EFFECTIVENESS OF SIMULATION-BASED TEACHING METHOD OVER CONVENTIONAL TEACHING METHOD IN TEACHING PHYSICS CONCEPTS AMONG VII STANDARD STUDENTS IN TIRUPUR DISTRICT

SHRINIDHI.S

24PED012

A THESIS SUMBITTED TO

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COIMBATORE-641043

In partial fulfilment of the requirements for the degree of

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CERTIFIED AS BONAFIDE RESEARCH WORK

S.S. Manimozhi 17/4/26
Signature of the Guide

17/4/2026
Signature of the

Head of Department

18/4/26
Signature of the Dean

DECLARATION

DECLARATION

I, **SHRINIDHI S**, hereby declare that the thesis entitled "**Effectiveness of simulation-Based teaching method over conventional teaching method in teaching physics among VII standard students in Tirupur district**" submitted to Avinashilingam Institute for Home Science and a Higher Education for Women, Coimbatore, in partial fulfilment of the requirements for the award of the **Degree of Master of Education**, is a record of original and independent research work done by me during the period under the supervision and guidance of **Mrs. S.S. MANIMOZHI, Assistant Professor (SG), Department of Education**, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, and it has not formed the basis for the award of any Degree/ Diploma/ Associateship/ Fellowship or other similar title to any candidate of this or any other University.

S Shrinidhi 17/4/26

Signature of the Candidate

S.S. Manimozhi 17/4/26

Signature of the Guide

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INTRODUCTION

1.1 EDUCATION

"Education is the most powerful weapon which you can use to change the world"

- Nelson Mandela

Education is a fundamental pillar of human development and societal progress. It is the process through which individuals acquire knowledge, skills, values, and attitudes that enable them to think critically, communicate effectively, and contribute meaningfully to their communities. From early childhood to higher education, it shapes personal growth and fosters intellectual, social, and emotional development.

1.2 INTRODUCTION TO CONVENTIONAL TEACHING METHOD

The conventional or traditional teaching method is a teacher-centred approach that mostly involves lectures, calk and talk method of explanation and textbook-based explanation and exercises. In this method of teaching teacher will plays a major role in imparting knowledge and students will be passive in this method of teaching.

1.2.1 CHARACTERISTICS OF CONVENTIONAL TEACHING METHOD

The major characteristics of conventional teaching method includes:

- Teacher plays a major role in class by explaining the concepts, solving problems and demonstrating experiments.
- The textbooks, preprepared notes by the teachers and chalkboard illustrations used as a primary instructional tools.
- The rigid and uniform curriculum is followed which has fewer flexibility.
- Teaching will have less focus on individual learning styles and paces. It always follows one-size-fits-all.
- It emphasis more on memorization and recall rather than exploration.

1.2.2 PEDAGOGICAL APPROCHES IN CONVENTIONAL TEACHING METHOD

Conventional teaching method mainly follows teacher -centred pedagogical approach. It includes as follows:

- **Lecture-Based teaching method**- In this method the teacher will deliver the content orally whereas students will listen to it and take notes. Students will answer to teachers question occasionally.
- **Chalk-and-Talk method**- In this method the teacher will use black board to explain concepts and show illustrations.
- **Demonstration method**- In this method the teacher conducts experiments in class and explains concepts. Students will observe the experiments.

1.2.3 ADVANTAGES OF CONVENTIONAL TEACHING METHOD

The following are the advantages of conventional teaching method:

- It provides the structured and organized learning environment for students.
- It relays on resources such as textbooks and printed materials which gives easy accessibility of resources.
- It focuses mainly on the fundamental skills like core literacy and numeracy skills.
- It is cost effective since it does not require computers, laptops, software and internet access.
- It is the most familiar method for both students and teachers.

1.2.4 LIMITATIONS OF CONVENTIONAL TEACHING METHOD

The following are the advantages of conventional teaching method:

- Conventional teaching method lacks in visualization of abstract concepts especially in physics.
- In this type of teaching method students will be passive and there will be limited interaction.
- This type of teaching could easily lead to misunderstanding and it is harder to identify and correct it.

1.3 IMPORTANCE OF TEACHING PHYSICS CONCEPTS

Physics is a fundamental branch of science that helps students to understand the natural laws that we see around us in the world. It plays an important role especially at the middle school stage which improves scientific attitude, critical thinking and problem-solving skills. Many day-to-day happenings such as reflection, formation of shadows, solar and lunar eclipse, synthesis of colours and phases of moon are explained clearly through principles of physics.

Physics teaching helps in developing curiosity, creativity, and develops positive attitude towards science learning. Teaching physics encourages inquiry-based learning.

1.3.1CHALLENGES IN TEACHING PHYSICS CONCEPTS

The following are some of the challenges in teaching physics concepts:

- Many concepts in physics cannot be effectively demonstrated without the use of laboratory equipment.
- The conventional teaching method lacks in student's participation, interest and curiosity.
- Without proper visual and interactive experiences there might be persistent misconception.
- Lack of laboratory equipment in schools also poses challenge in teaching physics concepts in schools effectively.

1.4 INTRODUCTION TO SIMULATION-BASED TEACHING METHOD

Simulation-Based teaching method uses computer -based models to represent the real world process or phenomena which helps students to observe, explore and interact with them in a virtual environment. In this method the complex scientific concepts are explained through interactive simulations that imitate real situations. It allows learners to change the variable and can see the result in an interactive way.

1.4.1 CHARACTERISTICS OF SIMULATION-BASED TEACHING METHOD

The following are the characteristics of Simulation-Based teaching method:

- It provides interactive learning environment for learners and encourages them with active participation rather than passive listening.
- Simulation-Based teaching method helps in visualization of abstract concepts which aids in the better understanding of the concepts.
- It promotes learning by doing which lets students to explore the experiments and investigate scientific phenomena in virtual environment.
- It provides the safe and controlled environment for experiment. It can eliminate the risk of accidents and the limitation of laboratory resources.
- It supports the conceptual understanding. This increases motivation and encourages learners for better participation.

1.4.2 PEDAGOGICAL APPROCHES IN SIMULATION-BASED TEACHING METHOD

Simulation-Based teaching method is supported by student-centred pedagogical approach.

- **Constructivist approach**- In this approach the students will construct their knowledge by interacting with simulations.
- **Inquiry-Based learning-** Simulations encourage students to ask questions, investigate any scientific phenomena and get conclusions on their own.
- **Experiential Learning-** Virtual experiments in simulations gives real laboratory experiments.
- **Collaborative learning-** Mostly students will explore simulation in groups which enhances team work, collaboration and communication.

1.4.3 ROLE OF SIMULATION-BASED LEARNING IN PHYSICS

Simulation-Based learning has been emerged as a powerful tool which enhances conceptual understanding. It allows students to observe, manipulate, and get knowledge about complex abstract concepts in a virtual environment.

It aids in dynamic visualization, safe experimentation and enhanced engagement. This type of teaching method provides immediate feedback.

1.4.4 ADVANTAGES OF SIMULATION-BASED TEACHING METHOD

The following are the advantages of Simulation-Based teaching method:

- Simulation improves conceptual understanding of abstract concepts in physics by providing clear visual representation.
- It aids in providing repeated practice until the students clearly understand the concepts.
- Students will actively participate in class and explore concepts while teacher can act as a guide.
- It helps to save more time and resources also it eliminate the risk of laboratory accidents or damage to the equipment.

1.4.5 LIMITATIONS OF SIMULATION-BASED TEACHING METHOD

The following are the advantages of Simulation-Based teaching method:

- In this method teacher needs more training to effectively use it in the class and it is also time consuming compared to traditional teaching method.

- Technical problems such as software failure, equipment failure and internet issues can affect the flow of class.
- It requires adequate infrastructure to set up simulation labs.

1.4.6 GEOGEBRA SIMULATION TOOL

GeoGebra is a free and open-source dynamic mathematics software that was developed by Markus Hohenwarter in 2001. It combines various mathematical tools, including geometry, algebra, statistics, and calculus, all within a single platform. GeoGebra enables users to create graphs, develop dynamic models, and interactively manipulate variables.

The software has become widely popular in mathematics education due to its intuitive interface and robust visualization features. Educators can create interactive lessons, demonstrations, and simulations with GeoGebra, making it a valuable resource for both classroom teaching and self-directed learning. Its accessibility and adaptability have also contributed to its use in science education, especially in the teaching of physics.

It helps especially in teaching concepts like laws of reflection, pinhole camera, shadows, parts of shadows, newton disc and synthesis of colours.

1.4.6.1 FEATURES OF GEOGEBRA IN TEACHING PHYSICS

GeoGebra helps teachers and students to explore and visualize physics concepts effectively. The following are some of the key features GeoGebra in teaching physics.

Graphs:

It provides features like creating and manipulating graphs effectively. The students can learn physics concepts like laws of reflection, pinhole camera, shadows and parts of shadows effectively by changing the variables and observe the changes in the graphs.

Free access:

It is a free and open access educational software that helps students to learn physics and mathematics concept efficiently.

Slider tools:

Slider tool in GeoGebra helps user to change the parameters easily and it helps to observe the changes made in the graphs or features.

3D- Visualization:

GeoGebra has many 3-D Visualization that helps to understand the concepts like pinhole camera, shadows etc.,

1.4.6.2 BENEFITS OF GEOGEBRA IN PHYSICS TEACHING

Using GeoGebra in physics teaching helps both students as well as teachers. It helps in enhancing student's engagement in classroom. It motivates students and creates interest towards learning. It acts as a bridge between mathematics and physics since many physics concepts are expressed mathematically. It supports Inquiry-Based learning and improves problem solving skills among students.

1.4.7 CK-12 SIMULATIONS TOOL

CK-12 simulations are engaging digital resources created to assist students in grasping scientific concepts via visual and interactive virtual experiences. Created by the CK-12 Foundation, these simulations enable learners to investigate scientific principles by adjusting variables and witnessing results in real time. They are extensively utilized in science education to promote inquiry-based and student-focused learning, particularly in disciplines like physics where visualization is crucial.

1.4.7.1 FEATURES OF CK-12 SIMULATIONS IN PHYSICS TEACHING

CK-12 Simulation provides various features for science and maths disciplines. The following are the key features of CK-12 Simulations

Free resources and accessibility:

It is a freely available online resource. Both teachers and students can access this resource which can be operated in computer, tablets or smartphones. It is also very much cost effective and it is suitable for both classroom and home learning.

Digital lessons:

It is integrated with digital textbooks, practice questions, and interactives lessons of various science disciplines. It helps teacher to combine both simulations and theorical explanation. It also provides assessment which enhances their understanding.

Visual representation:

Many physics concepts such as reflection of light, plane mirror and reflection, solar and lunar eclipse are difficult to visualize. This simulation tool helps in greater visualization making complex concepts easy.

Feedback:

The students will be getting immediate feedback like changing the parameters the result will be shown immediately. This gives better reinforcement for further improvement of the students.

1.3.7.2 BENEFITS OF CK-12 SIMULATIONS IN PHYSICS TEACHING

CK-12 Simulations help students to understand more complex concepts by providing enhanced visual representation. Simulations make learning in a more enjoyable way and it enhances student engagement. It is a student-centred learning which increases student's engagement. Also it promotes active learning.

It provides safe and practical virtual lab environment for performing experiments. CK-12 Simulations provides visual, interactive and experiential learning. It also provides individualized and flexible learning for students.

1.5 NEED AND IMPORTANCE OF THE STUDY:

Physics education is important in understanding and analysing the natural phenomenon that is happening around us. Especially at VII standard level student will learn many important physics concepts like light and universe and space. These concepts are more abstract and understanding through conventional teaching method alone makes it difficult.

Using simulation tools like GeoGebra and CK-12 Simulation helps students to visualize more abstract concepts easily and helps in better understanding. Therefore the present study aims to examine the effectiveness of simulation-based teaching method over conventional teaching method in teaching selected physics concepts among VII standard students in Tirupur District.

1.6 STATEMENT OF THE PROBLEM:

The study is entitles as **"Effectiveness of simulation-Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district"**.

1.7 OPERATIONAL DEFINITIONS OF KEY TERMS:

Simulation Based teaching method:

An instructional approach in physics where students actively manipulate virtual, interactive models to visualize abstract concepts, conduct experiments, and test "what-if" scenarios, enabling them to construct knowledge through inquiry, feedback, and repetition in a safe, controlled, computer-supported environment. (Hursen, C., & Asiksoy, G. (2015))

Conventional teaching method:

A teacher-centered instructional method, primarily characterized by direct instruction (lecturing), textbook reliance, and blackboarding. The instructor plays the dominant role in transmitting knowledge, while students are passive recipients, and assessment is heavily focused on rote memorization and reproduction of facts, formulas, and theories. (Hursen & Asiksoy (2015))

Physics concepts:

Physics concepts refer to the topics in VII standard Tamil Nadu state board term 3 science text book. The topics includes pinhole camera, reflection, laws of reflection, shadows, eclipses, solar eclipse, lunar eclipse, plane mirror and reflection, synthesis of colours and phases of moon.

Achievement test:

A researcher-developed, multiple-choice or short-answer test covering specific physics topics that measures students' cognitive understanding. It is used to compare the pre-test and post-test mean scores between groups. (Robert L. Ebel (1972))

1.8 OBJECTIVES OF THE STUDY:

- To determine the effectiveness of the simulation-based teaching method by comparing the post-test mean scores of the control group against experimental group among VII standard students in Tirupur district.

- To find out whether there is any significant difference between the control group and experimental group in their achievement of physics concepts among VII standard students in Tirupur district.
- To find out whether there is any significant difference between the post-test and delayed post-test scores of the control group and experimental group in physics concepts among VII standard students in Tirupur district.
- To find out whether there is any significant difference between control group and experimental group in the achievement of physics concepts among VII standard students in Tirupur district with respect to gender, locality, medium of instruction, father's educational qualification, mother's educational qualification, parent's socio economic status, father's occupation, mother's occupation, availability of computer at home and access to internet at home.
- To find out whether there is any significant difference between post-test scores and delayed post-test scores of control group and experimental group in achievement of physics concepts among VII standard students in Tirupur district.

