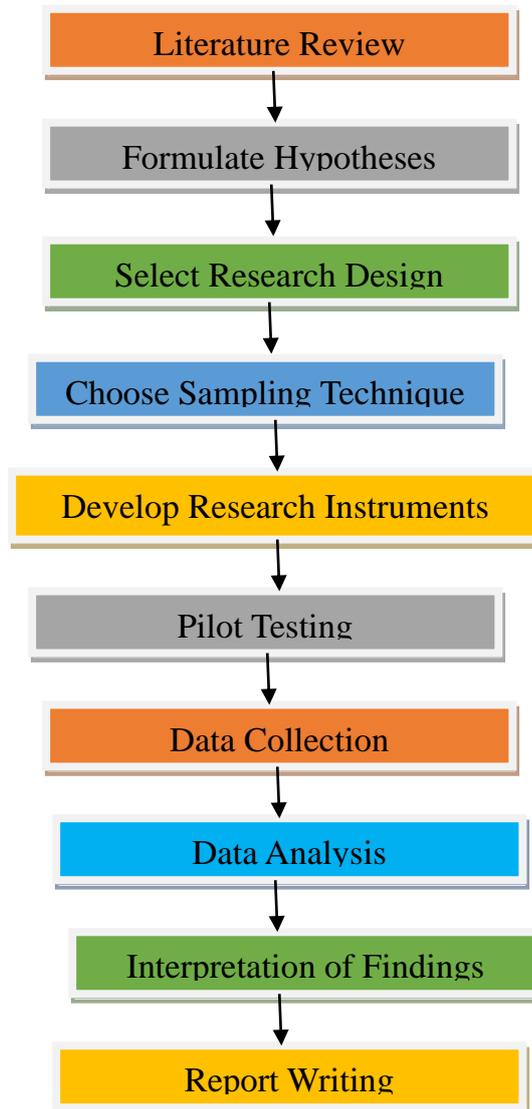
3.5 RESEARCH QUESTIONS

1. How does the implementation of Innovative Low-Cost Teaching Learning Materials (ILCTLM) impact the understanding of basic science concepts among upper primary level students in Krishnagiri District?
2. What are the perceptions of teachers regarding the effectiveness of ILCTLM in teaching basic science concepts at the upper primary level?
3. How do students' engagement and interest in learning basic science change with the introduction of ILCTLM in the teaching process?
4. Are there variations in the academic performance of students using ILCTLM compared to traditional teaching methods in basic science at the upper primary level?

3.6 RESEARCH METHOD

The experimental method is a research approach characterized by the systematic manipulation of one or more independent variables to observe their effect on a dependent variable while controlling for extraneous factors. This method is widely used in scientific inquiry to establish cause-and-effect relationships between variables. In an experimental design, researchers randomly assign participants to different experimental conditions and carefully manipulate the factors of interest. By comparing the outcomes of these conditions, researchers can infer whether the manipulated variables had a significant impact on the dependent variable. The experimental method emphasizes control, randomization, and manipulation to draw reliable conclusions about the causal relationships within a study. It is particularly valuable in testing hypotheses and establishing a rigorous foundation for scientific knowledge across various disciplines. In this study, the researcher adopted to employ an experimental method to conduct the research.

3.7 RESEARCH PROCESS



3.8 PILOT STUDY

A pilot study is the first step of the entire research protocol and is often a smaller study assisting in the planning and modification of the main study. A pilot study is a research study conducted before the intended study. Pilot studies are usually executed as planned for the intended study, but on a smaller scale. The investigator conducted a pilot study for a selected teachers in selected schools to standardize the developed tools. The investigator

obtained permission from the concerned school headmaster and gave the developed tools to the selected teachers. A sufficient time limit was given to the teachers to respond to the items and questions.

3.9 SAMPLE AND SAMPLING TECHNIQUE

To conduct the research investigation, the researcher selected 50 teachers for the experimental group. This assignment took place at the VII Science from 10 block in Krishnagiri district, where the experimental groups were established. The researcher utilized purposive sampling techniques to carefully select the sample for this study.

3.10 TOOLS USED FOR THE STUDY

- Module
- Pre test post test questionnaire (Based on ILTCM) was used in this study

3.11 CONSTRUCTION OF TOOL

The pre-test and post-test consisted of 25 questions based on the ILTCM. In the present study, both the pre-test and post-test were employed to evaluate the level of teachers' awareness and training in using ILCTLM, identify challenges faced in implementing ILCTLM, assess ILCTLM's impact on student engagement in the classroom, and make observations on its effect on students' understanding of basic science concepts.

The construction of the tool used in this study, the Research project Pre-test/Post-test Questionnaire, aimed to assess the effectiveness of Innovative Low-cost Teaching Learning Materials (ILTCM) in teaching Basic Science concepts at the upper primary level in Krishnagiri District. The questionnaire included multiple-choice questions related to characteristics, advantages, examples, roles, benefits, and demonstrations of low-cost aids in science education. The questions were designed to evaluate the participants' understanding of low-cost aids, such as their affordability, simplicity in construction, accessibility, hands-on learning experiences, and their applications in teaching various scientific principles like magnetic attraction, electrostatics, osmosis, wave phenomena, solar energy, light redirection, sound amplification, and resonance.

The questionnaire comprises 25 multiple-choice items. Each correct answer is scored one mark, while a wrong answer receives zero marks. This tool was developed and validated by the investigator in collaboration with the Diet Faculty and education experts. After completing the scoring, all the assigned scores were totalled and interpreted based on the overall obtained scores.

3.12 VALIDATION OF TOOL

VALIDITY

Validity refers to the adequacy or authenticity of the tool. A tool is effective if it actually measures what it is supposed to measure. Determine

the visual and content effectiveness of tools by distributing them to subject matter experts, research leaders, and submitting experts.

RELIABILITY

In order to establish the reliability of the assessment scale, screening test and achievement test calculated in Cronbach's Alpha test and retest method. The reliability so obtained for the questionnaire is 0.79 showing that the tools were reliable.

3.13 CONDUCTING EXPERIMENTATION

Administering Pre test

Prior to the commencement of any intervention or treatment, the investigator administered a pre-test to establish a baseline assessment of the participants' knowledge, skills, or behaviors related to the study's focus. The pre-test aimed to measure the initial level of familiarity, understanding, or proficiency in the specific subject matter, providing a foundation for later comparisons with post-test results. This initial assessment allowed the investigator to gauge the starting point of the participants and served as a valuable benchmark for evaluating the effectiveness of any subsequent educational or experimental activities. The pre-test data collection phase is crucial for understanding the existing conditions and ensuring a comprehensive analysis of the impact of the intervention over the course of the study.



Treatment

The treatment phase in this study involved implementing Innovative Low-cost Teaching Learning Materials (ILTCM) in teaching Basic Science concepts at the upper primary level in Krishnagiri District. Teachers were provided with these low-cost aids, which were designed to enhance the teaching and learning experience by making science education more accessible, engaging, and practical for students. The treatment phase focused on observing how the use of ILTCM influenced the teaching methods, student engagement, understanding of scientific concepts, and overall learning outcomes in the Basic Science curriculum.

The treatment period in this study spanned several weeks, during which teachers received training and support in integrating Innovative Low-cost Teaching Learning Materials (ILTCM) into their Basic Science lessons at the upper primary level in Krishnagiri District. The treatment phase involved a structured approach, including workshops, resource provision, and guidance on effective implementation strategies. Teachers were encouraged to use ILTCM during regular classroom sessions to supplement traditional teaching methods and promote hands-on learning experiences for students. Throughout the treatment period, data collection methods such as observations, interviews, and assessments were utilized to evaluate the impact of ILTCM on teaching practices and student learning outcomes in Basic Science concepts.

INTERVENTION

Activity 1: Electro static force

Aim: To know the **electro static force between two electrically charged particles**

Materials required: Two straw, Nylon cloth, Water bottle and

Scientific Principle: Electrostatic force definition for class 8 can be stated as **the force between two electrically charged particles**. They can either be a repulsive or attractive force. Like charges will repel each other and unlike charges will attract each other.

Procedure: The researcher collected the low cost material and given the following activity

- The same pole of straw repelled each other when the straw rubbed with the nylon cloth produce electrostatic force
- When we run a piece of paper with the oil in our head with the help of a comb produces electrostatic force.
- Balloons get attracted to another balloon when one of them are rubbed with hair.
- When I do iron my silk or cotton cloth and keep it right in front of me, they just cling on to my body.
- Lightning is also another example of electrostatic force."



Conclusion: Observe the electro static particles, the same charged particles repelled and opposite charged particle are attracted

Activity 2: Light refraction

Aim: To demonstrate the refraction of light on different kind of mirror

Materials required: Motor belt, three coconut stick, Glitters paper

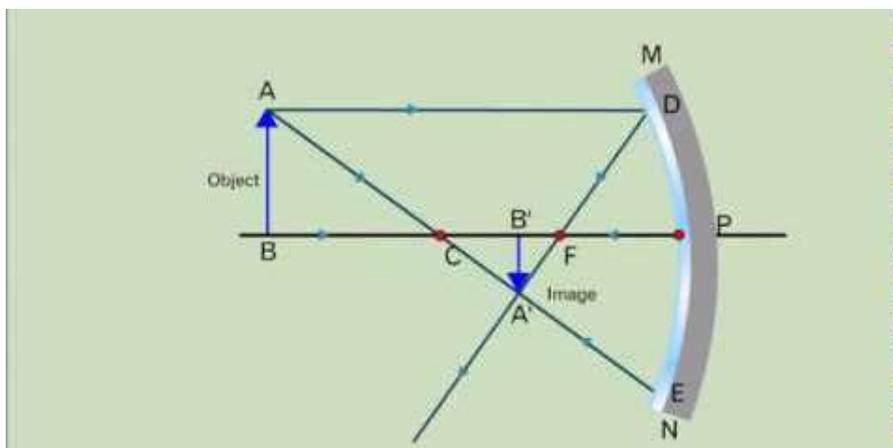
Scientific Principle

- Refraction is the bending of light (it also happens with sound, water and other waves) as it passes from one transparent substance into another.
- This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows. Even our eyes depend upon this bending of light. Without refraction, we wouldn't be able to focus light onto our retina.
- A lens is simply a curved block of glass or plastic. There are two kinds of lens.

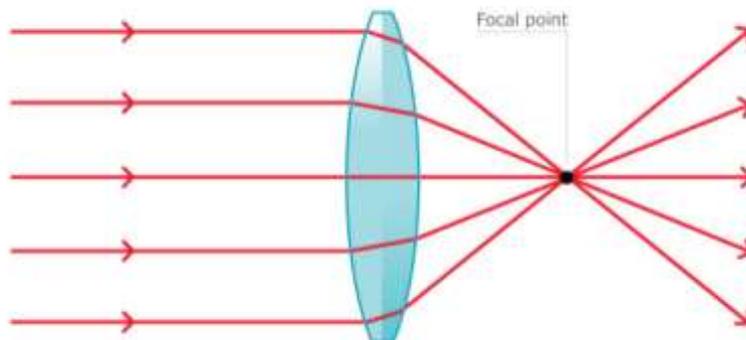
- A biconvex lens is thicker at the middle than it is at the edges. This is the kind of lens used for a magnifying glass. Parallel rays of light can be focused in to a focal point. A biconvex lens is called a converging lens.