1.9 HYPOTHESIS:

- There is no significant difference between the pre-test scores and post-test scores of the control group and experimental group in their academic achievement in physics among VII standard students in Tirupur district.
- There is no significant difference between the post-test mean scores of the control group and experimental group in achievement of physics concepts among VII standard students in Tirupur district.
- There is no significant difference between the post-test scores and delayed post-test scores of the control group and experimental group in achievement of physics concepts among VII standard students in Tirupur district.
- There is no significant difference in the achievement of physics concepts among VII standard students with respect to gender, locality, medium of instruction, father's educational qualification, mother's educational qualification, parents' socio-economic status, father's occupation, mother's occupation, availability of computer at home, and access to internet at home in Tirupur district.

1.10 LIMITATIONS OF THE STUDY:

The following are some of the limitations identified while conducting the experiments.

- This project is limited to the VII standard students in Tirupur district.
- This study focuses only on selected physics topics.
- This study is limited to the usage of only GeoGebra and CK-12 Simulations as the simulation tool for the study.
- Since the study is conducted in one district, generalization of the result to the whole state is difficult.

1.11 ORGANISATION OF THE STUDY:

The study **"Effectiveness of simulation-Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district"** is presented in five chapters.

The first chapter deals with the introduction, which includes the need of the study, statement of the problem, meaning and definitions of the key terms, objectives of the study, hypothesis and limitations of the study.

The second chapter deals with the related literature and studies relevant to the topic.

The third chapter deals with the methodology adopted by the investigator that has been used in detail for carrying out the study.

The fourth chapter deals with data analysis, results and interpretations.

The fifth chapter reports the findings and gives recommendations and suggestions, followed by a bibliography

LITERATURE REVIEW

CHAPTER-II

LITERATURE REVIEW

2.1 INTRODUCTION:

The literature review is used to explore the previous study related to the present study. It helps in analyzing the research methodology and data collection method used in the previous studies related to our present study. It helps in identifying the research gap which could make our present study even effective. It helps researcher to get familiarize with their area of research and to increase the knowledge in the research. It helps in preventing a researcher from doing the same work which was done already.

" The literature in any field forms the foundation upon which all future work will be built the foundation of knowledge provided by the review of literature our work is likely to be shallow and naïve and will often duplicate work that has already been done better by someone else".- Brog, W.R.

2.2 NEED FOR THE REVIEW OF LITERATURE:

The following are the need for the review of literature:

1. Provides the interpretation of existing literature in light of updated developments in the field to help in establishing the consistency in knowledge and relevancy of existing materials
2. It helps in calculating the impact of the latest information in the field by mapping their progress of knowledge.
3. It brings out the dialects of contradictions between various thoughts within the field to establish facts
4. The research gaps scrutinized initially are further explored to establish the latest facts of theories to add value to the field
5. Indicates the current research place in the schema of a particular field.

2.3 THE PURPOSE OF REVIEW:

The following are the reasons for doing review of literature:

- To gain the background knowledge of the research topic.

- To identify data sources used by other researchers.
- To learn how other researcher structured their reports.

2.4 RELATED REVIEWS:

Farouk Umar Adams et.al (2025) studied on "**The effectiveness of computer simulation software on students' learning and performance of scientific concepts in Sabon- Gari Educational Zones Kaduna state, Nigeria"**. Information was collected using a tool called the Science Concepts Performance Test (SCPT). The collected data was analysed with descriptive and inferential statistics of means, percentages and standard deviation to provide insight into the research questions and the quantitative statistics employed the use of t-test to test the null hypothesis at a 0.05 level of significance. The results indicated that Science concepts were easier to grasp through simulation software than through traditional lecture.

Fiola Marie G. Urieta et.al(2025) conducted a study on "**The Effectiveness of online interactive simulation laboratory in improving the performance in motion in two dimensions of Grade 9 students in San Jose Adventist Academy"**. The study was conducted for 40 students was divided into two groups: one experienced instruction using CK-12 online interactive physics simulations, and the other followed traditional, conventional teaching methods. Both groups participated in five targeted learning sessions, after which they completed a performance test on motion in two dimensions. This finding highlights the superior effectiveness of simulation-based learning in facilitating student comprehension and achievement in physics concepts that are typically abstract and conceptually demanding. Consequently, this study supports the integration of technology-enhanced simulations into physics instruction to optimize learning outcomes, promote deeper conceptual understanding, and address common learning difficulties in topics such as two-dimensional motion.

Hanan Zaki Alhusni et.al(2025) has investigated on "**The Simulation Technologies in Physics Learning for Education for Sustainable Development".** The study found that simulation technologies significantly enhance students' conceptual understanding, digital competence, and sustainability awareness in physics and STEM education. A systematic review of the literature revealed four main themes: (1) the use of simulations to support conceptual understanding, (2) the development of sustainability competencies, (3) the enhancement of teacher digital competence, and (4) equity in virtual learning environments. Simulations function as both cognitive and affective tools, helping students connect content mastery with sustainable values while fostering scientific literacy. These findings underscore the importance

of integrating simulation technologies in physics education to support interactive learning, promote critical thinking, and develop competencies that extend beyond traditional scientific knowledge.

Kelvin Lim Jian Kai and Samri Chongo(2025) conducted a study on **"The Impact of Computer-Based Simulation on Primary Students' Achievement and Interest in Learning Earth's Rotation and Revolution"**. The findings indicate that the use of Computer-Based Simulation had a positive and significant effect on students' achievement and interest in the topic of Earth's rotation and revolution. The results suggest that CBS is an effective instructional tool for addressing misconceptions and promoting interactive learning in primary science. It is recommended that science educators integrate CBS into teaching abstract astronomy concepts and develop training programs to equip teachers with the necessary skills for implementing ICT-based simulations in the classroom. The results suggest that CBS is an effective instructional tool for addressing misconceptions and promoting interactive learning in primary science.

Seuth Borliboune et.al(2025) studied on **"The influence of computer-based simulation in teaching direct current circuits on improving students' academic achievement and attitudes**. This study investigated the impact of computer-based simulations on students' academic achievement and attitudes toward learning Direct Current (DC) circuits in physics. The results showed that the experimental group achieved significantly higher post-test scores ($M = 78.60$, $SD = 12.63$) compared to the control group ($M = 68.80$, $SD = 11.24$). Similarly, students in the experimental group reported higher attitude scores ($M = 3.67$, $SD = 0.49$) than those in the control group ($M = 3.38$, $SD = 0.64$). Student feedback indicated that simulations were engaging and interactive, helping them visualize abstract concepts and develop confidence in conducting electrical experiments. The study demonstrates that computer-based simulations can effectively improve both academic performance and students' attitudes toward learning physics, and it recommends integrating simulations into physics instruction to enhance conceptual understanding and problem-solving skills.

Seuth Borliboune et.al(2025) investigated on "**The Comparison of Simulation-Based and Traditional Teaching Approaches in Improving Students' Learning Outcomes and Attitudes toward Newton's Laws"**. The study employed an experimental research design with secondary school students who were divided into a simulation-based group and a control group that received conventional physics instruction. The findings revealed a statistically significant

difference in post-test performance between the two instructional approaches. Students in the simulation-based group achieved a higher mean post-test score compared to control group. In addition to performance measures, the study also assessed students' attitudes toward learning physics. Results showed that learners exposed to simulation-based instruction demonstrated markedly higher levels of interest and motivation. These findings suggest that simulation-based teaching not only enhances cognitive outcomes but also positively influences affective factors such as interest and motivation.

A. Bayaga(2024) studied on "**The GeoGebra, a dynamic software for conceptual understanding and visualisation – multi-directionality of influence"**. The results revealed notable direct correlations between the Analogical Comparison Principle (ACP) and the Error and Misconceptions Reflection Principle (EMR), as well as between Mathematical and Computational Algorithms (MCA) and ACP. These findings suggest that GeoGebra can enhance conceptual understanding and cognitive growth in STEM education. Nevertheless, certain indirect pathways were found to be insignificant, indicating that the influence of GeoGebra primarily arises from direct engagement with the software rather than through mediated processes. The research concludes that while GeoGebra serves as an effective instrument for advancing STEM cognition and visualization, its efficacy may differ based on educational contexts, including geographical factors and the distinctions between urban and rural educational institutions.

Diana Kamalia et al(2024) studied on "**The Analysis of Students' Computational Thinking Skills Through The Implementation of GeoGebra Integrated Student Worksheets on Motion"**. The study utilized a mixed-methods approach, integrating both quantitative and qualitative analyses. The results indicated that students demonstrated strong computational thinking skills in the areas of abstraction, decomposition, and algorithmic thinking. In particular, students were capable of identifying pertinent information, effectively simplifying problems, and systematically explaining procedural steps. Conversely, the generalization indicator received a good rating, reflecting a slightly lower, yet acceptable, proficiency in applying learned concepts to wider contexts. this study indicates that the incorporation of GeoGebra into physics instruction not only aids in visualizing physical phenomena but also significantly enhances the development of students' computational thinking abilities, especially in abstraction, decomposition, and algorithmic reasoning.

S Yorganci and M Subasi (2024) conducted a study on "**The impact of interactive GeoGebra applets integrated into an e-book learning environment on students' academic performance and motivation".** The study explored how dynamic visualizations provided through GeoGebra could support conceptual understanding in mathematics and science education. The results indicated that students who learned using GeoGebra-based interactive materials showed higher achievement and increased motivation compared to those taught through traditional instructional methods. The dynamic and visual nature of GeoGebra enabled students to explore concepts actively, manipulate variables, and observe changes in real time. The study emphasized that interactive technologies such as GeoGebra can create engaging learning environments and significantly improve students' conceptual understanding and participation in the learning process.

Erasto Danie(2024) et.al studied on "**The Comparison of Traditional Teaching Methods Versus Computer Simulations on students' performance in Learning Ohm's Law at Dodoma City Secondary Schools, Tanzania"**. The study suggests that significant increase in students' performance scores following computer simulation-based instruction at p value of 0.000 which is less than threshold of 0.05. Furthermore, the dispersion of test scores revealed that computer simulation-based teaching led to lower score variations compared to traditional methods, with minimum scores showing improvement from 0% to 20%.

Nurlina et.al(2024) studied on **"STEM-Based Physics Modules with CK-12 Simulations for High School Students: Development and Implementation**". The study employed the ADDIE model—encompassing the phases of analysis, design, development, implementation, and evaluation—to systematically create instructional modules that combine physics content with interactive CK-12 simulations. Participants included Grade X students from two Indonesian schools, and the modules were evaluated for validity, practicality, and effectiveness through expert validators and feedback from both students and teachers. Importantly, the effectiveness of the modules was measured through student learning outcome tests, which demonstrated that students' performance met the established effectiveness criteria with a score of 79.17%. These findings suggest that embedding CK-12 simulations within STEM-based physics modules can meaningfully enhance the quality of physics teaching and learning for high school students by supporting deeper conceptual understanding and engagement. The authors recommend further exploration of this instructional approach for other topics and broader implementation contexts.

A P P Matos et.al(2023) studied on "**The Kepler's laws using GeoGebra simulations. The study shows that computer simulations play a crucial role as research instruments in the contemporary scientific landscape"**. The comprehensive collection of GeoGebra simulations pertaining to Kepler's laws was introduced. This collection has been utilized multiple times in high school classrooms, and the outcomes suggest that it can serve as an effective tool for teaching Kepler's laws.

B.S. Arymbekov et.al(2023) studied on **"Effect of using geogebra software for augmented reality visualization to teach physics in high school"**. The study aimed to examine the impact of GeoGebra software, integrated with augmented reality and sensing technology, on pupils' academic achievement and learning experience in physics, as well as their perceptions toward augmented reality in learning physics conceptsThe findings indicated that augmented reality-supported learning environments can effectively enhance physics instruction by combining visual and textual elements that make abstract concepts easier to understand and more engaging for pupils. The use of augmented reality also helped reduce pupils' fear of physics, increased their curiosity, and improved their interest in the subject. Moreover, students who participated in augmented reality-based activities showed higher participation, greater confidence, better ability to answer questions, and improved academic achievement.

Bounseng Bounthong et.al(2023) studied on **"Simulation instead of Experience by using GeoGebra for the Physics Teacher".** A study on the use of GeoGebra simulations in physics education investigated simulation training provided to 17 physics teachers from the northern provinces. The training aimed to equip teachers with the skills needed to create and apply GeoGebra simulations in teaching and to help them adapt to current educational demands. The results indicated that the training was highly suitable and beneficial for the teachers, as it enhanced their understanding of how simulations can support the teaching and learning process. Following the training, GeoGebra simulations were implemented in two schools in Luang Prabang to support classroom instruction. Feedback collected from the teachers showed very positive opinions about the use of simulations in teaching, particularly in explaining complex physics concepts and promoting interactive learning. Furthermore, students reported high levels of satisfaction with the use of simulations during lessons, indicating that the approach improved engagement and understanding.

Mohamed Droui(2023) investigated on **"Simulation and inquiry-based learning in physics teaching"**. This study investigated the impact of inquiry-based learning in conjunction with

computer simulations on students' academic performance and their understanding of the concepts of heat and temperature in the field of physics. The research included 234 middle school students from Morocco. A comparative analysis along with F-tests was performed to evaluate the performance differences among these groups. The findings revealed that students in the inquiry-based learning with simulation group (GAISV) achieved higher performance levels than those in the inquiry-only and simulation-only groups. The variations in normalized learning gains were found to be statistically significant, indicating that the combination of inquiry-based methods with computer simulations not only enhances students' academic performance but also enriches their conceptual grasp of heat and temperature.

Sushma Pradhan et.al(2023) studied on "**How can ck-12 (an open educational resource, oer) enhance the attitude and academic performance of class vii students in science?**". Findings from the research report that though there was no significant difference in the overall attitude of students between the pretest and post-test, there did exist a significant difference in the academic performance of students taught using CK-12 class and regular class. This indicates that though students enjoyed and performed academically well in the self-paced OER modules, it implies that they were aware that teacher-led instruction carried higher importance. Thus, teachers can never be replaced by online self-paced materials. Instead, the two should be complementary and coexist for effective learning.

Firas Almasri (2022) conducted a study on "**Simulations to Teach Science Subjects: Connections Among Students' Engagement, Self-Confidence, Satisfaction, and Learning Styles"**. The current study investigated the relationship between learners' engagement, satisfaction, and learning styles when using simulation-based learning in science education. For instance, a study involving 1,034 university students from a large public university in a Gulf country examined students' experiences with simulations in physics, chemistry, and biology courses. The findings indicated a very high level of student engagement and satisfaction with simulation-based learning. Additionally, students' self-confidence and learning styles, particularly kinesthetic modalities, were significant predictors of their engagement and satisfaction. These results highlight the value of simulations as an effective pedagogical tool, providing interactive and learner-centered experiences that enhance conceptual understanding and support diverse learning styles.

James R. Valles Jr(2022) studied on "**The Synthesis of Modeling, Visualization, and Programming in GeoGebra as an Effective Approach for Teaching and Learning STEM**

Topics". The study shows that GeoGebra is an interactive software application specifically created for the instruction and comprehension of mathematics, science, and engineering. It seamlessly integrates geometry, algebra, statistics, and calculus within a dynamic setting that enables users to visualize and investigate mathematical relationships in an interactive manner. The software encompasses three essential features—modeling, visualization, and programming (MVP)—which assist learners in grasping complex concepts through graphical representation and manipulation. Research has indicated that GeoGebra enhances the efficacy of teaching and learning in STEM education by fostering an interactive and collaborative learning atmosphere. The application of GeoGebra empowers students to dynamically explore mathematical concepts and reinforces their conceptual understanding.

Jovalson T. Abiasen and Gaudelia A. Reyes(2021) investigated on **"Computer Simulation Integration in Secondary Physics: Understanding its Nature, Impacts, and Challenges**". The study found that teachers used simulations in two main ways: process-based, where teachers manipulated simulations to engage students, illustrate concepts, elaborate on theories, and assess learning, and student-manipulated, where students interacted directly with simulations to explore physics phenomena. Integration of simulations was shown to positively impact knowledge acquisition, skill development, and value-based learning, while enhancing convenience, effectiveness, and diversity in instructional methods. Simulations enabled students to visualize abstract concepts, actively construct knowledge, and experiment in ways not possible with traditional teaching.

Lea Dela Cruz Kabigting(2021) studied on "**Computer Simulation on Teaching and Learning of Selected Topics in Physics"**. The findings shows that The pretest score of the experimental and control groups did not differ significantly, while pre-test and post-test of the experimental and control groups were found to be significantly different. There was a significant relationship between the sex and performance of the student respondents who were exposed to lecture with computer simulation method while the performance of the male and female student respondents exposed in conventional lecture method did not differ.

Lorena Solvang and Jesper Haglund(2021) studied that **"How can GeoGebra support physics education in upper-secondary school—a review".** GeoGebra can be used to support upper-secondary school physics education is comprised primarily of descriptions of educational material, mostly simulations. The ability to augment photos and videos of real experiments with virtual objects, such as arrows makes GeoGebra a suitable tool for making

formal representations of physical phenomena and concepts. GeoGebra is a user-friendly software that can be operated intuitively by teachers and students. It provides an environment in which the underlying mathematical structures are always at hand, enabling users to see connections between physical phenomena and their formal representations. In addition, teachers with or without programming skills can use the software to design custom-made computer simulations and augment real experiments with virtual objects.

Dr Ram Mehar and Neelu Arora(2021) studied **the contribution of computer simulation in conceptual understanding of science**. The study shows that Simulation serves as a potent tool that can significantly enhance learning and is a crucial component in the development of innovative educational environments, tailored to the needs of learners and incorporating technology at appropriate times for relevant activities. Computer simulation is essential in the science classroom and instructional practices. It enables learners to observe and engage with real-world experiences. Through the use of simulations, students can grasp challenging scientific concepts. Experiments that are impractical, costly, unfeasible, or too hazardous to conduct can be simulated using computer technology. Simulations also offer tools for scientific inquiry and problem-solving, contributing to conceptual change and providing open-ended learning experiences.

Daranee Jaimeetham and Niwat Srisawasdi(2018) studied on " **Usage of Mobile Game-like Simulation to Promote Inquiry-based Laboratory Learning in Elementary School Science"**. The study investigated the creation and execution of SmartFarm, an interactive simulation based on gaming principles aimed at improving inquiry-based laboratory learning for elementary school students. The findings revealed that engaging in SmartFarm-based inquiry activities significantly enhanced students' conceptual grasp of plant growth and improved their scientific reasoning and explanatory skills. Moreover, the engaging and interactive characteristics of the simulation heightened students' motivation, curiosity, and involvement in science lessons. The study highlights that mobile game-like simulations, when effectively combined with teacher-led inquiry-based learning, act as potent cognitive tools that not only facilitate conceptual understanding but also promote critical thinking, problem-solving, and practical experimental skills.

Vera Montalbano and Mauro Sirigu(2016) conducted a study on "**How fitting process works using GeoGebra"**. The study found that this approach encourages student's curiosity, critical thinking, and strategic problem-solving while strengthening their manual and digital

skills in conducting physics experiments. The study suggests that such visualization techniques can be applied more widely in physics education and may be introduced earlier through topics such as mechanics, where students are more familiar with linear relationships and proportional laws, thereby improving their overall understanding of experimental data analysis.

Nico Rutten et.al(2012) investigated on "**The learning effects of computer simulations in science education"**. The study on computer simulations in science education has consistently demonstrated that these simulations can significantly enhance or partially substitute traditional teaching methods, thereby improving both students' conceptual understanding and motivation. The effectiveness of simulations is greatly affected by the design of the simulation, the visualization of information, and the instructional support that is provided. Recent advancements in technology, coupled with enhanced instructional support over the last decade, have augmented the effectiveness of simulation-based instruction, underscoring the necessity of thoughtfully integrating simulations within the curriculum to foster both conceptual understanding and inquiry skills.

2.5 CONCLUSION:

Review of literature gives information which can aid and support or challenge the conclusions of the investigator's research and therefore provide dues for later research. This comprehensive review is followed by the methodology of the study in chapter III.

METHODOLOGY

CHAPTER III

METHODOLOGY

3.1 INTRODUCTION:

Webster defines methodology as "*the science of method or arrangement*". Research methodology is used to analyze the methods and techniques used in the research study. It gives information about the techniques used in research, is in alignment with the research topic. In this chapter the method used in the study, population and sampling involved in the study, the area of the study, data collection method used in the study and the data analysis method used in the study is discussed.

3.2 METHODS ADOPTED IN THE PRESENT STUDY:

Fiola Marie G (2025) employed quasi-experimental design where one group is taught by traditional method whereas other group is taught using Simulation-Based teaching method. This approach is more suitable for educational setting since randomization is impossible.

Mohamed Droui(2023) employed quasi-experimental design. It includes a pre-test and a post-test. The independent variable in this study was the teaching method used in middle school physics courses. Here paper-pencil test was employed to collect data.

With relevance to the previous study which adapted quasi-experimental design to conduct the research. Achievement test was employed to collect data. This study also adapts the Quasi-Experimental method to collect the data from VII standard students to analyse the effectiveness of Simulation-Based teaching method over conventional teaching methof for selected physics concepts. This involves the classification, collection, analysis and interpretation of data. This study provides the knowledge about how effective the Simulation-Based teaching method over convention teaching method using GeoGebra and CK-12 Simulation tool for selected physics concepts through pre-test, post-test and retention through delayed Post-test.

3.3 SELECTION OF SAMPLE:

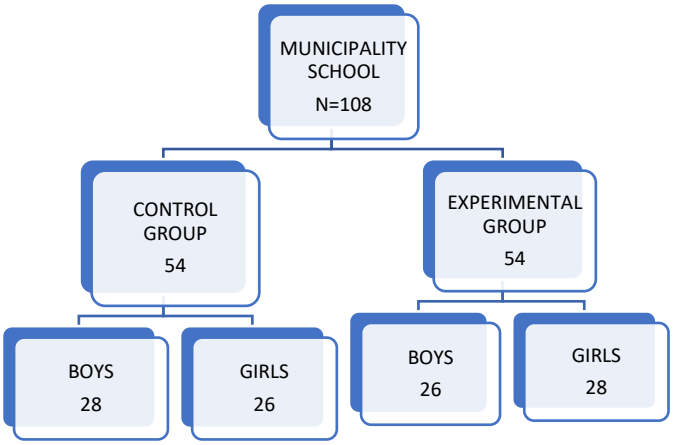
In this study the purposive sampling method was used to select the sample from the population to collect the data. In this method the samples were selected based on the need and specific characteristics of the study.

TABLE 3.1

SAMPLE SELECTED FOR THE STUDY

TYPE OF SCHOOL	NAME OF THE SCHOOL	NUMBER OF STUDENTS		
		BOYS	GIRLS	TOTAL
Municipality school	Municipality High school Karuvampalayam, Tirupur.	54	54	108

FIGURE 3.1



SELECTION OF SAMPLE FOR THE STUDY

3.4 LOCALE OF THE STUDY:

The researcher selected the sample from VII standard students of Municipality High School Karuvampalayam, Tirupur. The sample includes both Tamil medium and English medium students of VII standard.

3.5 TOOLS USED IN THE STUDY:

The tool is very important in collecting quantitative and qualitative data. It ensures the reliability and validity of the study. The effective tools make study even better. The tool gives the important information needed for the study.

Physics achievement test:

This study utilizes self-designed Achievement test to analyse students understanding of physics concepts. A total of 45 objective type questions were considered with multiple choice questions, fill in the blanks and true or false.

GeoGebra simulation:

GeoGebra is a free and open-source software that helps in the better visualization of abstract physics concepts like pinhole camera, laws of reflection shadows, parts of shadows, synthesis of colours etc.,

CK-12 Simulations:

CK-12 simulations are interactive digital learning tools developed by the CK-12 Foundation to support science and mathematics education. It presents physics concepts through animations, models, and adjustable parameters. It helps in teaching concepts like eclipses, solar eclipse, lunar eclipse, plane mirror and reflection and phases of moon.

3.6 PERSONAL DATA SHEET:

It includes the basic information of the sample. The basic information includes name of the sample, class, date, gender, locality, medium of instruction, parental educational level, parent's socio-economic status, parental occupation, availability of computer at home and access to internet at home.

3.8 ADMINISTRATION OF ACHIEVEMENT TEST:

The printed format of questionnaire consists of 45 questions which was given to the VII standard students to assess the pre knowledge of the physics concepts through pre-test. After intervention the post-test was given to students and after two weeks delayed post-test was conducted.

The clear instruction was given priorly to help the students understand the purpose of the study. Later the collected responses were used to study the **"Effectiveness of simulation-Based teaching method over conventional teaching method for selected physics concepts among VII standard students in Tirupur district".**

3.9 SCORING AND TABULATION:

All the responses were scored systematically using scoring keys. The total score gained by a person in each section was calculated and data were analysed statistically.

3.10 PROCEDURE OF THE STUDY:

The study follows a Pre-test – intervention – Post-test – Delayed Post-test design.

Pre-test:

Before intervention is given the samples of both control group and experimental group were given with the pre-test to determine the student's existing knowledge in the physics concepts. The questions are related to the selected physics concepts for 45 marks.

Intervention:

After conducting pre-test, the intervention was given to both control group and experimental group.

- The control group was taught with the selected physics concepts with the conventional teaching methods using lecture, chalk-and-board, textbooks and demonstrations.
- The experimental group was taught using Simulation-Based teaching method with GeoGebra and CK-12 Simulations. The students interact with simulations in groups to visualize physics concepts and explore them.

The intervention was given for the period of 2 weeks after the pre-test.

Post-test:

After the completion of the intervention, the post-test was conducted for both experimental group and control group. The post-test score measures the effectiveness of the intervention and the achievement level of the students in physics concepts.

Delayed post-test:

The delayed post-test was conducted after 2 weeks from the post-test. It measures the retention of the students from both control group and experimental group. It helps to determine how well the students retain the physics concepts taught using both conventional teaching method and Simulation-Based teaching method.

3.10.1 TIMELINE OF THE STUDY

TABLE 3.2

TIMELINE OF THE STUDY

S.No	DATE	TIMING	CONTROL GROUP	TIMING	EXPERIMENTAL GROUP
1	9/2/26	11.20AM - 12.50PM	Introduction	2.55PM-4.15PM	Introduction and Pre-test
2	10/2/26	11.20AM - 12.50PM	Pre-test	2.55PM-4.15PM	Pre-test
3	11/2/26	11.20AM - 12.50PM	Path of light	2.55PM-4.15PM	Path of light
4	12/2/26	11.20AM - 12.50PM	Pinhole camera	2.55PM-4.15PM	Pinhole camera
5	13/2/26	11.20AM - 12.50PM	Reflection and laws of reflection	2.55PM-4.15PM	Reflection and laws of reflection
6	23/2/26	11.20AM - 12.50PM	Shadows and parts of shadows	2.55PM-4.15PM	Shadows and parts of shadows
7	24/2/26	11.20AM - 12.50PM	Solar eclipse	2.55PM-4.15PM	Solar eclipse
8	25/2/26	11.20AM - 12.50PM	Lunar eclipse	2.55PM-4.15PM	Lunar eclipse

S.No	DATE	TIMING	CONTROL GROUP	TIMING	EXPERIMENTAL GROUP
9	26/2/26	11.20AM - 12.50PM	Plane mirror and reflection	2.55PM-4.15PM	Plane mirror and reflection
10	27/2/26	11.20AM - 12.50PM	Real image and virtual image	2.55PM-4.15PM	Real image and virtual image
11	2/3/26	11.20AM - 12.50PM	Newton disc	2.55PM-4.15PM	Newton disc
12	3/3/26	11.20AM - 12.50PM	Synthesis of colours	2.55PM-4.15PM	Synthesis of colours
13	4/3/26	11.20AM - 12.50PM	Phases of moon	2.55PM-4.15PM	Phases of moon
14	5/3/26	11.20AM - 12.50PM	Post -test	2.55PM-4.15PM	Post-test
15	16/3/26	11.20AM - 12.50PM	Delayed post-test	2.55PM-4.15PM	Delayed post-test

3.11 TOPICS SELECTED FOR THE STUDY

The following physics topics from the Tamil Nadu state board VII standard term 3 science text book are used in the study. They are Reflection, Laws of Reflection, Plane Mirror and Reflection, Pinhole Camera, Shadows, Parts of shadows, Solar Eclipse, Lunar Eclipse, Newton's Disc, Synthesis of Colours and Phases of the Moon.