Procedure

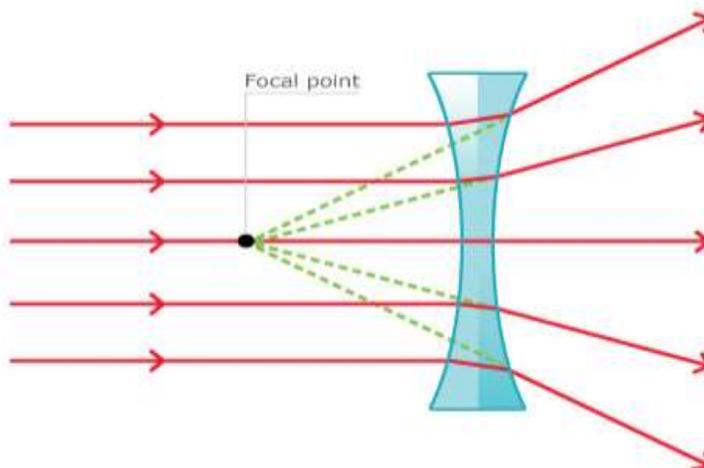
- The investigator making model for the concave and convex science concept with help of equal size of three coconut stick and 10 cm size of motor belt.
- Making three holes on the motor belt in top corner, middle and bottom corner and inserted the three coconut stick in three holes in the belt equal length in both side.
- The investigator making fold in the belt for the shape of convex lens, in opposite side all three sticks in the belt to converge in a single point to making image like original process.
- Making another folding for opposite direction in the belt for the shape of concave lens, in opposite side all the three sticks in the belt to diverge like original process.



Converging lens



Diverging lens



Conclusion

In this activity to indicate that how the concave and convex lens to penetrate the light rays in opposite side.

Activity 3: Light dispersion

Aim To demonstrate the light dispersion using low cost materials

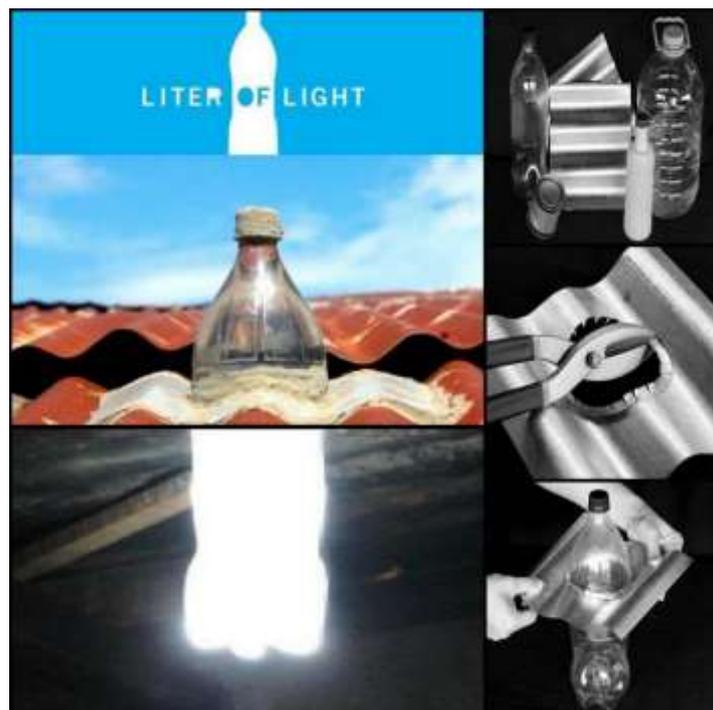
Material required: Water bottle, Water, Bleaching powder

Scientific Principle: The separation of visible light into its different colors is known as dispersion. It was mentioned in the Light and Color unit that each

color is characteristic of a distinct wave frequency; and different frequencies of light waves will bend varying amounts upon passage through a prism.

Procedure

When the investigator collected one-liter water bottle and filled with water making model its named as “sun lamp”. Many temple and houses have very dark at the day time. In these places the sun lamp fitted in the roof in partially outer side and partially in side. The sun rays travel the air and reached the bottle making two process one is refraction and another one is dispersion. In dispersion the light rays scattering in the room making brightness in the room.



Conclusion

So the investigator to explain this event to produce shining in the room with help sun rays by the process of refraction and dispersion.

Activity 4: Poles of magnet and Magnetism

Aim: To find out pole of magnet in different magnet

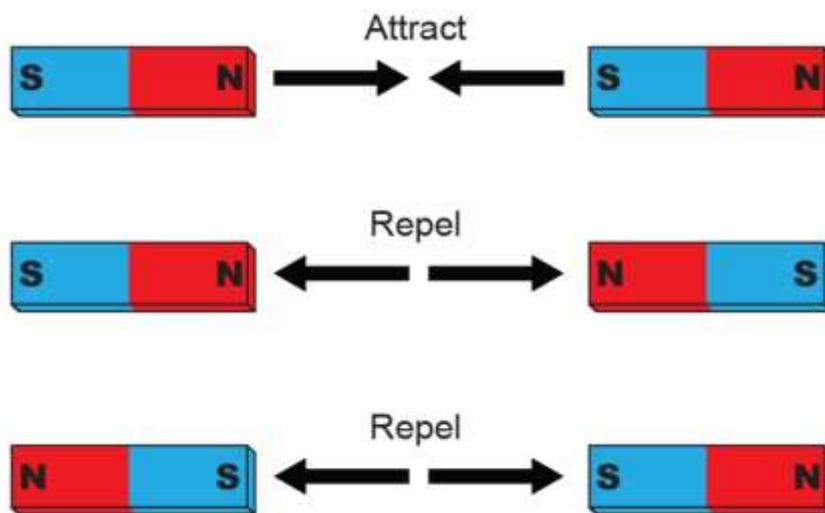
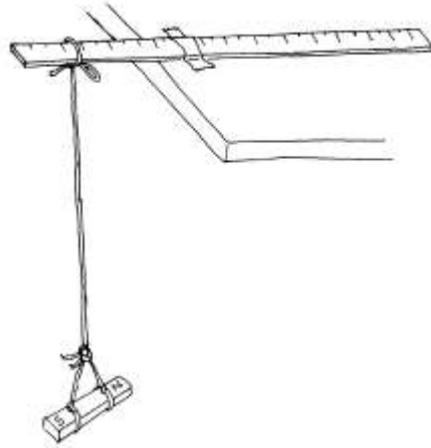
Materials required: Bar magnet, U shaped magnet and Round magnet

Scientific Principle: The areas of a magnet that have magnetic strength are called “*poles*”. When you have more than one magnet, like (or same) poles repel or push each other. Opposite poles attract or pull each other. In other words, the north pole of one magnet will click together with the south pole of another magnet and two north poles will push each other away. These acts of attraction and repulsion are called “*magnetism*”, and the magnetic space around a magnet is called the “*magnetic field*”.

Procedure

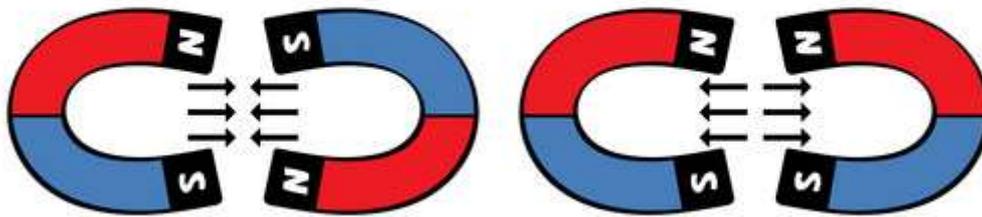
The investigator demonstrates the magnetic poles by the following activity

1. Put a small piece of masking tape on one end of a bar magnet.
2. Tie a string around the middle of your magnet.
3. Dangle the magnet from the string and then from a ruler. Watch as one end orients itself toward the north. This is the magnet’s north pole.
4. If that is the end with the masking tape, write “*N*” on the tape. If the other end has the tape, write “*S*.”



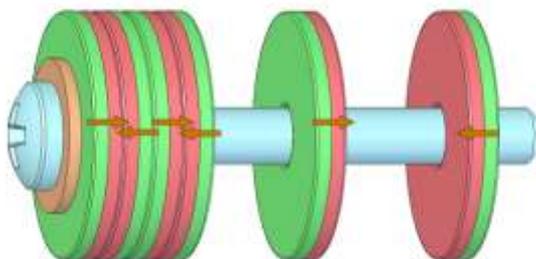
How to find the edges of U shaped magnet.

They are known as identical poles if the south end of the already detected bar magnet is distorted when it joins with one end of the shaped magnet. Otherwise, if the two ends of the magnet are attracted to each other, the bar magnet is called the south pole and the tip of U shaped magnet is called the north pole.



How to find the edges of a circular magnet?

The ends of the magnet are the upper and lower parts of the magnet. The northern and southern poles of the circular magnet can be detected by the above actions.



Conclusion

A magnet which is in the shape of a horse shoe is called a horseshoe magnet.

A horseshoe is of U shape where the two ends are a bit closer. So the shape of the magnet is a bit like U shape.

The shape of the magnet determines the strength of the magnetic field, closer the poles of the magnet stronger the magnetic field. This is the reason

for making a magnet in the shape of a horseshoe as in this type the poles are brought close enough to create a strong magnetic field are the poles.

Activity 5: Speed of conduction of sound

Which of the following medium has the highest speed of sound?

- A) Solid b) Milk c) Air d) Water

The question is often asked in competitive exam. How to make students understand this lesson concept? Explaining this concept through a story.

A student named Ramu has to cross his field, railway line and river to go to school daily. One day due to heavy rain, the river floods and the railway track breaks down. Ramu is shocked to see this. Seeing the train coming immediately, nothing was seen. Suddenly he feels the train coming when he steps on the railway road. He immediately took off his red shirt and waved it like a flag. The train driver sees the boy's action and stops the train. Immediately everyone comes downstairs and is shocked to see that the railway track is broken and everyone praises Ramu for avoiding the accident. The railway road is adjusted and the train departs. Through this story, how Ramu first felt the train coming. He feels the vibration as soon as he puts his foot on the railway road through which he knows the train is coming. Railroad is a solid material made of iron. The solid is bound by more atoms. Therefore, the mobility of the molecules in these is high. Materials with high mobility of molecules are more likely to transmit sound faster.