3.12 VALIDITY:

Validity refers to the degree to which the tool measures what it intend to measure. Validity is been done by six educational experts. Totally sixty questions were for achievement

test and was given to twenty five VII standard students in Rajalingam kalvi Niliyam, Tirupur for pilot study and it was reduced to 45 questions.

3.13 STATISTICAL STUDIES USED FOR THE PRESENT STUDIES:

The data collected was analysed and tabulated using the following statistical tools:

3.13.1 Mean, standard deviation and percentage analysis:

Used to find the effectiveness of simulation-Based teaching method over convention teaching method in teaching physics concepts among VII standard students.

3.13.2 t-test:

Used to find the significant difference between two groups (gender and academic stress, gender and study habits etc.,) t - test is used to find the significant level of difference between two groups of sample. The t- values are calculated with the help of the mean scores and standard deviation. If the obtained 't-value' is 2.58 and above, then the significant level of difference is 0.01 and if the value lies between 1.96 and 2.58, the significant level is 0.05 and if the value is below 1.96, the difference is not significant.

3.13.3 ANOVA:

Used to find the significant difference from more than two variables (academic stress and type of school, study habits and type of school etc.,). In ANOVA if p value is less than 0.05 then it the difference between two groups is statistically significant.

3.14 CONCLUSION:

In this chapter, the methodology of the present investigation is enumerated. A clear-cut view of the method selected, administration of the tool, and evaluation of the tool are discussed. Thus the data obtained was consolidated, analyzed, and interpreted and is presented in chapter IV- Analysis and interpretation.

ANALYSIS AND INTERPRETATION

CHAPTER IV
ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION:

Analysis and Interpretation is very important in the research process. It gives the findings of the study, it converts raw data into the results of the findings and helps in checking the hypothesis and to check whether the results are significant.

The current study aimed at findings of the **"Effectiveness of simulation-Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district".**

The different statistical procedures adopted are given in the following:

- Descriptive analysis
- Differential analysis

4.2 DESCRIPTIVE ANALYSIS:

The effectiveness of teaching physics concepts through Simulation-Based teaching method over conventional teaching method was analyzed through pre-test, post-test and delayed post-test

TABLE 4.1

DESCRIPTIVE ANALYSIS

SIMULATION- BASED TEACHING METHOD OVER CONVENTIONAL TEACHING METHOD IN TEACHING PHYSICS CONCEPTS AMONG VII STANDARD STUDENTS WITH RESPECT TO GROUP, GENDER, LOCALITY, MEDIUM, FATHER'S EDUCATION, MOTHER'S EDUCATION, SOCIO ECONOMIC STATUS, FATHER'S OCCUPATION, MOTHER'S OCCUPATION, SCIENCE ACHIEVEMENT, AVAILABILITY OF COMPUTER AND ACCESS TO INTERNET

Variables		Number
Gender	Boys	54
	Girls	54

Variables		N
Locality	Rural	26
	Urban	82
Medium	English	56
	Tamil	52
Father education	No formal	9
	Primary	26
	Secondary	58
	UG	15
Mother education	No formal	4
	Primary	26
	Secondary	65
	UG	13
Socio Economic status	Below 10000	38
	10000-20000	32
	20000-30000	23
	30000-40000	8
	40000 and above	7
	Private	33
	Business	19
	Daily wages	54
	Others	2
	Private	22
	Business	26
	Daily wages	37
	Others	23
Science Achievement	0-20	4
	21-40	37
	41-60	53
	61-80	11
	81-100	3
Computer	yes	17
	No	91
Internet	Yes	50
	No	58

4.3 DIFFERENTIAL ANALYSIS:

Differential analysis was used to find out the whether pretest, post-test, delayed post-test of control group and experimental group has significant difference with respect to variables namely gender, locality, medium of instruction, , father education, mother education, socio economic status, father occupation, mother occupation, science achievement, availability of computer at home and access to internet at home among VII Standard students in teaching physics concepts.

TABLE 4.2

COMPARISION OF PRETEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP

PRE-TEST SCORE	NUMBER	MEAN	SD	Df	't' VALUE	SIG.
Control group	54	13.9259	3.3862	106	1.560	NS
Experimental group	54	14.9815	3.6419			

NS- Not Significant

From the table 4.2 it is found that the mean score value of the pre-test of the experimental group (14.9815) is slightly higher than that of the control group (13.9259). From the t-value it is found that there is no significant difference between the pre-test scores of the control group and experimental group ($t = 1.560$, $p > 0.05$). Hence, the hypothesis stated *"there is no significant difference between the pre-test scores of the control group and experimental group*" is accepted. It infers that both the groups were almost equal before the intervention because both group were selected equally.

TABLE 4.3

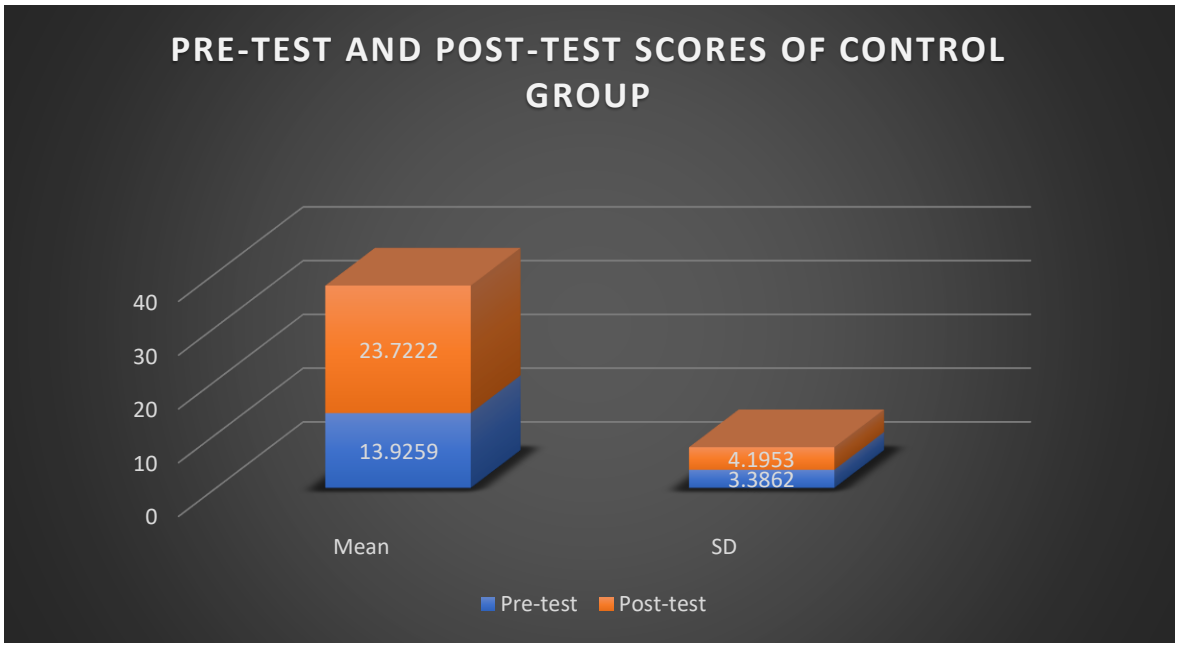
COMPARISION OF PRE-TEST AND POST-TEST SCORES OF CONTROL GROUP

PAIR	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Pre-test	54	13.9259	3.3862	53	-20.801	Sig**
Post-test	54	23.7222	4.1953			

Sig**- Significant

From the table 4.3 it is found that the mean score value of the post-test (23.7222) is higher than the pre-test (13.9259) for the control group. The calculated t-value (-20.801) at 53 degrees of freedom is found to be significant at the 0.05 level ($p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the pre-test and post-test scores of the control group"* is rejected. It infers that there is a significant improvement in the achievement of learning physics concepts among VII standard students in the control group.

FIGURE 4.1



PRE-TEST AND POST-TEST SCORES OF CONTROL GROUP

TABLE 4.4

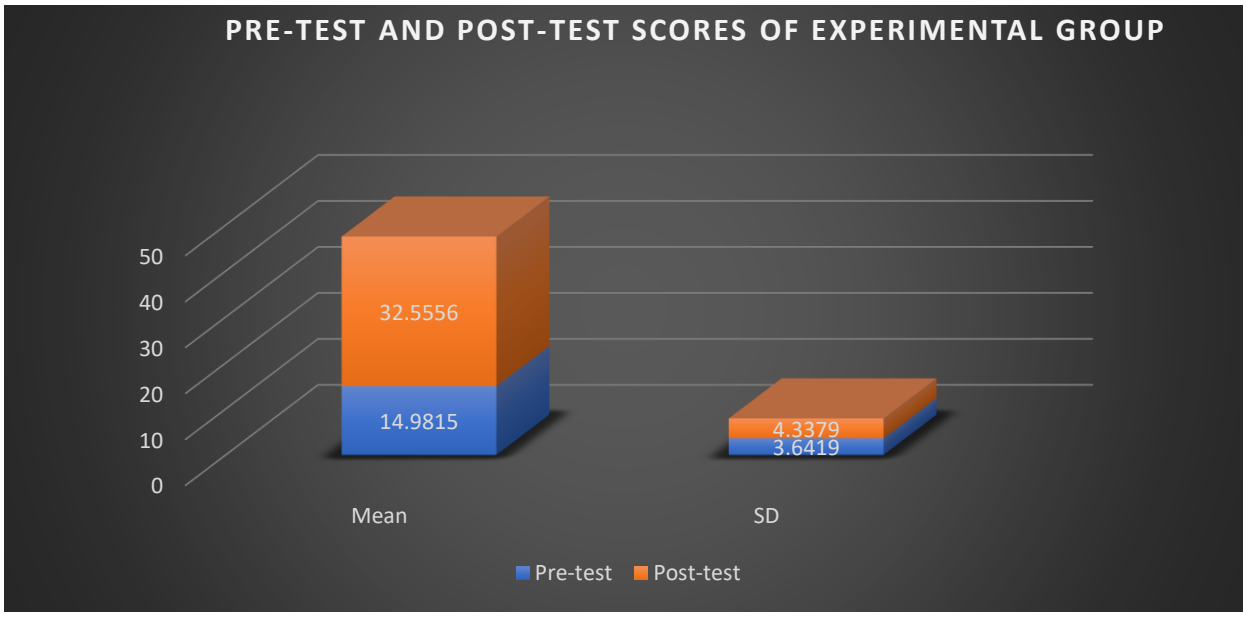
COMPARISION OF PRE-TEST AND POST-TEST SCORES OF EXPERIMENTAL GROUP

PAIR	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Pre-test	54	14.9815	3.6419	53	-27.954	Sig**
Post-test	54	32.5556	4.3379			

Sig**- Significant

From the table 4.4 it is found that the mean score value of the post-test (32.5556) is higher than the pre-test (14.9815) for the experimental group. From the t-value it is found that there is a significant difference between the pre-test and post-test scores of the experimental group ($t = -27.954$, $p < 0.05$). It is significant at 0.05 level. Hence, the hypothesis stated *"there is no significant difference between the pre-test and post-test scores of the experimental group"* is rejected. It infers that the intervention has been highly effective in improving the achievement of learning physics concepts among VII standard students in the experimental group.

FIGURE 4.2



PRE-TEST AND POST-TEST SCORES OF EXPERIMENTAL GROUP

TABLE 4.5

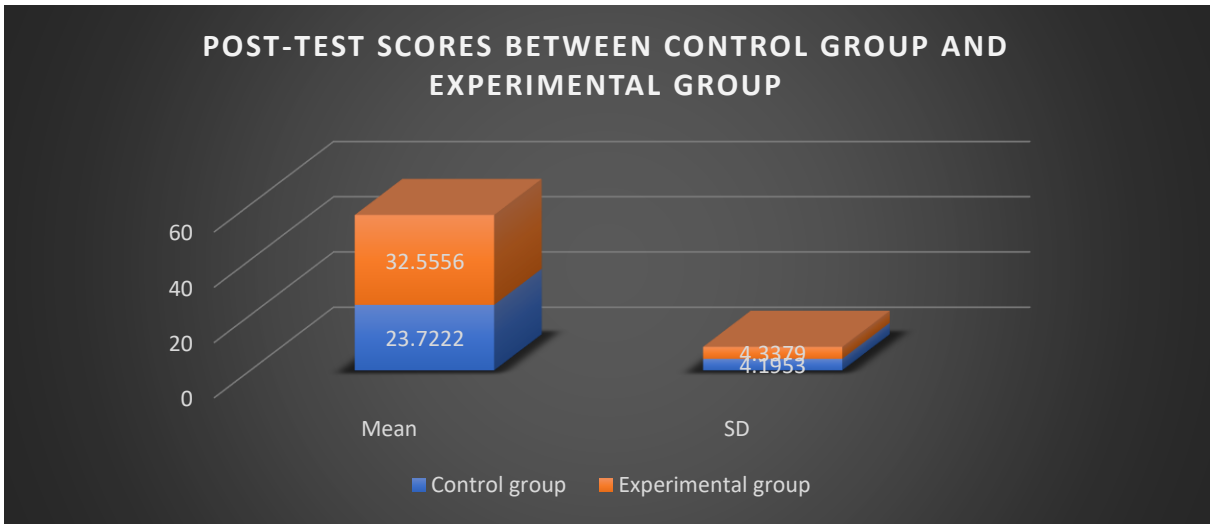
COMPARISION OF POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP

PRE-TEST SCORE	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Control group	54	23.7222	4.1953	106	10.756	Sig**
Experimental group	54	32.5556	4.3379			

Sig**- Significant

From the table 4.5 it is found that the mean score value of the post-test (32.5556) of the experimental group is higher than that of the control group (23.7222). From the t-value it is found that there is a significant difference between the post-test scores of the control group and experimental group ($t = 10.756$, $p < 0.05$). It is significant at 0.05 level. Hence, the hypothesis stated *"there is no significant difference between the post-test scores of the control group and experimental group"* is rejected. It infers that the experimental group has performed better than the control group in achievement of learning physics concepts among VII standard students. Teaching with simulation-Based teaching method has enhanced learning of students.

FIGURE 4.3



POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP

TABLE 4.6

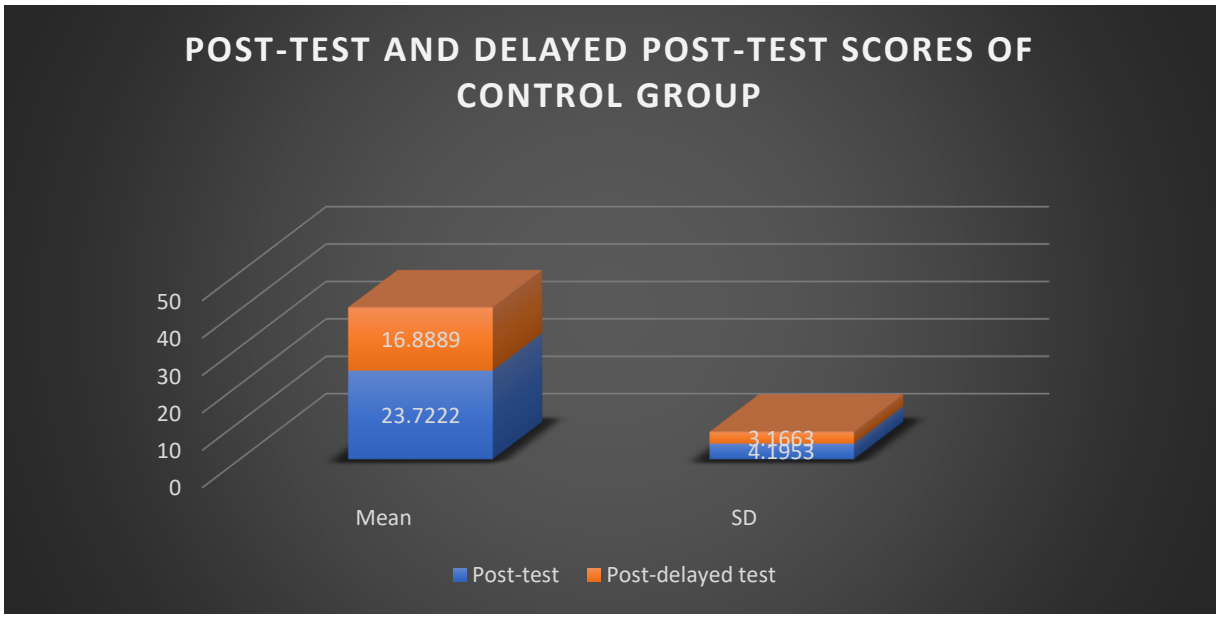
COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP

PAIR	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Post-test	54	23.7222	4.1953	53	17.599	Sig**
Delayed post-test	54	16.8889	3.1663			

Sig**- Significant

From the table 4.6 it is found that the mean score value of the post-test (23.7222) is higher than that of the delayed post-test (16.8889) for the control group. From the t-value it is found that there is a significant difference between the post-test and delayed post-test scores of the control group ($t = 17.599$, $p < 0.05$). It is significant at 0.05 level. Hence, the hypothesis stated *"there is no significant difference between the post-test and delayed post-test scores of the control group"* is rejected. It infers that there is a significant decline in the achievement of the students in the control group in learning physics concepts among VII standard students after the delay period.

FIGURE 4.4



POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP

TABLE 4.7

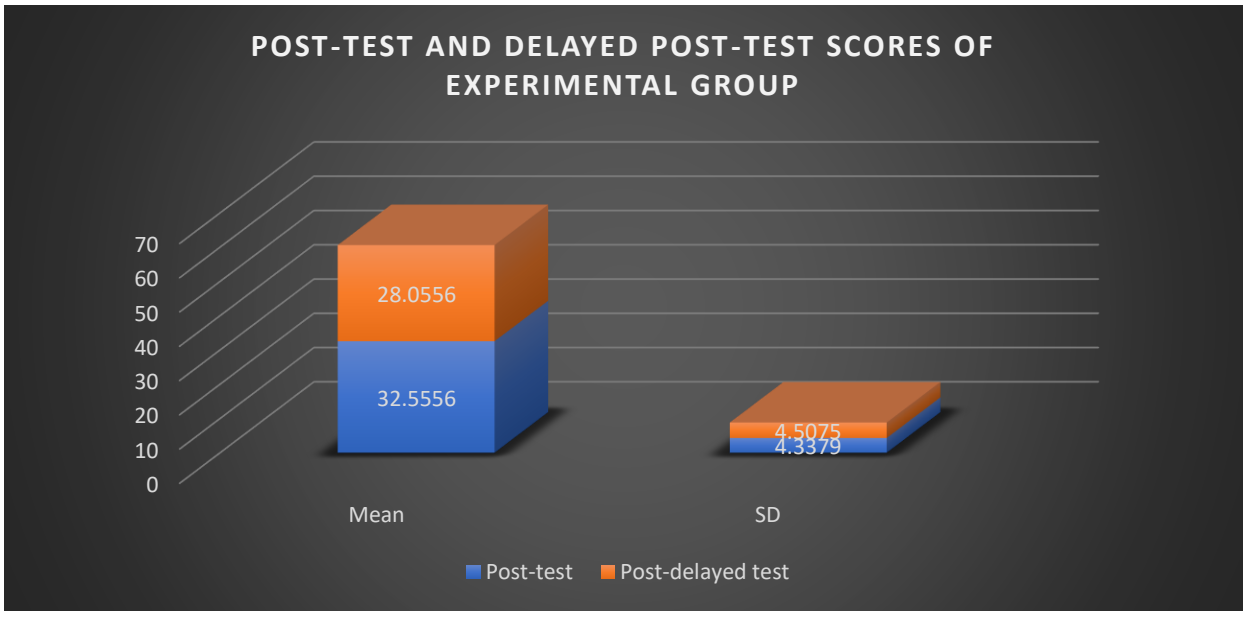
COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF EXPERIMENTAL GROUP

PAIR	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Post-test	54	32.5556	4.3379	53	10.070	Sig**
Delayed Post- test	54	28.0556	4.5075			

Sig**- Significant

From the table 4.7 it is found that the mean score value of the post-test (32.5556) is higher than that of the delayed post-test (28.0556) for the experimental group. From the t-value it is found that there is a significant difference between the post-test and delayed post-test scores of the experimental group ($t = 10.070$, $p < 0.05$). It is significant at 0.05 level. Hence, the hypothesis stated *"there is no significant difference between the post-test and delayed post-test scores of the experimental group"* is rejected. It infers that there is a decline in the achievement of the students in the experimental group in learning physics concepts among VII standard students after the delay period.

FIGURE 4.5



POST-TEST AND DELAYED POST-TEST SCORES OF EXPERIMENTAL GROUP

TABLE 4.8

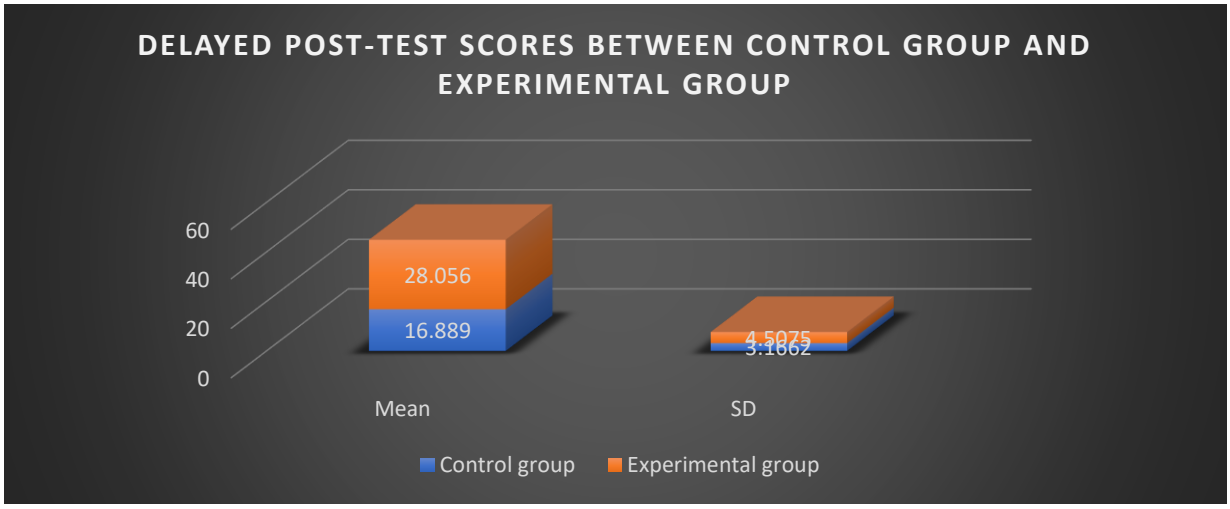
COMPARISION OF DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP

DELAYED POST-TEST SCORE	NUMBER	MEAN	SD	df	't' VALUE	SIG.
Control group	54	16.889	3.1662	106	14.897	Sig**
Experimental group	54	28.056	4.5075			

Sig**- Significant

From the table 4.8 it is found that the mean score value of the delayed post-test of the experimental group (28.056) is higher than that of the control group (16.889). From the t-value it is found that there is a significant difference between the delayed post-test scores of the control group and experimental group ($t = 14.897$, $p < 0.05$). It is significant at 0.05 level. Hence, the hypothesis stated *"there is no significant difference between the delayed post-test scores of the control group and experimental group"* is rejected. It infers that the experimental group has better retention in the achievement of learning physics concepts among VII standard students compared to the control group.

FIGURE 4.6



DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP

TABLE 4.9

COMPARISION OF POST-TEST AND DELAYED POST TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO GENDER

TEST	GROUP	GENDER	N	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	Boys	28	22.286	3.9049	52	-2.771	Sig**
		Girls	26	25.269	4.0055			
	Experimental group	Boys	26	32.500	3.9522	52	-0.90	NS
		Girls	28	32.607	4.7402			
DELAYED POST-TEST	Control group	Boys	28	16.679	3.1862	52	-0.503	NS
		Girls	26	17.115	3.1916			
	Experimental group	Boys	26	27.192	3.6989	52	-1.367	NS
		Girls	28	28.857	5.0824			

Sig**-Significant

NS- Not Significant

From the table 4.9 it is found that in the post-test, girls have higher mean scores(25.269) than boys(22.286) in the control group. The obtained t-value shows that there is a significant difference in the control group at 0.05 level ($p < 0.05$). There is no significant difference in the post-test score of experimental group and delayed post-test score of control group and experimental group. The hypothesis stated *"there is no significant difference between the post-test scores of control group with respect to gender"* is rejected. Compared to boys, girls achievement is even better because of their attentiveness in the class.

Also *"there is no significant difference between the post-test scores of experimental group, delayed post- test scores of control group and experimental group with respect to gender"* is accepted. It can be inferred that gender does not have a significant influence on student's achievement of learning physics concepts among VII standard students and retention of learning in both post-test and delayed post-test scores.

TABLE 4.10

COMPARISION OF POST-TEST AND DELAYED POST TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO LOCALITY

TEST	GROUP	LOCALITY	N	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	Rural	14	21.857	4.6716	52	-1.986	NS
		Urban	40	24.375	3.8676			
	Experimental group	Rural	12	32.333	4.2498	52	-0.199	NS
		Urban	42	32.619	4.4114			
DELAYED POST-TEST	Control group	Rural	14	15.071	3.5619	52	-2.631	Sig**
		Urban	40	17.525	2.7918			
	Experimental group	Rural	12	27.583	3.9187	52	-0.408	NS
		Urban	42	28.191	4.6969			

Sig**- Significant

NS- Not Significant

From the table 4.10 it is found that in the delayed post-test, urban students (17.525) have higher mean scores than rural students (15.071). Also found that there is no significant difference between the post-test score of both control group and experimental group and delayed post-test score of experimental group with respect to locality. The hypothesis stated *"there is no significant difference between the delayed post-test scores of control group with respect to locality"* is rejected. Control group students from urban locality has greater retention than rural students in the achievement of learning physics concepts among VII standard students.

Also *"there is no significant difference between the post-test score of control group and experimental group, delayed post- test scores of experimental group with respect to locality"* is accepted.

TABLE 4.11

COMPARISION OF POST-TEST AND DELAYED POST TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO MEDIUM OF INSTRUCTION

TEST	GROUP	MEDIUM	N	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	English	28	23.393	4.7791	52	-0.595	NS
		Tamil	26	24.078	3.5204			
	Experimental group	English	28	33.000	4.3461	52	0.778	NS
		Tamil	26	32.078	4.3628			
DELAYED POST-TEST	Control group	English	28	15.857	3.5352	52	-3.619	Sig**
		Tamil	26	18.000	2.2978			
	Experimental group	English	28	28.821	4.3889	52	1.304	NS
		Tamil	26	27.231	4.5722			

Sig**- Significant

NS- Not Significant

From the table 4.10 it is found that in the delayed post-test, Tamil medium students (18.000) have higher mean scores than English medium students (15.857). It is significant at 0.05 level. It also founds that there is no significant difference between the post-test score of both control group and experimental group and delayed post-test score of experimental group with respect to medium of instruction. The hypothesis stated *"there is no significant difference between the delayed post-test scores of control group with respect to medium of instruction"* is rejected. It infers that Tamil medium students achievement is higher compared to English medium students in learning physics concepts among VII standard students in control group of delayed post-test..

Also *"there is no significant difference between the post-test scores of control group and experimental group, delayed post- test scores of experimental group with respect to medium of instruction"* is accepted.