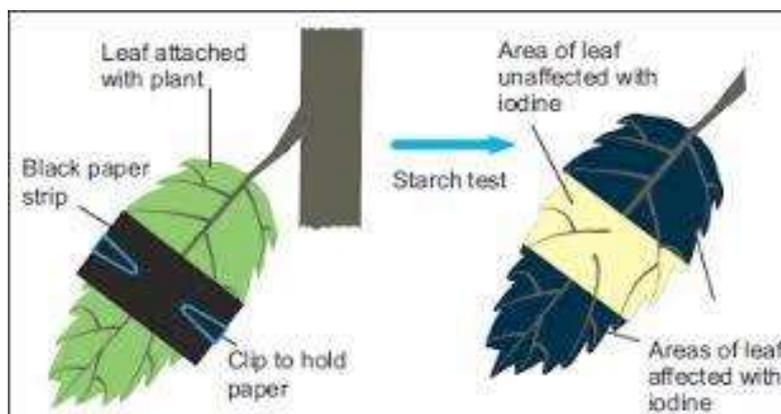
Activity 6: Sunlight is necessary for photosynthesis

Aim: To show the sunlight is very important for photosynthesis process

Material required: A plotted plans, Black paper, Beaker, Test tube, Ethanol, Burner, Iodine solution, Dropper and Paper clips

Procedure:

- Cover a part of one green leaf with a strip of black paper and fix with the help of paper clips
- Place the plant in a dark room for two days to destarch
- Keep the plant in sunlight for 5 to 6 hours
- Pluck the leaf covered with the black paper strip
- Test the leaf for the presence of starch



Observation

The portion of the leaf covered with black paper strip remains light brown. However, the uncovered portion of the leaf turns blue black

Explanation:

In the absence of sunlight, the covered portion of the leaf was not able to produce starch. The uncovered portion of the leaf regained the starch in the presence of sunlight

Conclusion:

Sunlight is necessary for Photosynthesis

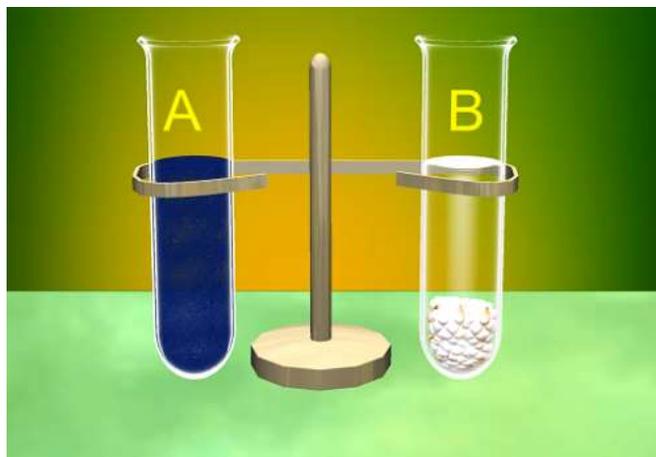
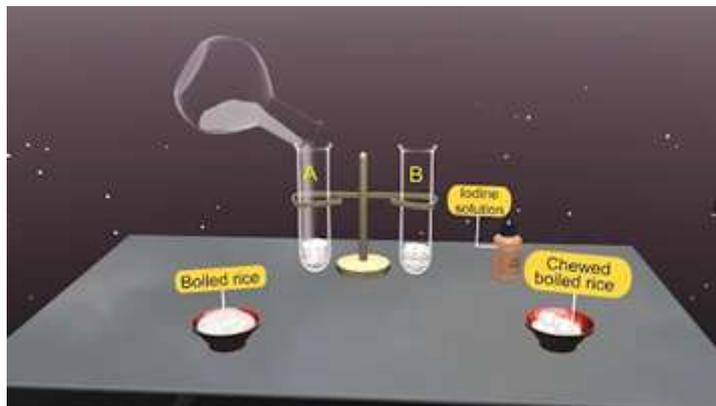
Activity 7: Effect of saliva on food

Aim: To study the effect of saliva on food

Materials required: Two test tube, Boiled rice and iodine solution

Procedure:

- Label one test tube as A and another as B
- Put some boiled rice in test tube A
- Partially masticate some rice and put in test tube B
- Add few drops of iodine solution into Test tube A and B to observe few minutes



Observation:

The rice in the test tube A turns in Blue – Black colour. The rice in the test tube B does not turns any changes in colour

Explanation:

In test tube A, the rice turned black Blue as it contained starch. In test tube B, the chewed rice did not show any changes in colour as the saliva in the mouth had decomposed the starch into sugar

Conclusion:

Saliva breaks down the starch present in food into sugar

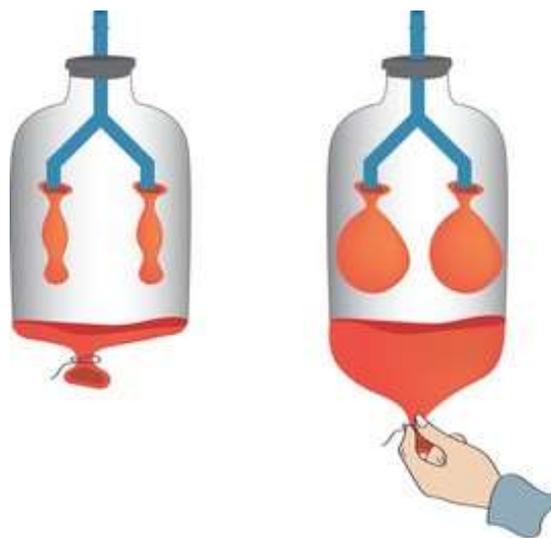
Activity 8: Working of diaphragm during breathing

Aim: To understand the Working of diaphragm during breathing

Materials required: A bell Jar, Y tube, Two small balloons, Thin rubber sheet, Rubber band, Thread and Cork with hole.

Procedure:

- With help of the tread, fix a balloon each at the two ends of the fork of the Y tube
- Insert the long end of the Y tube through the hole in the cork and fix the cork on the mouth of the bell jar
- Fix the thin rubber sheet at the bottom of the bell jar with the help of rubber bands
- Pull the rubber sheet down and observe the change in the balloons
- Push the rubber sheet up and observe the changes in the balloons



Observation

When the rubber sheet is pulled down, the balloons inflate. When the rubber sheet is pushed up, the balloons deflate.

Explanation:

The thin rubber sheet at the bottom of the bell jar acts like the diaphragm and the two small balloons act like the lungs. When the sheet is pulled down, it creates extra space inside the jar. The air from outside the jar rushes in through the Y tube and inflates the balloons. When the rubber sheet is released, it pushes the air inside the balloons out, due to which the balloons deflate.

Activity 9: Acid and Bases test

Aim: To prepare a natural indicator using turmeric powder and use it to test acid and bases

Materials required: Turmeric Powder, water, Filter paper, Soap solution, Vinegar, Bowls and Paint brush

Procedure:

Put some turmeric powder into bowl

Add some water to it and prepare a smooth paste

Smear the paste evenly on the filter paper and let it dry

Take small amount of vinegar and soap solution in different bowls

Using the paint brush, draw a floral pattern on the dried filter paper, once with vinegar and then with the soap solution

**Observation**

The floral pattern drawn with the vinegar is not visible on the filter paper but the one drawn with soap solution turns red

Explanation

Turmeric indicator gives yellow colour with vinegar, which is acidic in nature, while it turns red in soap solution, which is basic in nature







Conducting Post test

Following the completion of the intervention, the investigator conducted a post-test to assess the impact and effectiveness of the intervention. The post-test aimed to identify any changes, improvements, or

advancements in the knowledge, skills, or behavior of the participants, specifically the experimental group. By comparing the results of the post-test with the previously administered pre-test, the investigator sought to measure the extent of the acquired knowledge and skills related to the Innovative Low-Cost Teaching Learning Materials (ILCTLM). This post-test phase serves as a crucial component in the evaluation process, allowing for a comprehensive analysis of the treatment's influence on the targeted outcomes.





3.14 DATA COLLECTION

The investigator obtained permission from the headmasters of upper primary schools in and around the 10 block Krishnagiri district, before conducting the data collection. Visits to these schools were made to facilitate the administration of research tools. Prior to administering the tools, the

investigator provided a detailed explanation of the study's aims and objectives to the school teachers. The research tools were then administered to gather relevant information from the teachers. Once the data collection phase was complete, the collected data underwent analysis. The investigator computed frequencies for all question items and systematically entered the data into a master table for further organization and interpretation. This meticulous process ensured that the collected data were systematically managed and prepared for subsequent stages of analysis in the research study.

3.15 DATA ANALYSIS

The following statistical techniques are used in the present study

- Descriptive Analysis
- Differential Analysis
- ANOVA
- Effect Size

3.16 DELIMITATION OF THE STUDY

The following is a delimitation of the study

1. The present study is limited to upper primary level
2. The present study is limited to 50 teachers from 10 block in Krishnagiri district
3. The present study is confined to ILCTLM based on the science concept only

3.17 CONCLUSION

The methodology chapter comprehensively outlines the entire research plan. This section elucidates the method employed in the study, the chosen sample and its size, the tools utilized, and the reliability and validity of these tools. Additionally, the chapter delves into the study's design, the process of data collection, and the statistical techniques applied for data analysis. The subsequent chapter will focus on the Analysis and Interpretation of Data, providing further insights derived from the collected information.

CHAPTER-IV

DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

In the chapter," the focus is on delving into the process of analyzing the data collected for the study and interpreting its significance. Data analysis is a crucial step in research, as it allows for deriving meaningful insights, drawing conclusions, and making informed decisions based on empirical evidence. This chapter outlines the methods, techniques, and tools used to analyze the data, along with the processes involved in interpreting the results. Through this analysis and interpretation, the aim is to uncover patterns, trends, relationships, and key findings that contribute to a deeper understanding of the research objectives and advance knowledge in the field of study.

4.2 STATISTICAL TECHNIQUES USED IN THIS STUDY

The following statistical techniques are used in this study

Descriptive Analysis: Descriptive analysis involves summarizing and describing the main characteristics of a dataset or a set of data points. It aims to provide a clear and concise summary of the data's central tendencies, variability, and distribution through measures such as mean, median, mode, range, standard deviation, and graphical representations like histograms or box plots.

Differential Analysis: Differential analysis is a comparative method used to examine differences between two or more groups, variables, or conditions. It involves analyzing variations, contrasts, or disparities in outcomes, responses, or characteristics across different categories or levels. This analysis helps identify significant differences and understand the factors influencing these variations.

ANOVA: ANOVA stands for Analysis of Variance. It is a statistical method used to analyze the differences among group means in a sample. ANOVA tests whether there are statistically significant differences between the means of three or more independent groups. It does this by comparing the variance between group means to the variance within groups. If the variance between groups is significantly larger than the variance within groups, it suggests that there are differences in the means of the groups being compared. ANOVA is commonly used in research and data analysis to assess the effects of categorical independent variables on a continuous dependent variable.

Effect Size: Effect size quantifies the magnitude or strength of a relationship, difference, or intervention's impact in statistical analysis. It provides a standardized measure that is independent of sample size, allowing researchers to assess the practical significance of results. Common effect size measures include Cohen's d for comparing means, eta-squared (η^2) for explaining variance in ANOVA, and Pearson's r or Cramer's V for correlation and association.

4.3 DATA ANALYSIS

Table 1
Pre test and Post test score

S.NO	Pre test	Post test
1	48	76
2	48	72
3	64	84
4	56	84
5	48	80
6	52	84
7	48	76
8	60	84
9	52	78
10	40	72
11	36	72
12	48	84
13	40	60
14	76	96
15	52	88
16	72	96
17	44	80
18	44	80
19	56	80
20	72	92
21	44	68
22	76	96
23	44	76
24	64	80
25	64	84
26	72	96
27	56	76
28	52	80
29	72	80

30	64	76
31	56	80
32	48	64
33	60	80
34	56	80
35	60	76
36	52	74
37	48	80
38	52	84
39	52	80
40	48	76
41	44	80
42	52	76
43	44	72
44	32	60
45	48	80
46	64	84
47	44	76
48	52	84
49	72	86
50	56	76

The table above displays the overall pre-test and post-test scores for teachers.