TABLE 4.12

COMPARISION OF POST-TEST AND DELAYED POST TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO AVAILABILITY OF COMPUTER AT HOME

TEST	GROUP	COMPUTER	N	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	Yes	8	23.375	2.4458	52	-0.251	NS
		No	46	23.783	4.4468			
	Experimental group	Yes	9	32.000	5.8095	52	-0.418	NS
		No	45	32.667	4.0564			
DELAYED POST-TEST	Control group	Yes	8	16.625	3.8522	52	-0.253	NS
		No	46	16.935	3.0797			
	Experimental group	Yes	9	26.667	4.8477	52	-1.013	NS
		No	45	28.333	4.4415			

NS- Not Significant

From the table 4.12 it is found that there is no significant difference between the post-test scores of control group and experimental group with respect to availability of computer at home. Also it shows that there is no significant difference between the delayed post-test scores of control group and experimental group with respect to availability of computer at home. The hypothesis stated *"there is no significant difference between the post-test scores and delayed post-test scores of control group and experimental group with respect to availability of computer at home"* is accepted. It infers that availability of computer at home does not affects the student's achievement and retention of learning of physics concepts in both control group and experimental group among VII standard students.

TABLE 4.13

COMPARISION OF POST-TEST AND DELAYED POST TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO ACCESS TO INTERNET FACILITY AT HOME

TEST	GROUP	INTERNET	N	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	Yes	21	25.476	3.7765	52	2.578	Sig**
		No	33	22.606	4.1151			
	Experimental group	Yes	29	32.862	4.3648	52	0.556	NS
		No	25	32.200	4.3684			
DELAYED POST-TEST	Control group	Yes	21	17.238	3.7670	52	0.643	NS
		No	33	16.667	2.7575			
	Experimental group	Yes	29	27.862	4.7789	52	-0.337	NS
		No	25	28.280	4.2575			

Sig**- Significant

NS- Not Significant

From the Table No. 4.13, it is found that in the post-test, students of the control group with internet facility at home (25.476) have higher mean scores than those without internet facility (22.606), and it is significant at 0.01 level. It is also found that there is no significant difference between the post-test scores of the experimental group and the delayed post-test scores of both control group and experimental group with respect to access to internet facility at home. The hypothesis stated *"there is no significant difference between the post-test scores of control group with respect to access to internet facility at home"* is rejected. It infers that achievement of the students is higher for the students having internet facility at home in post - test of control group in learning physics concepts among VII standard students compared to the students without internet facility.

Also *"there is no significant difference between the post-test scores of experimental group and delayed post-test scores of control group and experimental group with respect to access to internet facility at home" is accepted*. It can be inferred that access to internet facility at home does not have a consistent significant influence on student's achievement and retention of learning physics concepts among VII standard students.

TABLE 4.14

COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO FATHER'S EDUCATION

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	**Between groups**	24.518	3	8.173	0.450	NS
		Within groups	908.316	50	18.166		
		Total	932.833	53			
	Experimental group	**Between groups**	48.817	3	16.272	0.858	NS
		Within groups	948.517	50	18.970		
		Total	997.333	53			
DELAYED POST-TEST	Control group	**Between groups**	21.227	3	7.076	0.694	NS
		Within groups	510.106	50	10.202		
		Total	531.333	53			
	Experimental group	**Between groups**	111.274	3	37.091	1.921	NS
		Within groups	965.560	50	19.311		
		Total	1076.833	53			

NS- Not Significant

From the table 4.14 it is found that in the post-test scores and delayed post-test scores of both control group and experiment group shows no significant difference among students with respect to father's education. The hypothesis stated "*there is no significant difference between post-test scores and delayed post-test scores of control group and experimental group with respect to Father's educational qualification*" is accepted. It can be inferred that father's educational qualification does not have a significant influence on student's achievement and retention of learning in both post-test scores and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.15

COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO MOTHER'S EDUCATION

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	**Between groups**	12.223	3	4.074	0.221	NS
		Within groups	920.610	50	18.412		
		Total	932.833	53			
	Experimental group	**Between groups**	25.816	3	8.605	0.443	NS
		Within groups	971.518	50	19.430		
		Total	997.333	53			
DELAYED POST-TEST	Control group	**Between groups**	14.283	3	4.761	0.460	NS
		Within groups	517.050	50	10.341		
		Total	531.333	53			
	Experimental group	**Between groups**	46.482	3	15.494	0.752	NS
		Within groups	1030.351	50	20.607		
		Total	1076.833	53			

NS- Not Significant

From the Table No. 4.15, it is found that the post-test scores and delayed post-test scores of both control group and experimental group show no significant difference among students with respect to mother's education. The hypothesis stated *"there is no significant difference between post-test and delayed post-test scores of control group and experimental group with respect to mother's educational qualification"* is accepted. It can be inferred that mother's educational qualification does not have a significant influence on student's achievement and retention of learning in both post-test scores and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.16

COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO SOCIO ECONOMIC STATUS

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	**Between groups**	90.724	4	22.681	1.320	NS
		Within groups	842.109	49	17.186		
		Total	932.833	53			
	Experimental group	**Between groups**	19.297	3	6.432	0.042	NS
		Within groups	683.684	50	13.674		
		Total	702.981	53			
DELAYED POST-TEST	Control group	**Between groups**	78.313	4	19.578	2.118	NS
		Within groups	453.021	49	9.245		
		Total	531.333	53			
	Experimental group	**Between groups**	46.482	3	15.494	0.076	NS
		Within groups	1030.351	50	20.607		
		Total	1076.833	53			

NS- Not Significant

From the Table No. 4.16, it is found that the post-test scores and delayed post-test scores of both control group and experimental group show no significant difference among students with respect to socio-economic status, as all the obtained *F* values are not significant at 0.05 level. The hypothesis stated *"there is no significant difference between post-test scores and delayed post-test scores of control group and experimental group with respect to socio-economic status"* is accepted. It can be inferred that socio-economic status does not have a significant influence on students' achievement and retention of learning in both post-test and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.17

COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORE OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO FATHER'S OCCUPATION

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	**Between groups**	4.785	2	2.392	0.131	NS
		Within groups	928.049	51	18.197		
		Total	932.833	53			
	Experimental group	**Between groups**	115.954	3	38.651	2.193	NS
		Within groups	881.379	50	17.628		
		Total	997.333	53			
DELAYED POST-TEST	Control group	**Between groups**	8.054	2	4.027	0.392	NS
		Within groups	523.279	51	10.260		
		Total	531.333	53			
	Experimental group	**Between groups**	82.524	3	27.508	1.383	NS
		Within groups	994.310	50	19.886		
		Total	1076.833	53			

NS- Not Significant

From the Table No. 4.17, it is found that the post-test scores and delayed post-test scores of both control group and experimental group show no significant difference among students with respect to father's occupation, as all the obtained *F* values are not significant at 0.05 level. The hypothesis stated *"there is no significant difference between post-test scores and delayed post-test scores of control group and experimental group with respect to father's occupation"* is accepted. It can be inferred that father's occupation does not have a significant influence on student's achievement and retention of learning in both post-test and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.18

COMPARISION OF POST-TEST AND DELAYED POST-TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO MOTHER'S OCCUPATION

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	Between groups	31.664	3	10.555	0.586	NS
		Within groups	901.169	50	18.023		
		Total	932.833	53			
	Experimental group	Between groups	21.929	3	7.310	0.375	NS
		Within groups	975.404	50	19.508		
		Total	997.333	53			
DELAYED POST-TEST	Control group	Between groups	31.664	3	7.163	0.702	NS
		Within groups	901.169	50	10.197		
		Total	932.833	53			
	Experimental group	Between groups	72.196	3	24.065	1.198	NS
		Within groups	1004.638	50	20.093		
		Total	1076.833	53			

NS- Not Significant

From the Table No. 4.18, it is found that the post-test scores and delayed post-test scores of both control group and experimental group show no significant difference among students with respect to mother's occupation, as all the obtained *F* values are not significant at 0.05 level. *The hypothesis stated "there is no significant difference between post-test and delayed post-test scores of control group and experimental group with respect to mother's occupation"* is accepted. It can be inferred that mother's occupation does not have a significant influence on student's achievement and retention of learning in both post-test and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.19

COMPARISION OF POST-TEST, DELAYED POST-TEST SCORES OF CONTROL GROUP AND EXPERIMENTAL GROUP WITH RESPECT TO SCIENCE ACHIEVEMENT

TEST	GROUP	SOURCE OF VARIABLES	SUM OF SQUARES	df	MEAN SQUARE	f	RESULT AT 5% LEVEL
POST-TEST	Control group	**Between groups**	284.646	4	71.161	5.379	Sig**
		Within groups	648.188	49	13.228		
		Total	932.833	53			
	Experimental group	**Between groups**	194.902	3	64.967	4.048	Sig**
		Within groups	802.431	50	16.049		
		Total	997.333	53			
DELAYED POST-TEST	Control group	**Between groups**	155.533	4	38.883	5.070	Sig**
		Within groups	375.801	49	7.669		
		Total	531.333	53			
	Experimental group	**Between groups**	265.008	3	88.336	5.441	Sig**
		Within groups	811.825	50	16.237		
		Total	1076.833	53			

Sig**-Significant

From the Table No. 4.19, it is found that the post-test scores of both control group and experimental group show significant difference with respect to science achievement, as the obtained *F* values (5.379 and 4.048) are significant at 0.05 level. It is also found that the delayed post-test scores of both control group and experimental group show significant difference with respect to science achievement, as the obtained *F* values (5.070 and 5.441) are significant at 0.05 level. The hypothesis stated *"there is no significant difference between post-test and delayed post-test scores of control group and experimental group with respect to science achievement"* is rejected. It can be inferred that science achievement has a significant influence on student's achievement and retention of learning in both post-test and delayed post-test scores of control group and experimental group in learning physics concepts among VII standard students.

TABLE 4.20

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR REFLECTION CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	2.000	0.7115	106	8.239	Sig**
	Experimental group	54	3.277	0.8902			
DELAYED POST- TEST	Control group	54	1.555	0.8393	106	7.799	Sig**
	Experimental group	54	2.833	0.8633			

Sig**-Significant

From the table 4.20 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 8.239$, $p < 0.05$) and delayed post-test ($t = 7.799$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for reflection concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning reflection concept among VII standard students.

TABLE 4.21

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR LAWS OF REFLECTION CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.722	0.9793	106	6.647	Sig**
	Experimental group	54	2.889	0.8393			
DELAYED POST-TEST	Control group	54	1.518	0.9264	106	6.024	Sig**
	Experimental group	54	2.556	0.8615			

Sig**-Significant

From the table 4.21 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 6.647$, $p < 0.05$) and delayed post-test ($t = 6.024$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for laws of reflection concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning laws of reflection concept among VII standard students.

TABLE 4.22

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR PLANE MIRROR AND REFLECTION CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	3.2407	1.8058	106	3.883	Sig**
	Experimental group	54	4.1296	1.1921			
DELAYED POST- TEST	Control group	54	2.0185	1.1409	106	7.573	Sig**
	Experimental group	54	3.7962	1.2941			

Sig**-Significant

From the table 4.22 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 3.883$, $p < 0.05$) and delayed post-test ($t = 7.573$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for plane mirror and reflection concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning plane mirror and reflection concept among VII standard students.

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TABLE 4.23

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR PINHOLE CAMERA CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.7778	0.8614	106	7.013	Sig**
	Experimental group	54	2.9815	0.9212			
DELAYED POST-TEST	Control group	54	1.3148	0.8428	106	7.037	Sig**
	Experimental group	54	2.5556	0.98415			

Sig**-Significant

From the table 4.23 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 7.013$, $p < 0.05$) and delayed post-test ($t = 7.037$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for pinhole camera concept*" is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning pinhole camera concept among VII standard students.

TABLE 4.24

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR SHADOW CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	2.5556	0.9248	106	2.726	Sig**
	Experimental group	54	3.0370	0.91038			
DELAYED POST-TEST	Control group	54	1.5556	1.02178	106	5.758	Sig**
	Experimental group	54	2.6296	0.91726			

Sig**-Significant

From the table 4.24 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 2.726$, $p < 0.05$) and delayed post-test ($t = 5.758$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for shadow concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning shadow concept among VII standard students.

TABLE 4.25

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORE BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR PARTS OF SHADOW CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.6667	0.7523	106	4.531	Sig**
	Experimental group	54	2.2963	0.6903			
DELAYED POST-TEST	Control group	54	1.3704	0.5922	106	2.246	Sig**
	Experimental group	54	1.6852	0.8428			

Sig**-Significant

From the table 4.25 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 3.266$, $p < 0.05$) and delayed post-test ($t = 5.441$, $p < 0.05$). Hence, the hypothesis stated "*there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for parts of shadow concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning parts of shadow concept among VII standard students.

TABLE 4.26

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR SOLAR ECLIPSE CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.8148	0.9331	106	3.266	Sig**
	Experimental group	54	2.3333	0.7004			
DELAYED POST-TEST	Control group	54	1.1852	0.8259	106	5.441	Sig**
	Experimental group	54	2.0185	0.7646			

Sig**-Significant

From the table 4.26 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 3.266$, $p < 0.05$) and delayed post-test ($t = 5.441$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for solar eclipse concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning solar eclipse concept among VII standard students.

TABLE 4.27

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORE BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR LUNAR ECLIPSE CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.5370	0.9052	106	2.890	Sig**
	Experimental group	54	2.0000	0.7524			
DELAYED POST-TEST	Control group	54	0.9630	0.6994	106	6.142	Sig**
	Experimental group	54	1.7963	0.7107			

Sig**-Significant

From the table 4.27 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 2.890$, $p < 0.05$) and delayed post-test ($t = 6.142$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for lunar eclipse"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning lunar eclipse concept among VII standard students.

TABLE 4.28

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR NEWTON DISC CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	1.3889	0.6564	106	2.906	Sig**
	Experimental group	54	1.7222	0.5290			
DELAYED POST-TEST	Control group	54	1.0741	0.7734	106	2.624	Sig**
	Experimental group	54	1.4444	0.6914			

Sig**-Significant

From the table 4.28 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 2.906$, $p < 0.05$) and delayed post-test ($t = 2.624$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for Newton disc concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning Newton disc concept among VII standard students.

TABLE 4.29

COMPARISION OF POST-TEST SCORE AND DELAYED POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR SYNTHESIS OF COLOUR CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	2.2222	0.8831	106	3.783	Sig**
	Experimental group	54	2.9074	0.9956			
DELAYED POST-TEST	Control group	54	1.6481	0.9144	106	2.302	Sig**
	Experimental group	54	2.0741	1.0066			

Sig**-Significant

From the table 4.29 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 3.783$, $p < 0.05$) and delayed post-test ($t = 2.302$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for synthesis of colour concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning synthesis of colour concept among VII standard students.

TABLE 4.30

COMPARISION OF POST-TEST SCORE AND DELAYE D POST-TEST SCORES BETWEEN CONTROL GROUP AND EXPERIMENTAL GROUP FOR PHASES OF MOON CONCEPT

TEST	GROUP	NUMBER	MEAN	SD	df	't' VALUE	SIG.
POST-TEST	Control group	54	3.8889	1.2689	106	4.030	Sig**
	Experimental group	54	4.9815	1.5356			
DELAYED POST- TEST	Control group	54	2.8148	1.3468	106	6.315	Sig**
	Experimental group	54	4.6667	1.6823			

Sig**-Significant

From the table 4.30 it is found that the mean score value of the experimental group in both post-test and delayed post-test is higher than that of the control group. From the t-value it is found that there is a significant difference between the control group and experimental group scores in both post-test ($t = 4.030$, $p < 0.05$) and delayed post-test ($t = 6.315$, $p < 0.05$). Hence, the hypothesis stated *"there is no significant difference between the control group and experimental group in post-test and delayed post-test scores for phases of moon concept"* is rejected. It infers that the experimental group had more retention in delayed post-test and achieved better in post-test than the control group in learning phases of moon concept among VII standard students.

CONCLUSION:

The study found that there is significant increase in the post test scores of experimental group compared to control group. This shows the effectiveness of Simulation-Based teaching method over convention teaching method in teaching Physics concepts among VII standard students. Also the study found that delayed post test scores of experimental group is comparatively high compared to the control group which shows that the experimental group students have greater retention of physics concepts among VII standard students compared to the control group.

SUMMARY AND CONCLUSION

CHAPTER V

SUMMARY AND CONCLUSION

5.1 INTRODUCTION:

In this chapter the summary and findings of the study **"Effectiveness of Simulation-Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district."** is presented on the basis of statistical interpretations.

5.2 SUMMARY OF THE FINDINGS:

The investigator selected 108 samples from municipality school from Tirupur district. The purposive sampling method was used to select the sample. The Science achievement test was used to find the pre knowledge of the students in both experimental and control group. Then after intervention post test was conducted to analyze the effectiveness of the Simulation-Based teaching method over conventional teaching method. Then the delayed post-test was conducted to analyze the retention of physics concepts among VII standard students. Personal data sheet also used to collect the required information. The data were analyzed and the conclusions were drawn.

From the study it is found that,

- There is no significant difference between the pre-test scores of the control group and experimental group in learning physics concepts among VII standard students.
- There is significant difference between the pre-test and post-test scores of the control group in learning physics concepts among VII standard students.
- There is significant difference between the pre-test and post-test scores of the experimental group in learning physics concepts among VII standard students.
- There is significant difference between the post-test scores of the control group and experimental group in learning physics concepts among VII standard students.
- There is significant difference between the post-test and post delayed test scores of the control group in learning physics concepts among VII standard students.
- There is significant difference between the post-test and post delayed test scores of the experimental group in learning physics concepts among VII standard students.
- There is significant difference between the delayed post-test scores of the control group and experimental group in learning physics concepts among VII standard students.

- There is significant difference between the post-test scores of control group with respect to gender and access to internet facility at home in learning physics concepts among VII standard students.
- There is no significant difference between the post-test scores of experimental group, delayed post- test scores of control group and experimental group with respect to gender and access to internet facility at home in learning physics concepts among VII standard students.
- There is no significant difference between the delayed post-test scores of control group with respect to locality in learning physics concepts among VII standard students.
- There is no significant difference between the post-test score of control group and experimental group with respect to locality in learning physics concepts among VII standard students.
- There is no significant difference between delayed post- test scores of experimental group with respect to locality in learning physics concepts among VII standard students.
- There is no significant difference between the delayed post-test scores of control group with respect to medium of instruction in learning physics concepts among VII standard students.
- There is no significant difference between the post-test scores of control group and experimental group with respect to medium of instruction in learning physics concepts among VII standard students.
- There is no significant difference between delayed post- test scores of experimental group with respect to medium of instruction in learning physics concepts among VII standard students.
- There is no significant difference between post-test and delayed post-test scores of control group and experimental group with respect to availability of computer at home, Father's education, Mother's education, socio-economic status, Father's occupation and Mother's occupation in learning physics concepts among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group with respect to science achievement in learning physics concepts among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning reflection concept among VII standard students.

- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning laws of reflection concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning plane mirror and reflection concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning pinhole camera concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning shadow concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning parts of shadow concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning solar eclipse concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning lunar eclipse concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning Newton disc concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning synthesis of colour concept among VII standard students.
- There is significant difference between the post-test and delayed post-test scores of control group and experimental group in learning phases of moon concept in learning among VII standard students.

5.3 RECOMMANDATIONS:

- Educational institutions can offer training programs aimed at equipping teachers with the skills necessary to utilize simulation tools effectively, thereby enhancing both classroom instruction and student involvement.
- Educators may incorporate simulation activities into their standard lesson plans, facilitating a deeper comprehension of abstract concepts in physics for students.
- Schools might also ensure access to technology-enhanced classrooms, which include computers, to facilitate learning through simulations.
- Students could be motivated to engage with simulations for independent learning, which may lead to improved understanding of concepts and enhanced problem-solving abilities.
- Orientation sessions for parents could be arranged, aiding them in grasping the advantages of simulation-based learning and how they can assist their children's science education at home.

5.4 SUGGESTIONS FOR FUTURE STUDY:

- The study was considered in only one district, it can be extended to other districts.
- The present study has been conducted only for VII standard students, it can be extended to other standards students as well as for college students.
- A similar study could be carried out to large sample.

5.5 CONCLUSION:

The study found that there is significant increase in the post test score of experimental group compared to control group. This shows the effectiveness of Simulation-Based teaching method over convention teaching method in teaching Physics concepts for VII standard students. Also the study found that delayed post test score of experimental group is comparatively high compared to the control group which shows that the experimental group students have greater retention of concepts compared to the control group studen

BIBILIOGRAPHY

BIBILIOGRAPHY

Abiasen, J. T., & Reyes, G. (2021). Computer simulation integration in secondary physics: Understanding its nature, impacts, and challenges. *International Journal of Asian Education*, *2*(4), 480–492. https://doi.org/10.46966/ijae.v2i4.185

Adams, F. U., Yawa, A. F., & Harry, H. I. (2025). Effectiveness of computer simulation software on students' learning and performance of scientific concepts in Sabon- Gari Educational Zones Kaduna state, Nigeria.

Alhusni, H. Z., Ramadani, R., Sunarti, T., & Madlazim, M. (2025). Simulation Technologies in Physics Learning for Education for Sustainable Development. *Journal of Innovative Technology and Sustainability Education*, *1*(3), 107-107.

Almasri, F. (2022). *Simulations to teach science subjects: Connections among students' engagement, self-confidence, satisfaction, and learning styles.* Education and Information Technologies, 27(5), 7161–7181. https://doi.org/10.1007/s10639-022-10940-w

Arymbekov, B. S., Turekhanova, K. M., Alipbayev, D. D., Tursanova, E. R., & Suprapto, N. (2023). The effect of using Geogebra software for augmented reality visualization to teach physics in high school. *Farabi Journal of Social Sciences*, *9*(2), 46-71.

Bayaga, A. (2024). Geogebra, a dynamic software for conceptual understanding and visualisation-multi-directionality of influence. *South African Journal of Higher Education*, *38*(3), 9-28.

Borliboune, S., Chuechor, K., Vilaysane, T., & Keovilaysack, S. (2025). The influence of computer-based simulation in teaching direct current circuits on improving students'academic achievement and attitudes. *Mojes: Malaysian Online Journal of Educational Sciences*, *13*(2), 27-39.

Borliboune, S., Keovilaylack, S., Xaiyalath, S., Vilaisane, T., & Siboualipha, S. (2025). Comparing Simulation-Based and Traditional Teaching Approaches in Improving Students' Learning Outcomes and Attitudes toward Newton's Laws. *Journal of Science and Teacher Education*, *1*(1), 157-166.

Bounthong, B., Vangchangyia, S., Thipphaphone, K., Vongvilay, C., & Keomanychan, P. (2023). Simulation instead of Experience by using GeoGebra for the Physics Teacher:

https://doi. org/10.69692/SUJMRD090163. *Souphanouvong University Journal Multidisciplinary Research and Development*, *9*(1), 68-77.

Daniel, E., Juma, Z. R., & Kyobe, J. (2024). Comparing traditional teaching methods versus computer simulations on students' performance in learning Ohm's Law at Dodoma City Secondary Schools. *Tanzania. Journal of Research Innovation and Implications in Education*, *8*(3), 402-412.

Droui, M. (2023). *Quasi-experimental study on the effect of teaching methods in middle school physics education using pre-test and post-test design*.

DROUI, M. (2023). Simulation and inquiry-based learning in physics teaching. *The International Journal of Science Didactics and Educational Engineering*, *1*(1), 83-94.

Ebel, R. L. (1972). *Essentials of educational measurement*. Prentice-Hall.

Fiola Marie G. (2025). *A quasi-experimental study comparing traditional and simulation-based teaching methods in education*.

Hursen, C., & Asiksoy, G. (2015). *The effect of simulation-based instruction on students' achievement in physics education*. Journal of Educational Technology & Society, 18(2), 1–10.

Jaimeetham, D., & Srisawasdi, N. (2018, November). Using mobile game-like simulation to promote inquiry-based laboratory learning in elementary school science. In *International Conference on Computers in Education*.

Kabigting, L. D. C. (2021). Computer simulation on teaching and learning of selected topics in physics. *European Journal of Interactive Multimedia and Education*, *2*(2), e02108.

Kai, K. L. J., & Chongo, S. The Impact of Computer-Based Simulation on Primary Students' Achievement and Interest in Learning Earth's Rotation and Revolution.

Kamalia, D., Lesmono, A. D., Handayani, R. D., & Choirrudin, C. (2024). *The analysis of students' computational thinking skills through the implementation of GeoGebra integrated student worksheets on motion*. *Berkala Ilmiah Pendidikan Fisika, 12*(1), 45–56. https://doi.org/10.20527/bipf.v12i1.18458

Mehar, R., & Arora, N. (2021). Contribution of computer simulation in conceptual understanding of science. *Globus Journal of Progressive Education*, *11*(2), 125-131.

Montalbano, V., & Sirigu, M. (2016). Seeing how fitting process works. *arXiv preprint arXiv:1601.01351*.

Nurlina, N., Hajati, K., & Zulfiani, U. (2024). STEM-Based Physics Modules with CK-12 Simulations for High School Students: Development and Implementation. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *10*(2), 395-408.

P Matos, A. P., do Espírito Santo, M. A., & S Souza, P. V. (2023). Studying Kepler's laws using GeoGebra simulations. *Physics Education*, *58*(5), 055012.

Pradhan, S., Zam, S., & Zangmo, Y. (2023). How can ck-12 (an open educational resource, oer) enhance the attitude and academic performance of class vii students in science. *Journal of Educational Action Research*, *7*(1).

Rutten, N., Van Joolingen, W. R., & Van Der Veen, J. T. (2012). The learning effects of computer simulations in science education. *Computers & education*, *58*(1), 136-153.

Solvang, L., & Haglund, J. (2021). How can GeoGebra support physics education in upper-secondary school—a review. *Physics Education*, *56*(5), 055011.

Urieta, F. M., Beliran, J. M., Carpentero, A. C., Gabay, S., Gadon, J., Nicolas, G., & Novio, J. M. (2025). Effectiveness of online interactive simulation laboratory in improving the performance in motion in two dimensions of Grade 9 students in San Jose Adventist Academy. *Aka Student Research Journal*, *4*(1), 83-92.

Yorganci, S., & Subasi, M. (2025). Interactive GeoGebra applets to improving students' learning performance in e-book-based learning environment. *Education and Information Technologies*, *30*(5), 5477-5500.

Ziatdinov, R., & Valles Jr, J. R. (2022). Synthesis of modeling, visualization, and programming in GeoGebra as an effective approach for teaching and learning STEM topics. *Mathematics*, *10*(3), 398.

WEBSITES:

- **https://interactives.ck12.org/simulations/physics.html**
- **https://www.geogebra.org/m/XMz9xCGC**

Avinashilingam Institute for Home Science and Higher Education for Women
Deemed-to-be-University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)
Re-accredited with 'A++' Grade by NAAC CGPA 3.65/4, Category I by UGC
Coimbatore-641 043, Tamil Nadu, India

Institutional Human Ethics Committee (IHEC)

Date 4.3.2026

To
Shrinidhi S
24PED012
Department of Education
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore 641043

Dear Ms Shrinidhi S
Ref: Your application IHEC 2026/EDN8
Effectiveness of simulation -Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district submitted for approval of IHEC

The Institutional Human Ethics Committee of Avinashilingam Institute for Home Science and Higher Education for Women after careful scrutiny and review of your application, hereby grants approval to your application titled 'Effectiveness of simulation -Based teaching method over conventional teaching method in teaching physics concepts among VII standard students in Tirupur district'. The approval number for the same is IHEC 2026/EDN8/ XMT
This certificate is issued for the study period specified in your application.

Best Wishes,

Dr. Shubashini K. Sripathi
Member Secretary

APPENDICES

APPENDIX-A

PERSONAL DATA SHEET

(Please tick (✓) the appropriate box or fill in the blanks.)