Table 2

The mean, standard deviation (SD), and t-test values for the pre-test and post-test of ILTCM in teaching the Basic Science concept at the upper primary level

	Mean	SD	't' value	Level of Significance
Pre test	54.08	10.46	13.78	S
Post test	79.56	7.82		

Significant at 0.05 level 1.98

The above table shows that the mean score of the post-test, 79.56, is higher than the mean score of the pre-test, 54.08. The calculated 't' value of 13.78 exceeds the table value of 1.98, which is significant at the 0.05 level. Therefore, the hypothesis is rejected, leading to the conclusion that there is a significant difference between the pre-test and post-test scores of ILTCM in teaching the Basic Science concept at the upper primary level.

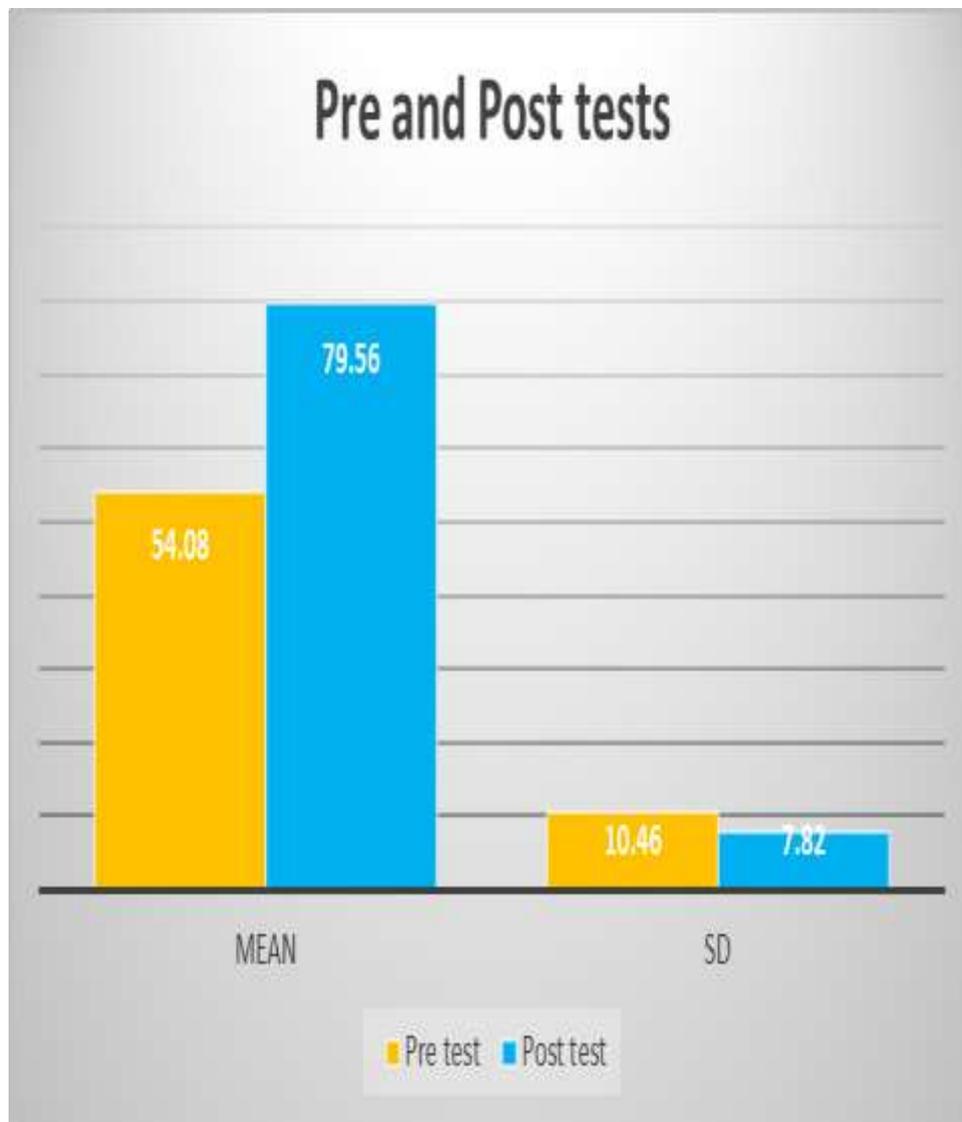


Fig 1.

The mean, standard deviation (SD) values for the pre-test and post-test of ILTCM in teaching the Basic Science concept at the upper primary level

Table 3

The effect size of the difference between the pre - test and post- test

	Mean	SD	σ	E.S (d)
Pre test	54.08	10.46	2.43	2.75
Post test	79.56	7.82		

Table 3 presents the effect size of the difference between the pre-test and post-test scores for the ILTCM in teaching the Basic Science concept at the upper primary level. The effect size (d) is calculated to be 2.75. This effect size indicates a large difference between the pre-test and post-test scores, suggesting a substantial impact of ILTCM on students' understanding of the Basic Science concept. The higher effect size suggests that the intervention had a significant positive effect on students' learning outcomes.

Table 4
Pre-test mean, standard deviation (SD), and t-test values for the ILTCM in teaching the Basic Science concept at the upper primary level with respect to gender.

Pre test	Mean	SD	't' value	Level of Significance
Male	54.15	14.08	0.07	NS
Female	54.40	8.82		

Significant at 0.05 level 2.01

The above table shows that the mean scores in the pre-test for female teachers (54.40) are higher than the mean scores for male teachers (54.15). The calculated 't' value of 0.07 is less than the table value of 2.01, which is significant at the 0.05 level. Therefore, it is concluded that there is no significant difference between male and female teachers in the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning gender.

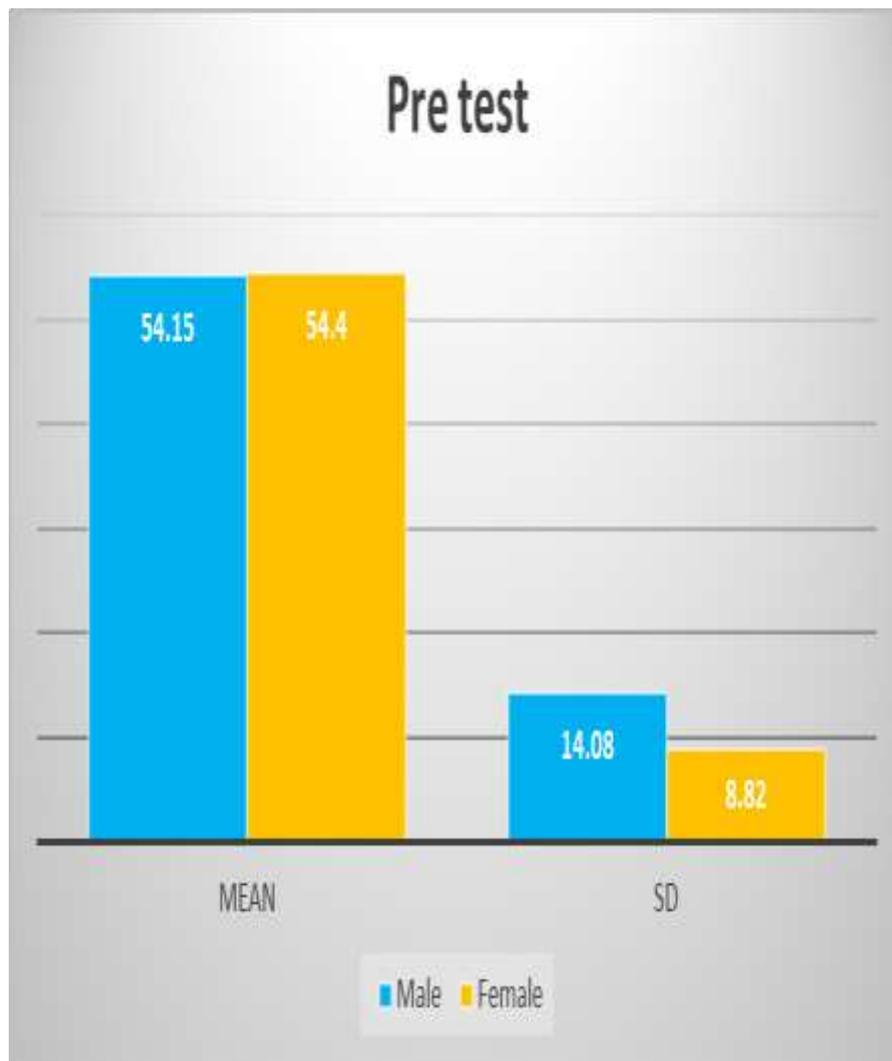


Fig 2

Pre-test mean, standard deviation (SD), for the ILTCM in teaching the Basic Science concept at the upper primary level with respect to gender.

Table 5
Post-test mean, standard deviation (SD), and t-test values for the ILTCM
in teaching the Basic Science concept at the upper primary level with
respect to gender.

Post test	Mean	SD	't' value	Level of Significance
Male	81.23	11.13	0.90	NS
Female	78.91	6.31		

Significant at 0.05 level 2.01

The above table shows that the mean scores in the post-test for male teachers (81.23) are higher than the mean scores for female teachers (78.91). The calculated 't' value of 0.90 is less than the table value of 2.01, which is significant at the 0.05 level. Therefore, it is concluded that there is no significant difference between male and female teachers in the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning gender.

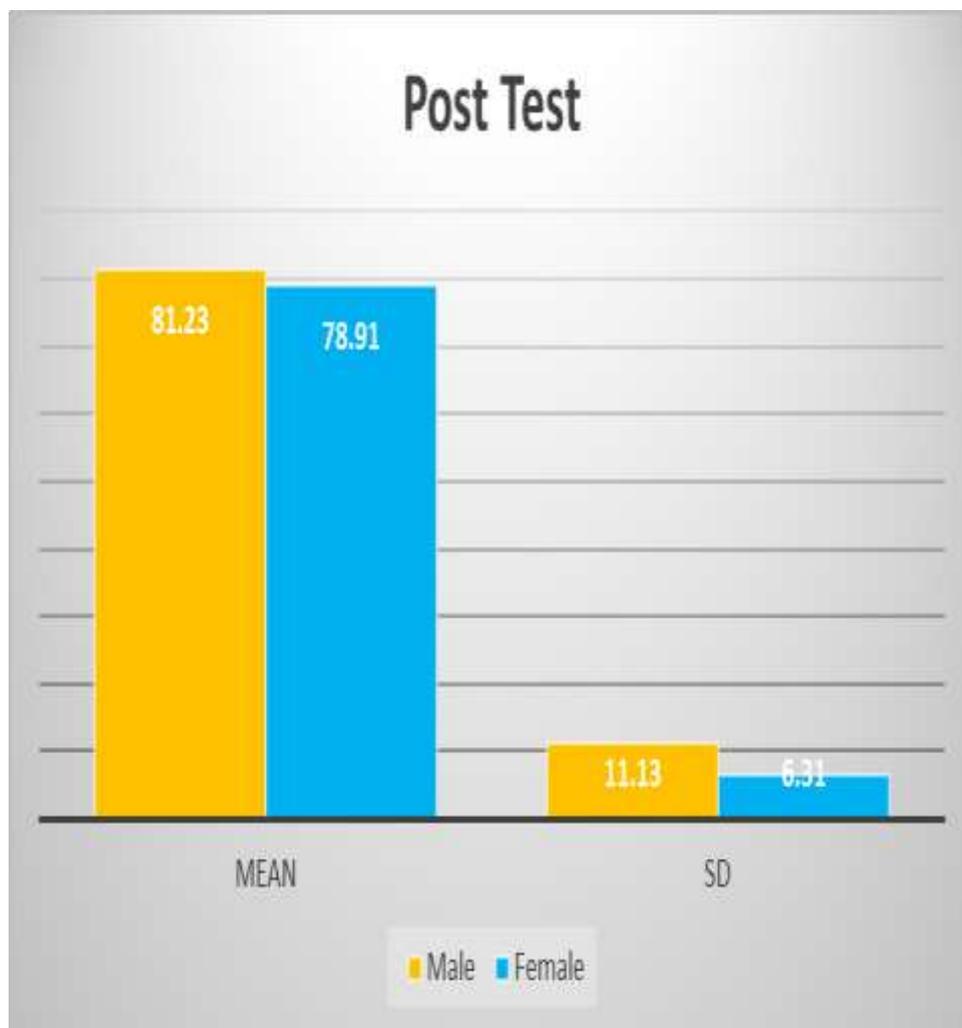


Fig 3

Post-test mean, standard deviation (SD), for the ILTCM in teaching the Basic Science concept at the upper primary level with respect to gender.

Table 6
Pre-test mean, standard deviation (SD), and t-test values for the ILTCM
in teaching the Basic Science concept at the upper primary level with
respect to locality

Pre test	Mean	SD	't' value	Level of Significance
Rural	53.53	11.22	0.68	NS
Urban	56.00	6.62		

Significant at 0.05 level 2.01

The above table shows that the mean scores in the pre-test for urban teachers (56.00) are higher than the mean scores for rural teachers (53.53). The calculated 't' value of 0.68 is less than the table value of 2.01, which is significant at the 0.05 level. Therefore, it is concluded that there is no significant difference between rural and urban teachers in the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning locality.

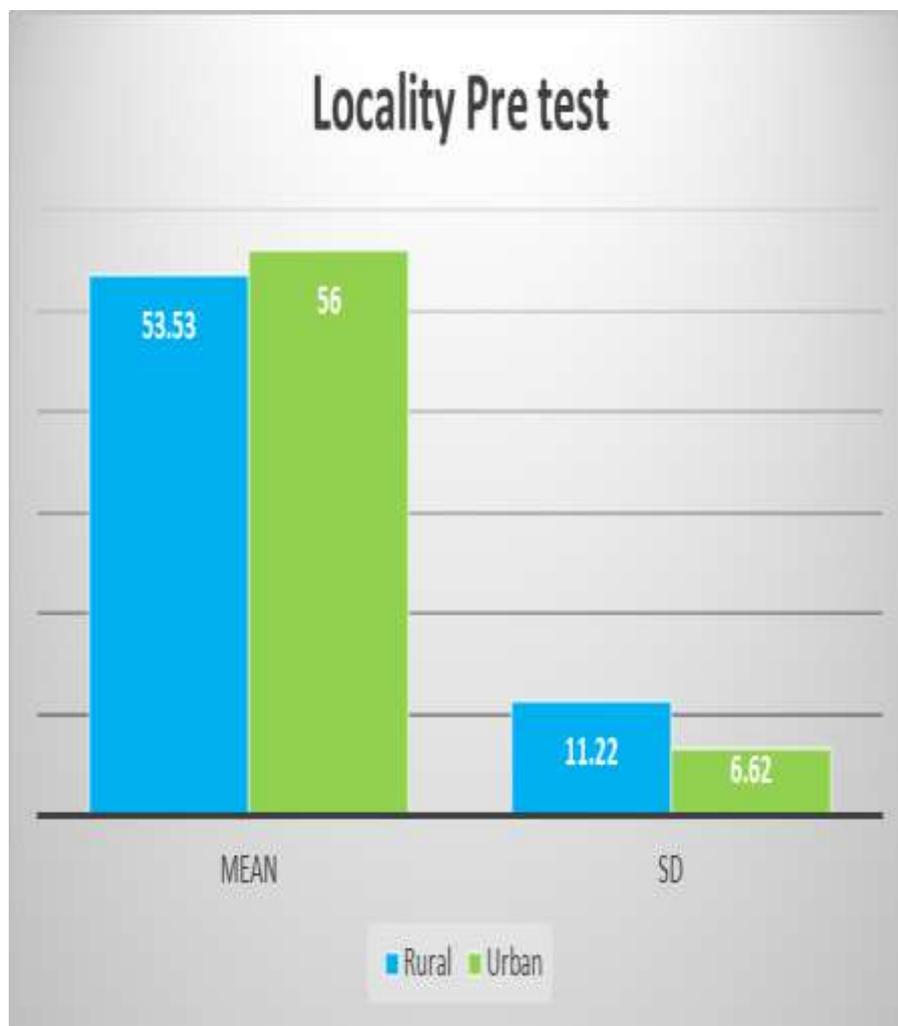


Fig 4

Pre-test mean, standard deviation (SD) values for the ILTCM in teaching the Basic Science concept at the upper primary level with respect to locality

Table 7
Pre-test mean, standard deviation (SD), and t-test values for the ILTCM
in teaching the Basic Science concept at the upper primary level with
respect to locality

Post test	Mean	SD	't' value	Level of Significance
Rural	80.05	8.38	0.83	NS
Urban	77.81	5.00		

The above table shows that the mean scores in the post-test for rural teachers (80.05) are higher than the mean scores for urban teachers (77.81). The calculated 't' value of 0.83 is less than the table value of 2.01, which is significant at the 0.05 level. Therefore, it is concluded that there is no significant difference between rural and urban teachers in the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning locality.



Fig 5
Post-test mean, standard deviation (SD) values for the ILTCM in teaching the Basic Science concept at the upper primary level with respect to locality

Table 8

**Pre-test 'F' values for the ILTCM in teaching the Basic Science concept
at the upper primary level with respect to Teaching Experience**

ANOVA Pre test

Result Details					
<i>Source</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	Level; of Significance
Between-treatments	121.2343	2	60.6171	0.53178	NS
Within-treatments	5357.4857	47	113.9891		
Total	5478.72	49			

The calculated 'F' value for the pre-test of Teaching Experience, 0.53, is less than the table value. Therefore, it is concluded that there is no significant difference between the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning Teaching Experience.

Table 9

**Post-test 'F' values for the ILTCM in teaching the Basic Science concept
at the upper primary level with respect to Teaching Experience
ANOVA Post test**

Result Details					
<i>Source</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	Level; of Significance
Between-treatments	8.0571	2	4.0286	0.06278	NS
Within-treatments	3015.9429	47	64.169		
Total	3024	49			

The calculated 'F' value for the post-test of Teaching Experience, 0.062, is less than the table value. Therefore, it is concluded that there is no significant difference between the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning Teaching Experience.

4.4 CONCLUSION

This chapter analyses data, and their interpretations are given. A summary of findings, recommendations, educational implications, and suggestions for further research are discussed in the next chapter.

CHAPTER-V

SUMMARY OF FINDINGS AND CONCLUSION

5.1 INTRODUCTION

This chapter is mainly focusing on a summary of findings, discussion, education implications, recommendations, suggestions for further research, and the conclusion that is also presented in the research report.

5.2 FINDINGS OF THE STUDY

1. There is a significant difference between the pre-test and post-test scores of ILTCM in teaching the Basic Science concept at the upper primary level.
2. The effect size (d) is calculated to be 2.75. This effect size indicates a large difference between the pre-test and post-test scores, suggesting a substantial impact of ILTCM on students' understanding of the Basic Science concept. The higher effect size suggests that the intervention had a significant positive effect on students' learning outcomes.
3. There is no significant difference between male and female teachers in the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning gender.
4. There is no significant difference between male and female teachers in the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning gender.

5. There is no significant difference between rural and urban teachers in the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning locality.
6. There is no significant difference between rural and urban teachers in the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning locality.
7. There is no significant difference between the pre-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning Teaching Experience.
8. There is no significant difference between the post-test scores for ILTCM in teaching the Basic Science concept at the upper primary level concerning Teaching Experience.

5.3 IMPLICATIONS OF THE STUDY

The findings of this study have several important implications for educational practice and policy. Firstly, the significant difference observed between pre-test and post-test scores of ILTCM in teaching the Basic Science concept at the upper primary level underscores the effectiveness of using innovative and low-cost teaching materials in enhancing students' comprehension and learning outcomes. This suggests that educators and policymakers should consider integrating similar innovative teaching approaches and materials into the curriculum to improve the quality of science education at the primary level. Additionally, the large effect size calculated ($d=2.75$) indicates a substantial

impact of ILTCM on students' understanding, highlighting the potential of such interventions to bring about significant improvements in student learning.

Secondly, the absence of significant differences based on teachers' gender, locality (rural vs. urban), or teaching experience in both pre-test and post-test scores for ILTCM suggests that these factors may not play a significant role in the effectiveness of ILTCM in teaching Basic Science concepts. This implies that ILTCM can be a versatile and inclusive approach that can benefit students across different demographics and teacher backgrounds. Educators and policymakers can leverage these findings to promote the adoption of ILTCM and similar innovative teaching strategies in diverse educational settings, aiming to improve educational outcomes and bridge learning gaps among students from various backgrounds.

The implications of the study are significant for both educational practice and policy. The observed significant improvement in post-test scores compared to pre-test scores indicates the potential of ILTCM to enhance students' understanding of Basic Science concepts, highlighting the importance of integrating innovative and cost-effective teaching materials into the curriculum. This suggests that educators and policymakers in Krishnagiri District, and potentially in similar educational contexts, should consider adopting ILTCM and similar strategies to improve the quality of science education at the primary level. Furthermore, the non-significant differences based on teachers' gender, locality, and teaching experience underscore the versatility and inclusivity of ILTCM, indicating its potential to benefit students across diverse demographic and

teacher backgrounds. These implications emphasize the need for continued research and implementation of innovative teaching approaches like ILTCM to address educational challenges and improve learning outcomes among primary school students in Krishnagiri District and beyond.

5.4 RECOMMENDATION OF THE STUDY

Teachers

- ❖ Conduct workshops to train teachers on using ILTCM effectively in teaching basic science concepts. Provide hands-on training and guidance on integrating these materials into their lesson plans.
- ❖ Create a platform or network where teachers can share innovative teaching materials and strategies related to basic science concepts. Encourage collaboration and peer learning among educators.
- ❖ Implement a feedback mechanism to gather input from teachers regarding their experiences with ILTCM. Collect data on usability, effectiveness, and areas for improvement to inform future developments.
- ❖ Provide ongoing monitoring and support to teachers using ILTCM. Offer assistance, troubleshooting, and additional resources as needed to ensure successful implementation and positive outcomes.
- ❖ Develop an evaluation framework to assess the impact of ILTCM on teachers' instructional practices, student engagement, and learning outcomes in basic science. Use both qualitative and quantitative measures to gather comprehensive data.

- ❖ Involve the local community, school administrators, and education stakeholders in the project. Seek their input, collaboration, and support to enhance the adoption and sustainability of ILTCM in teaching basic science.
- ❖ Offer professional development opportunities for teachers to expand their knowledge and skills in using ILTCM effectively. Provide access to relevant resources, research, and best practices in science education.
- ❖ Document the process, outcomes, and lessons learned from implementing ILTCM in teaching basic science. Disseminate findings through reports, presentations, and publications to share insights and recommendations with the education community.

Students

- ❖ Create worksheets that involve hands-on activities and interactive elements to engage students in learning basic science concepts.
- ❖ Utilize visual aids such as charts, diagrams, and models to enhance understanding and retention of scientific principles.
- ❖ Develop educational games related to basic science concepts to make learning more enjoyable and effective.
- ❖ Design do-it-yourself science kits using easily available and affordable materials to promote experiential learning.
- ❖ Use multimedia resources such as videos, animations, and interactive simulations to supplement classroom teaching and reinforce key concepts.

- ❖ Organize field trips to science museums, nature reserves, or science laboratories to provide real-world exposure and practical application of science concepts.
- ❖ Encourage peer teaching by providing materials that facilitate group discussions, collaborative learning, and peer-to-peer knowledge sharing.
- ❖ Explore open educational resources available online for free or at low cost, including digital textbooks, lesson plans, and educational apps.
- ❖ Experiment with innovative teaching tools like augmented reality (AR) apps, interactive whiteboards, and gamified learning platforms to enhance engagement and comprehension.
- ❖ Involve the local community, parents, and stakeholders in the development and implementation of teaching materials to ensure relevance and effectiveness in the Krishnagiri District context.

5.5 SUGGESTION FOR FURTHER RESEARCH

1. Conduct longitudinal studies to assess the long-term impact of ILTCM on students' retention of Basic Science concepts.
2. Investigate the specific teaching strategies and instructional techniques associated with ILTCM that contribute significantly to improved learning outcomes.
3. Compare the effectiveness of ILTCM with other teaching methods or materials in teaching Basic Science concepts at the upper primary level.
4. Explore the generalizability of findings by conducting similar studies in diverse educational settings beyond Krishnagiri District.

5. Consider qualitative research methods such as interviews or observations to gain deeper insights into effective pedagogical practices related to ILTCM implementation.
6. Examine the scalability and sustainability of ILTCM implementation in larger educational contexts to inform policy and practice.

5.6 CONCLUSION

The study has yielded valuable insights into the efficacy of ILTCM in enhancing students' understanding of Basic Science concepts. The significant improvement observed in post-test scores compared to pre-test scores indicates the effectiveness of ILTCM in facilitating learning outcomes among upper primary students. This finding underscores the importance of integrating innovative and cost-effective teaching materials into the curriculum to improve the quality of science education at the primary level.

Furthermore, the study's findings suggest that ILTCM is a versatile and inclusive approach that can benefit students across different demographic backgrounds and teacher characteristics, as evidenced by the non-significant differences based on teachers' gender, locality, and teaching experience. These results have implications for educational practice and policy, highlighting the potential of ILTCM to bridge learning gaps and enhance educational outcomes among primary school students. Overall, this study contributes to the ongoing discourse on effective teaching strategies and underscores the importance of innovative approaches like ILTCM in improving the quality of education.

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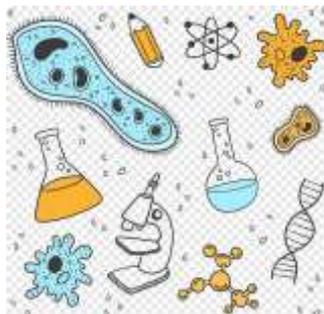
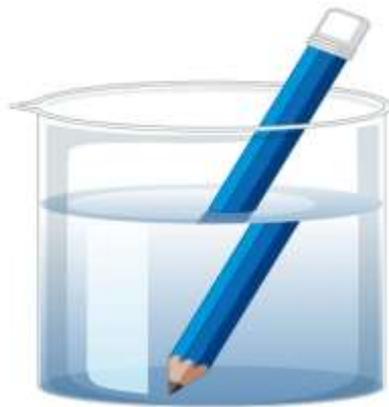
APPENDIX



District Institute of Education and



“EFFECTS OF INNOVATIVE LOW-COST TEACHING LEARNING MATERIAL (ILCTLM) IN TEACHING OF BASIC SCIENCE CONCEPTS AT UPPER PRIMARY LEVEL IN KRISHNAGIRI DISTRICT”



Research Module - 2024

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Nowadays adaptation of new teaching techniques to stimulate the knowledge of the students according to the time in teaching and learning is very important.

In this case **LOW-COST TEACHING LEARNING MATERIAL (ILCTLM)** play an important role in understanding the fundamentals of scientific concepts and developing curia city among the students. Science subject consists of 4 sub-subjects namely Physics, chemistry, Botany and Zoology

LOW-COST TEACHING LEARNING MATERIAL (ILCTLM) help a teacher to understand and teach students all the concepts. These materials are easily available in local area and can be prepared in less amount.

Science subject is based on learning by doing, so when teaching the basic concepts of science with **LOW-COST TEACHING LEARNING MATERIAL (ILCTLM)**, it is simple for the teachers and stimulates students' interest and higher order thinking.

I hope that this foundation will encourage the creativity of teachers and students and make them think in terms of subject matter and use **LOW-COST TEACHING LEARNING MATERIAL (ILCTLM)**.

Best regards,
Mayilsamy M
Researcher
DIET, Krishnagiri

Introduction

Innovative Low-Cost Teaching Learning Materials (ILCTLM) refer to educational resources and tools designed to facilitate effective teaching and learning experiences while maintaining affordability and accessibility. These materials aim to provide educators with innovative resources that enhance the quality of education, especially in contexts where financial constraints may limit access to traditional teaching aids. ILCTLM encompasses a diverse range of tools, including low-cost experiments, interactive simulations, multimedia content, and hands-on activities that cater to the specific needs of learners at various educational levels. The development and implementation of ILCTLM represent a significant stride towards democratizing education, ensuring that even resource-constrained environments can benefit from engaging and effective teaching methods. These materials not only make learning more enjoyable and relatable but also contribute to fostering a deeper understanding of fundamental concepts, such as those in basic science, at the upper primary level.

In recent years, the integration of technology and innovative teaching methods has become pivotal in enhancing educational outcomes, particularly at the upper primary level where foundational concepts are laid for further academic pursuits. One notable development in this realm is the advent of Innovative Low-Cost Teaching Learning Materials (ILCTLM), which has emerged as a transformative tool in the teaching of basic science concepts. These materials, characterized by their affordability and ingenuity, offer a promising avenue for educators to engage students more effectively, fostering a dynamic

and interactive learning environment. This introduction sets the stage for an exploration of the effects of ILCTLM on the teaching of basic science concepts, delving into its potential to revolutionize pedagogical approaches and contribute to the overall improvement of educational experiences at the upper primary level.

Learning by doing, also known as experiential learning, holds immense importance in education across various levels. This pedagogical approach emphasizes active engagement and practical application of knowledge, offering a dynamic and effective learning experience. Several key aspects highlight the importance of learning by doing:

1. Active Engagement: Learning by doing encourages active participation in the learning process. Instead of passively receiving information, students engage with the subject matter through hands-on activities, experiments, and real-world applications. This active engagement enhances understanding and retention of concepts.

2. Practical Application: The approach emphasizes the practical application of knowledge in real-life situations. By applying theoretical concepts in practical scenarios, learners can bridge the gap between theory and practice, gaining a deeper and more meaningful understanding of the subject matter.

3. Critical Thinking Skills: Learning by doing fosters the development of critical thinking skills. Through problem-solving activities and hands-on projects, students learn to analyze situations, make decisions, and creatively solve problems. This skill set is invaluable in various aspects of life and future careers.

4. Retention of Information: Studies have shown that actively engaging with learning materials leads to better retention of information. When individuals participate in activities related to the subject matter, they are more likely to remember and understand the concepts over the long term.

5. Motivation and Interest: Learning by doing often sparks curiosity and interest in the subject matter. Hands-on activities make learning enjoyable and relevant, motivating students to explore topics further and take ownership of their education.

6. Skill Development: Beyond academic knowledge, learning by doing promotes the development of practical skills. Whether it's in the sciences, arts, or other disciplines, hands-on experiences help students acquire skills that are applicable in real-world settings.

7. Teamwork and Collaboration: Many experiential learning activities involve collaboration with peers. Students learn to work effectively in teams, share ideas, and leverage each other's strengths. These interpersonal skills are crucial for success in both academic and professional environments.

8. Preparation for the Real World: Learning by doing prepares individuals for real-world challenges and situations. This approach aligns with the demands of a rapidly changing world, where adaptability and practical skills are often as important as theoretical knowledge.

In essence, learning by doing not only enhances academic learning but also cultivates skills and qualities that are essential for personal and professional

success. It transforms education into a dynamic, interactive, and meaningful experience, laying the foundation for a lifelong love of learning.

Electro static force

Aim: To know the **electro static force between two electrically charged particles**

Materials required: Two straw, Nylon cloth, Water bottle and

Scientific Principle: Electrostatic force definition for class 8 can be stated as **the force between two electrically charged particles**. They can either be a repulsive or attractive force. Like charges will repel each other and unlike charges will attract each other.

Procedure: The researcher collected the low cost material and given the following activity

- The same pole of straw repelled each other when the straw rubbed with the nylon cloth produce electrostatic force
- When we run a piece of paper with the oil in our head with the help of a comb produces electrostatic force.
- Balloons get attracted to another balloon when one of them are rubbed with hair.
- When I do iron my silk or cotton cloth and keep it right in front of me, they just cling on to my body.
- Lightning is also another example of electrostatic force."



Conclusion: Observe the electro static particles, the same charged particles repelled and opposite charged particle are attracted

Light refraction

Aim: To demonstrate the refraction of light on different kind of mirror

Materials required: Motor belt, three coconut stick, Glitters paper

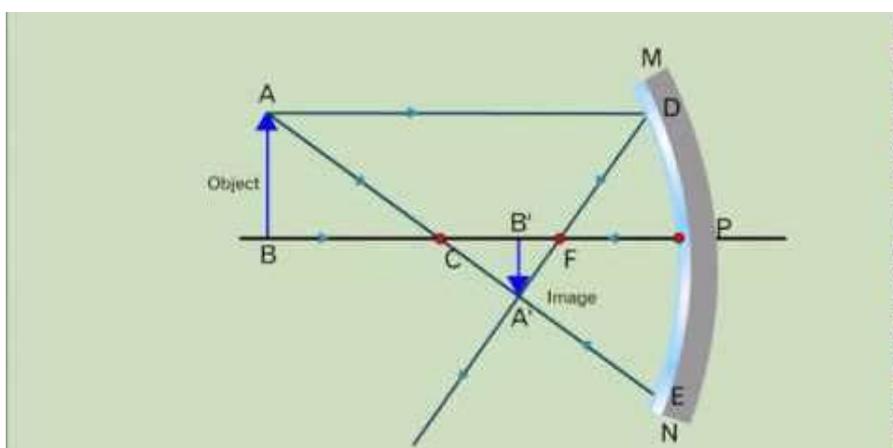
Scientific Principle

- Refraction is the bending of light (it also happens with sound, water and other waves) as it passes from one transparent substance into another.
- This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows. Even our eyes depend upon this bending of light. Without refraction, we wouldn't be able to focus light onto our retina.
- A lens is simply a curved block of glass or plastic. There are two kinds of lens.

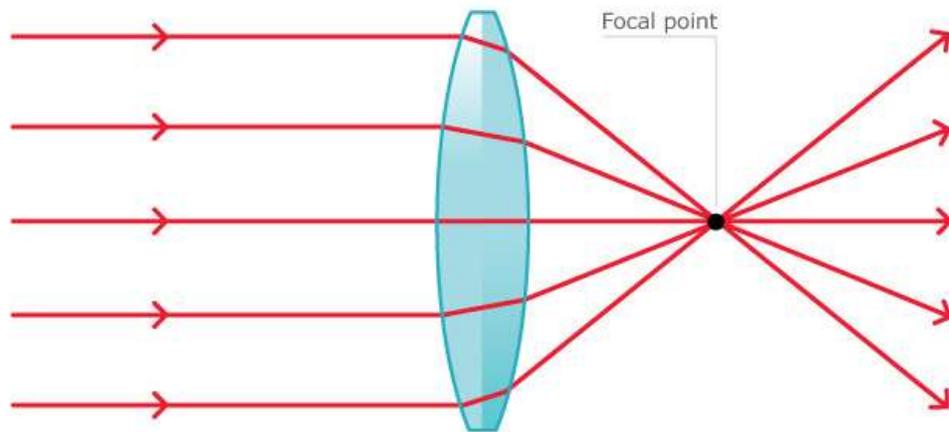
- A biconvex lens is thicker at the middle than it is at the edges. This is the kind of lens used for a magnifying glass. Parallel rays of light can be focused in to a focal point. A biconvex lens is called a converging lens.

Procedure

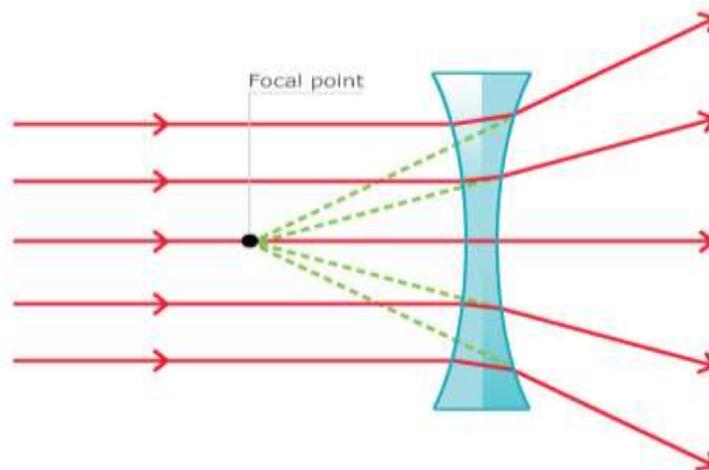
- The investigator making model for the concave and convex science concept with help of equal size of three coconut stick and 10 cm size of motor belt.
- Making three holes on the motor belt in top corner, middle and bottom corner and inserted the three coconut stick in three holes in the belt equal length in both side.
- The investigator making fold in the belt for the shape of convex lens, in opposite side all three sticks in the belt to converge in a single point to making image like original process.
- Making another folding for opposite direction in the belt for the shape of concave lens, in opposite side all the three sticks in the belt to diverge like original process.



Converging lens



Diverging lens



Conclusion

In this activity to indicate that how the concave and convex lens to penetrate the light rays in opposite side.

Light dispersion

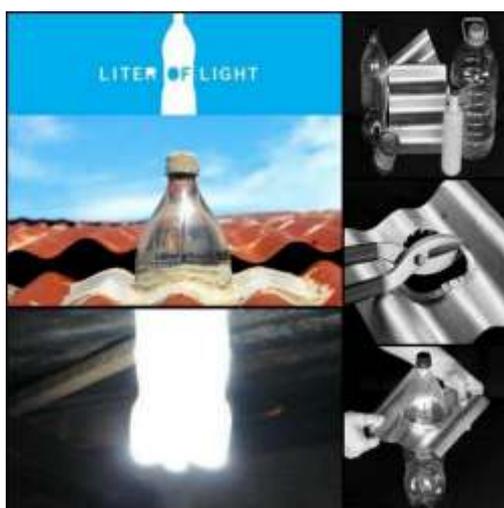
Aim To demonstrate the light dispersion using low cost materials

Material required: Water bottle, Water, Bleaching powder

Scientific Principle: The separation of visible light into its different colors is known as dispersion. It was mentioned in the Light and Color unit that each color is characteristic of a distinct wave frequency; and different frequencies of light waves will bend varying amounts upon passage through a prism.

Procedure

When the investigator collected one-liter water bottle and filled with water making model its named as “sun lamp”. Many temple and houses have very dark at the day time. In these places the sun lamp fitted in the roof in partially outer side and partially in side. The sun rays travel the air and reached the bottle making two process one is refraction and another one is dispersion. In dispersion the light rays scattering in the room making brightness in the room.



Conclusion

So the investigator to explain this event to produce shining in the room with help sun rays by the process of refraction and dispersion.

Poles of magnet and Magnetism

Aim: To find out pole of magnet in different magnet

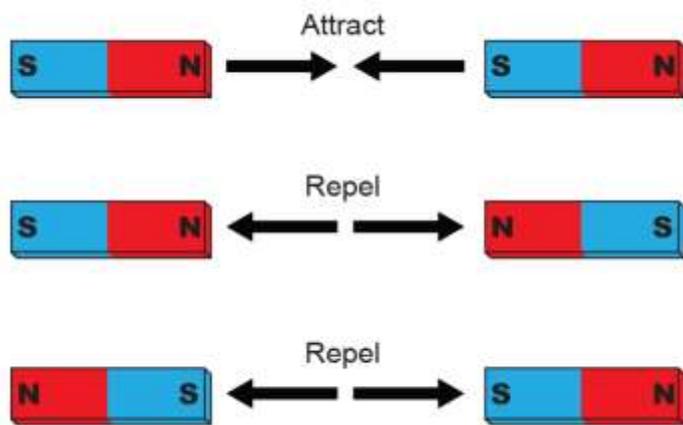
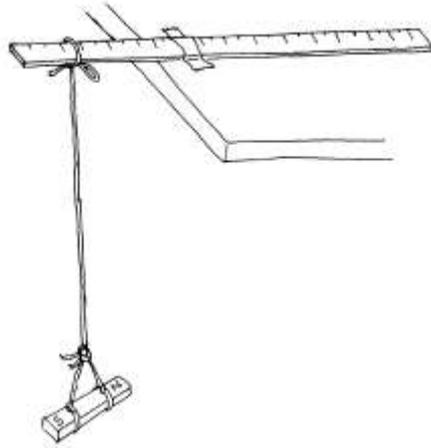
Materials required: Bar magnet, U shaped magnet and Round magnet

Scientific Principle: The areas of a magnet that have magnetic strength are called “*poles*”. When you have more than one magnet, like (or same) poles repel or push each other. Opposite poles attract or pull each other. In other words, the north pole of one magnet will click together with the south pole of another magnet and two north poles will push each other away. These acts of attraction and repulsion are called “magnetism”, and the magnetic space around a magnet is called the “magnetic field”.

Procedure

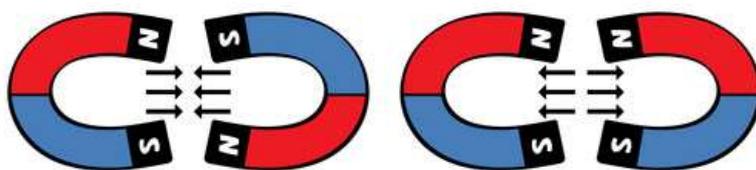
The investigator demonstrates the magnetic poles by the following activity

1. Put a small piece of masking tape on one end of a bar magnet.
2. Tie a string around the middle of your magnet.
3. Dangle the magnet from the string and then from a ruler. Watch as one end orients itself toward the north. This is the magnet’s north pole.
4. If that is the end with the masking tape, write “*N*” on the tape. If the other end has the tape, write “*S*.”



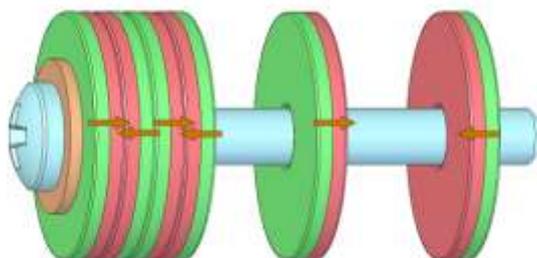
How to find the edges of U shaped magnet.

They are known as identical poles if the south end of the already detected bar magnet is distorted when it joins with one end of the shaped magnet. Otherwise, if the two ends of the magnet are attracted to each other, the bar magnet is called the south pole and the tip of U shaped magnet is called the north pole.



How to find the edges of a circular magnet?

The ends of the magnet are the upper and lower parts of the magnet. The northern and southern poles of the circular magnet can be detected by the above actions.



Conclusion

A magnet which is in the shape of a horse shoe is called a horseshoe magnet. A horseshoe is of U shape where the two ends are a bit closer. So the shape of the magnet is a bit like U shape.

The shape of the magnet determines the strength of the magnetic field, closer the poles of the magnet stronger the magnetic field. This is the reason for making a magnet in the shape of a horseshoe as in this type the poles are brought close enough to create a strong magnetic field are the poles.

Speed of conduction of sound

Which of the following medium has the highest speed of sound?

- A) Solid b) Milk c) Air d) Water

The question is often asked in competitive exam. How to make students understand this lesson concept? Explaining this concept through a story.

A student named Ramu has to cross his field, railway line and river to go to school daily. One day due to heavy rain, the river floods and the railway track

breaks down. Ramu is shocked to see this. Seeing the train coming immediately, nothing was seen. Suddenly he feels the train coming when he steps on the railway road. He immediately took off his red shirt and waved it like a flag. The train driver sees the boy's action and stops the train. Immediately everyone comes downstairs and is shocked to see that the railway track is broken and everyone praises Ramu for avoiding the accident. The railway road is adjusted and the train departs. Through this story, how Ramu first felt the train coming. He feels the vibration as soon as he puts his foot on the railway road through which he knows the train is coming. Railroad is a solid material made of iron. The solid is bound by more atoms. Therefore, the mobility of the molecules in these is high. Materials with high mobility of molecules are more likely to transmit sound faster.

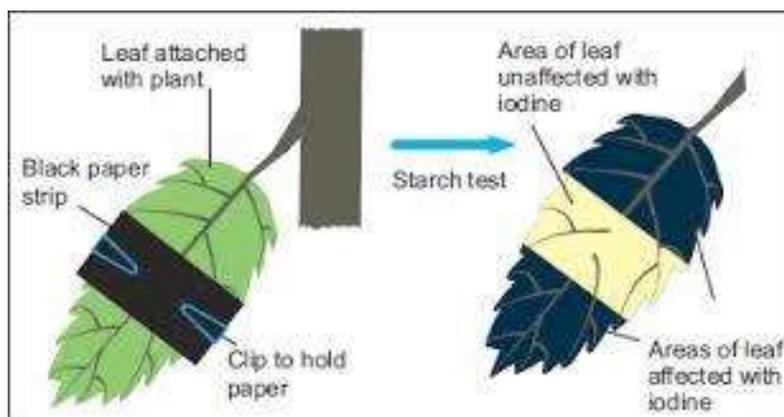
Sunlight is necessary for photosynthesis

Aim: To show the sunlight is very important for photosynthesis process

Material required: A plotted plans, Black paper, Beaker, Test tube, Ethanol, Burner, Iodine solution, Dropper and Paper clips

Procedure:

- Cover a part of one green leaf with a strip of black paper and fix with the help of paper clips
- Place the plant in a dark room for two days to destarch
- Keep the plant in sunlight for 5 to 6 hours
- Pluck the leaf covered with the black paper strip
- Test the leaf for the presence of starch



Observation

The portion of the leaf covered with black paper strip remains light brown.

However, the uncovered portion of the leaf turns blue black

Explanation:

In the absence of sunlight, the covered portion of the leaf was not able to produce starch. The uncovered portion of the leaf regained the starch in the presence of sunlight

Conclusion:

Sunlight is necessary for Photosynthesis

Effect of saliva on food

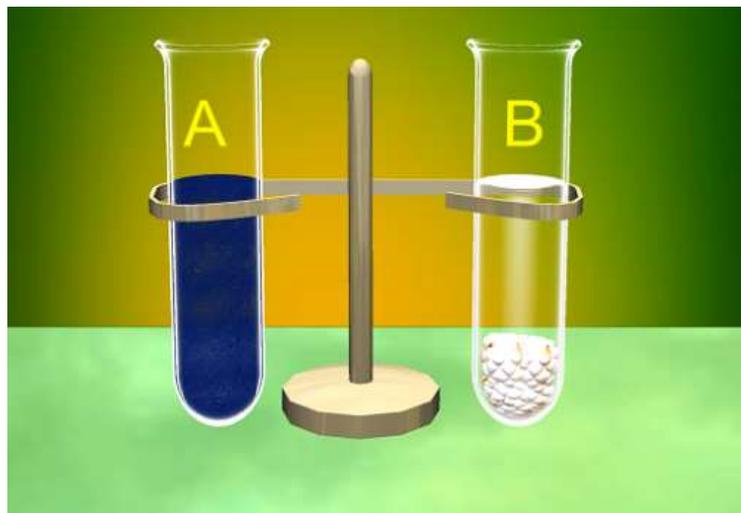
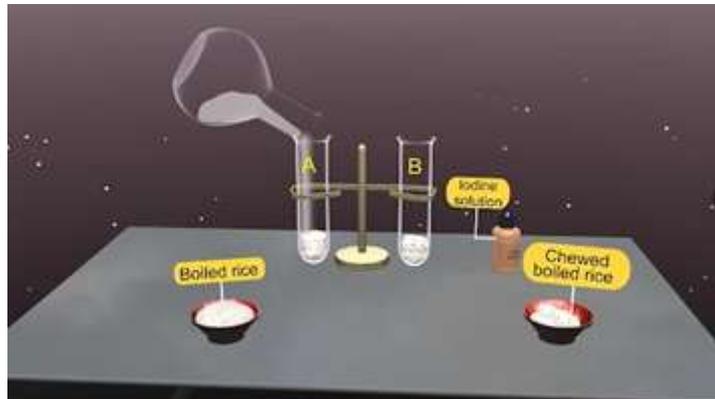
Aim: To study the effect of saliva on food

Materials required: Two test tube, Boiled rice and iodine solution

Procedure:

- Label one test tube as A and another as B
- Put some boiled rice in test tube A
- Partially masticate some rice and put in test tube B

- Add few drops of iodine solution into Test tube A and B to observe few minutes



Observation:

The rice in the test tube A turns in Blue – Black colour. The rice in the test tube B does not turns any changes in colour

Explanation:

In test tube A, the rice turned black Blue as it contained starch. In test tube B, the chewed rice did not show any changes in colour as the saliva in the mouth had decomposed the starch into sugar

Conclusion:

Saliva breaks down the starch present in food into sugar

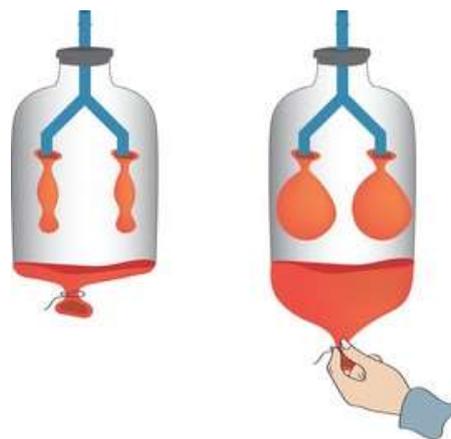
Working of diaphragm during breathing

Aim: To understand the Working of diaphragm during breathing

Materials required: A bell Jar, Y tube, Two small balloons, Thin rubber sheet, Rubber band, Thread and Cork with hole.

Procedure:

- With help of the tread, fix a balloon each at the two ends of the fork of the Y tube
- Insert the long end of the Y tube through the hole in the cork and fix the cork on the mouth of the bell jar
- Fix the thin rubber sheet at the bottom of the bell jar with the help of rubber bands
- Pull the rubber sheet down and observe the change in the balloons
- Push the rubber sheet up and observe the changes in the balloons



Observation

When the rubber sheet is pulled down, the balloon inflates. When the rubber sheet is pushed up, the balloon deflates.

Explanation:

The thin rubber sheet at the bottom of the bell jar acts like the diaphragm and the two small balloons act like the lungs. When the sheet is pulled down, it creates extra space inside the jar. The air from outside the jar rushes in through the Y tube and inflates the balloons. When the rubber sheet is released, it pushes the air inside the balloons out, due to which the balloons deflate.

Acid and Bases test

Aim: To prepare a natural indicator using turmeric powder and use it to test acids and bases

Materials required: Turmeric Powder, water, Filter paper, Soap solution, Vinegar, Bowls and Paint brush

Procedure:

Put some turmeric powder into bowl

Add some water to it and prepare a smooth paste

Smear the paste evenly on the filter paper and let it dry

Take small amount of vinegar and soap solution in different bowls

Using the paint brush, draw a floral pattern on the dried filter paper, once with vinegar and then with the soap solution



Observation

The floral pattern drawn with the vinegar is not visible on the filter paper but the one drawn with soap solution turns red

Explanation

Turmeric indicator gives yellow colour with vinegar, which is acidic in nature, while it turns red in soap solution, which is basic in nature

**EFFECT OF INNOVATIVE LOW-COST TEACHING LEARNING MATERIAL
IN
TEACHING OF BASIC SCIENCE CONCEPT AT UPPER PRIMARY LEVEL
IN KRISHNAGIRI DISTRICT**

Researcher:

M.MAYILSAMY

SENIOR LECTURER

District Institute of Teacher Education and Training

Krishnagiri- 635 001

Dear Sir/Madam,

I am doing a research project on the above topic. I, therefore, assure you that you may read the details Provided in this questionnaire and choose your best answers and that your views will be taken up for scrutiny only and will be kept confidential.

Yours faithfully
M.Mayilsamy

Teacher Profile

1. Name:

2. Designation :

3. Educational Qualifications :

4. School Address :

5. Block :

6. District :

7. Gender :

8. Work experience (in years)

0-10	11-20	21-30	Above 31

9. School Type:

Government Schools	GHSS	GHS	PUMS	PUPS
School Location	village	city	Urban	

**EFFECT OF INNOVATIVE LOW-COST TEACHING LEARNING MATERIAL
IN
TEACHING OF BASIC SCIENCE CONCEPT AT UPPER PRIMARY LEVEL
IN KRISHNAGIRI DISTRICT**

Dear Sir/Madam,

Read the questions given below and are given 4 options for each question, choose which option you think and Put tick mark. Kindly attend all questions.

1. Which of the following is a characteristic of low-cost aids used in science education?
 - a) Expensive materials
 - b) Complex construction
 - c) Affordable materials and simple construction
 - d) Limited accessibility
2. What is the primary advantage of using low-cost aids in science education?
 - a) They are highly durable
 - b) They require extensive maintenance
 - c) They are accessible to a wider audience
 - d) They are only suitable for advanced learners
3. Which of the following is an example of a low-cost aid commonly used in science education?
 - a) Advanced laboratory equipment
 - b) Virtual reality simulations
 - c) Homemade models and experiments
 - d) High-speed computers
4. What role do low-cost aids play in enhancing science education?
 - a) They make learning more expensive
 - b) They limit experimentation opportunities
 - c) They increase accessibility and hands-on learning
 - d) They decrease student engagement
5. Which of the following is NOT a benefit of incorporating low-cost aids into science education?
 - a) Encouraging creativity and innovation
 - b) Fostering critical thinking skills
 - c) Restricting access to educational resources
 - d) Providing practical, real-world applications

15. What is the purpose of using a ripple tank in wave experiments?
- a) To measure the frequency of waves b) To observe the interference of waves
- c) To generate sound waves d) To detect electromagnetic waves
16. Which of the following low-cost aids can be used to demonstrate the principle of reflection of waves?
- a) Mirror b) Lens c) Seismograph d) Laser pointer
17. What type of waves are produced by shaking a rope up and down?
- a) Longitudinal waves b) Surface waves c) Transverse waves d) Sine waves
18. Which low-cost aid can be used to visualize standing waves?
- a) Rubens' tube b) Opaque screen c) Ripple tank d) Guitar string
19. Which of the following materials can be used to construct a low-cost solar cooker?
- a) Aluminum foil b) Glass mirrors c) Cardboard d) All of the above
20. What is the purpose of using a reflector in solar lighting systems?
- a) To absorb sunlight b) To concentrate light
- c) To scatter light d) To block light
21. What type of low-cost aid can be used to redirect natural light into dark rooms or spaces?
- a) Prisms b) Diffraction gratings c) Light tubes d) Photovoltaic cells
22. What is the primary function of a sound amplifier in a low-cost sound system?
- a) To increase the volume of sound b) To filter out background noise
- c) To convert sound waves into electrical signals d) To produce echo effects
23. Which low-cost aid can be used to improve sound quality in a room by reducing echo and reverberation?
- a) Acoustic panels b) Tuning forks c) Bullhorns d) Sound meters
24. What is the purpose of using a resonance tube in a low-cost sound experiment?
- a) To measure the intensity of sound b) To generate ultrasonic waves
- c) To amplify sound d) To determine the speed of sound in air

25. Which low-cost aid is commonly used to transmit sound over long distances in rural areas?

- a) Telegraph wires b) Megaphones c) Whisper dishes d) Tin can telephones

PHOTOS