NAME OF THE STUDENT:

CLASS:

DATE:

GENDER:

☐ Boys ☐ Girls

LOCALITY:

☐ Rural ☐ Urban

MEDIUM OF INSTRUCTION:

☐ English ☐ Tamil

PARENTAL EDUCATION LEVEL:

Father: ☐ No formal education ☐ Primary ☐ Secondary ☐ College/Degree ☐ Postgraduate

Mother: ☐ No formal education ☐ Primary ☐ Secondary ☐ College/Degree ☐ Postgraduate

SOCIO ECONOMIC STATUS:(Parents salary per month)

☐ Below 10,000 ☐ 10,000-20,000 ☐ 20,000-30,000 ☐ 30,000-40,000 ☐ 40,000 and above

PARENTAL OCCUPATION:

Father: _____

Mother: _____

SCIENCE ACHIEVEMENT:(Enter your previous exam mark)

Science mark: _____

AVAILABILITY OF COMPUTER AT HOME:

☐ Yes ☐ No

ACCESS TO INTERNET AT HOME:

☐ Yes ☐ No

APPENDIX-B

CLASS: VII **MARKS:45**

SCIENCE:PHYSICS-LIGHT,UNIVERSE AND SPACE

I)CHOOSE THE CORRECT ANSWER: 1x20=20

1)Which property of light explains the working of a pinhole camera?

a) Reflection b) Refraction c) Rectilinear propagation of light d) Dispersion

2)The bouncing back of light from a surface is called

a) Refraction b) Reflection c) Dispersion d) Absorption

3) The angle of incidence is always _____ the angle of reflection.

a) Greater than b) Less than c) Equal to d) Double

4)The incident ray, reflected ray and normal lie in

a) Different planes b) Same straight line c) Same plane d) Different angles

5)Which of the following creates a shadow?

a) Transparent object b) Opaque object c) Translucent object d) Mirror

6) In a Solar Eclipse, the position of celestial bodies is:

a) Sun - Earth – Moon b) Earth - Sun – Moon c) Sun - Moon – Earth d) Moon - Sun – Earth

7)The image formed by a plane mirror is always:

a) Real and inverted b) Virtual and erect c) Real and erect d) Virtual and inverted

8)The darkest inner part of a shadow is called the:

a) Penumbra b) Umbra c) Antumbra d) Silhouette

9)If you raise your right hand in front of a plane mirror, your image appears to raise its left hand. This phenomenon is called:

a) Vertical inversion b) Regular reflection c) Lateral inversion d) Irregular reflection

10)Solar eclipse occurs on a

a) Full moon day b) New moon day c) Half moon day d) Any day

11)During lunar eclipse, Earth's shadow falls on the

a) Sun b) Moon c) Mars d) Venus

12) Newton's disc proves that white light is a mixture of

a) Two colours b) Three colours c) Seven colours d) Infinite colours

13)The size of a shadow depends on

a) Colour of object b) Distance between object and light source

c) Shape only d) Temperature

14) If you stand 2 meters away from a plane mirror, how far is your image from you?

a) 2 meters b) 1 meter c) 4 meters d) 3 meters

15) The Moon revolves around the

a) Sun b) Earth c) Mars d) Stars

16) The changing shapes of the Moon are called

a) Orbits b) Eclipses c) Phases d) Shadows

17) The phase of the moon where the moon is not visible at all is called:

a) Full Moon b) New Moon c) Crescent Moon d) Gibbous Moon

18)A pinhole camera produces an image that is:

a) Erect and same size b) Inverted and real c) Erect and virtual d) Inverted and virtual

19) Mixing red, green and blue light produces

a) Black b) White c) Yellow d) Pink

20)Which are the primary colours of light?

a) Red, Yellow, Blue b) Red, Green, Blue c) Yellow, Green, Blue d) Red, Black, White

II) FILL IN THE BLANKS: 1x10=10

21) Light travels in a _____ line.

22) The angle between the incident ray and the normal is called the _____.

23) The light ray get _____ when it falls on a mirror.

24) The region of illuminated shadow area is called as _____.

25) The image formed in a plane mirror is of the _____ size as the object.

26) When the Earth comes between the Sun and the Moon, a _____ eclipse occurs.

27) In a pinhole camera, if the hole is made larger, the image becomes _____.

28) Equal proportion of two primary colours creates _____ colours.

29) One complete cycle of moon phases takes about _____ days.

30) The moon does not produce its own light; it reflects the light of the_____.

III) TRUE OR FALSE: 1x15=15

31) A pinhole camera uses a lens to form an image. _____

32) Reflection occurs only on shiny surfaces. _____

33) An umbra is the darkest part of a shadow where no light reaches. _____

34) Shadows are always formed on the opposite side of the light source. _____

35) The incident ray, the reflected ray and the normal at the point of incidence lie on the different plane. _____

36) The shadow will be always darker whatever may be the colour of the light. _____

37) People in all region see a solar eclipse equally. _____

38) A plane mirror is a mirror which has flat non reflective surface. _____

39) White light consist of all colours. _____

40) Lunar eclipse happens when moon comes between earth and sun. _____

41) The secondary colours are magenta, cyan and yellow. _____

42) The image formed in the plane mirror are greater than the size of the object. _____

43) The new moon occurs when the moon is between the sun and the earth. _____

44) The phases of the moon caused because of the earth's shadow falling on the moon. _____

45) The full moon occurs once every 15 days. _____

APPENDIX-C

தனிப்பட்ட தகவல் படிவம்

(தயவு செய்து பொருத்தமான இடத்தில் ✓ குறியீடு இடவும் அல்லது காலியிடங்களை நிரப்பவும்)

மாணவரின் பெயர் : _____

வகுப்பு : _____

தேதி : _____

பாலினம் :

☐ **ஆண்** ☐ **பெண்**

வசிப்பிடம் :

☐ **கிராமப்புறம்** ☐ **நகர்ப்புறம்**

கற்பித்தல் மொழி :

☐ **ஆங்கிலம்** ☐ **தமிழ்**

பெற்றோரின் கல்வித் தகுதி :

தந்தை :

☐ **கல்வி இல்லை** ☐ **தொடக்கக் கல்வி** ☐ **மேல்நிலை கல்வி**
☐ **கல்லூரி / பட்டம்** ☐ **முதுநிலை**

தாய் :

☐ **கல்வி இல்லை** ☐ **தொடக்கக் கல்வி** ☐ **மேல்நிலை கல்வி**
☐ **கல்லூரி / பட்டம்** ☐ **முதுநிலை**

சமூக–பொருளாதார நிலை (பெற்றோரின் மாத வருமானம்) :

☐ **ரூ.**10,000 **க்குக் கீழ்**☐ **ரூ.**10,000 – 20,000☐ **ரூ.**20,000 – 30,000☐ **ரூ.**30,000 – 40,000☐ **ரூ.**40,000 **மற்றும் அதற்கு மேல்**

பெற்றோரின் தொழில் :

தந்தை : _____

தாய் : _____

அறிவியல் பாடத் தேர்ச்சி :

(முந்தைய தேர்வில் பெற்ற மதிப்பெண்)

அறிவியல் மதிப்பெண் : _____

வீட்டில் கணினி வசதி உள்ளதா?

☐ ஆம் ☐ இல்லை

வீட்டில் இணைய வசதி உள்ளதா?

☐ ஆம் ☐ இல்லை

APPENDIX-D

வகுப்பு : VII **மதிப்பெண்கள்** : 45

அறிவியல் – இயற்பியல் : ஒளி, அண்டம் மற்றும் விண்வெளி

I) **சரியான விடையைத் தேர்ந்தெடுக்கவும்:** 1x20=20

1. **ஊசித்துளைக் கேமரா செயல்படுவதற்கு காரணமான ஒளியின் பண்பு எது?**

   a) எதிரொளிப்பு b) முறிவு

   c) ஒளியின் நேர்கோட்டுப் பயணம் d) பரவல்

2. **ஒரு மேற்பரப்பிலிருந்து ஒளி திரும்பிப் பாய்வதை என்ன என்பார்கள்?**

   a) முறிவு b) எதிரொளிப்பு

   c) பரவல் d) உறிஞ்சுதல்

3. **படுகதிர் கோணம் எப்போதும் எதிரொளிப்பு கோணத்துடன் _____இருக்கம்.**

   a) அதிகமாக b) குறைவாக

   c) சமமாக d) இரட்டிப்பாக

4. **படுகதிர், எதிரொளிக்கப்பட்ட கதிர் மற்றும் குத்துக்கோடு ஆகியவை**

   a) வேறு வேறு தளங்களில் b) ஒரே நேர்கோட்டில்

   c) ஒரே தளத்தில் d) வேறு கோணங்களில்

5. **கீழ்கண்டவற்றில் எது நிழலை உருவாக்கும்?**

   a) வெளிப்படையான பொருள் b) ஒளியின்மை பொருள்

   c) அரை வெளிப்படையான பொருள் d) கண்ணாடி

6. **சூரிய கிரகணத்தில் விண்மீன் பொருட்களின் நிலை:**

   a) சூரியன் – பூமி – நிலா b) பூமி – சூரியன் – நிலா

   c) சூரியன் – நிலா – பூமி d) நிலா – சூரியன் – பூமி

7. **சமதள கண்ணாடியில் உருவாகும் படம் எப்போதும்:**

   a) உண்மை மற்றும் தலைகீழ் b) மாயை மற்றும் நேரான

   c) உண்மை மற்றும் நேரான d) மாயை மற்றும் தலைகீழ்

8. **நிழலின் மிக இருண்ட உள்பகுதியை என்ன என்பார்கள்?**

   a) **பூறநிழல்** b) **கருநிழல்** c) ஆன்டம்ப்ரா d) சில்ஹூயட்

9. **நீங்கள் சமதள கண்ணாடி முன் வலது கையை உயர்த்தினால், உங்கள் படம் இடது கையை உயர்த்துவது போலத் தெரியும். இதை என்ன என்பார்கள்?**

a) செங்குத்து மாற்றம் b) வழக்கமான பிரதிபலிப்பு

c) இடத்தால மாற்றம் d) வழக்கற்ற பிரதிபலிப்பு

10. **சூரிய கிரகணம் நடைபெறும் நாள்:**

a) பௌர்ணமி நாள் b) அமாவாசை நாள்

c) அரை நிலா நாள் d) எந்த நாளிலும்

11. **சந்திர கிரகணத்தின் போது பூமியின் நிழல் விழுவது:**

a) சூரியன் b) நிலா

c) செவ்வாய் d) வெள்ளி

12. **நியூட்டனின் வட்டு வெள்ளை ஒளி _____ கலவையாக இருப்பதை நிரூபிக்கிறது.**

a) இரண்டு நிறங்கள் b) மூன்று நிறங்கள்

c) ஏழு நிறங்கள் d) எண்ணற்ற நிறங்கள்

13. **நிழலின் அளவு எதற்கு சார்ந்தது?**

a) பொருளின் நிறம்

b) பொருளுக்கும் ஒளி மூலத்துக்கும் உள்ள தூரம்

c) வடிவம் மட்டும் d) வெப்பநிலை

14. **நீங்கள் சமதள கண்ணாடியிலிருந்து 2 மீட்டர் தொலைவில் நின்றால், உங்கள் படம் உங்களிடமிருந்து எவ்வளவு தொலைவில் இருக்கும்?**

a) 2 மீட்டர் b) 1 மீட்டர்

c) 4 மீட்டர் d) 3 மீட்டர்

15. **சந்திரன் எவ்விடம் சுற்றிக்கொண்டிருக்கும்?**

a) சூரியன் b) பூமி

c) செவ்வாய் கிரகம் d) நட்சத்திரங்கள்

16. **சந்திரனின் மாறும் வடிவங்களை என்ன என அழைக்கின்றனர்?**

a) பயணங்கள் (Orbits) b) கிரகச்சாயல்கள் (Eclipses)

c) கட்டமைப்புகள் / நிலைமைகள் (Phases)

d) நிழல்கள் (Shadows)

17. **நிலா முற்றிலும் தெரியாத நிலை:**

a) பௌர்ணமி b) அமாவாசை

c) குறுநிலா d) கிபஸ் நிலா

18. **ஊசித்துளைக் கேமராவில் உருவாகும் படம்:**

a) நேரான மற்றும் அதே அளவு

b) தலைகீழ் மற்றும் உண்மை

c) நேரான மற்றும் மாயை

d) தலைகீழ் மற்றும் மாயை

19. **சிவப்பு, பச்சை, நீலம் ஒளிகளை கலந்தால் உருவாகுவது:**

a) கருப்பு b) வெள்ளை

c) மஞ்சள் d) இளஞ்சிவப்பு

20. **ஒளியின் முதன்மை நிறங்கள் எவை?**

a) சிவப்பு, மஞ்சள், நீலம்

b) சிவப்பு, பச்சை, நீலம்

c) மஞ்சள், பச்சை, நீலம்

d) சிவப்பு, கருப்பு, வெள்ளை

II) **காலியிடங்களை நிரப்புக:** 1x10=10

21) ஒளி _____ கோட்டில் பயணிக்கிறது.

22) படுகதிருக்கும் குத்துகோடுக்கும் இடையிலான கோணம் _____ எனப்படும்.

23) கண்ணாடியில் விழும் ஒளிக் கதிர் _____ பெறுகிறது.

24) ஒளி பெற்ற நிழல் பகுதி _____ எனப்படுகிறது.

25) சமதள கண்ணாடியில் உருவாகும் படம் பொருளின் _____ அளவாக இருக்கும்.

26) பூமி சூரியனுக்கும் நிலாவுக்கும் இடையில் வந்தால் _____ கிரகணம் நிகழும்.

27) ஊசித்துளைக் கேமரா துளை பெரியதாக இருந்தால் படம் _____ ஆகும்.

28) இரண்டு முதன்மை நிறங்களை சம அளவில் கலந்தால் _____ நிறங்கள் உருவாகும்.

29) நிலா நிலைகளின் ஒரு முழுச் சுழற்சி சுமார் _____ நாட்கள்.

30) நிலாவிற்கு சொந்த ஒளி இல்லை; அது _____ ஒளியை பிரதிபலிக்கிறது.

III) **உண்மை அல்லது பொய்** (True / False): 1x15=15

31) ஊசித்துளைக் கேமரா லென்ஸைப் பயன்படுத்தி படம் உருவாக்குகிறது. _____

32) எதிரொளிப்பு பளபளப்பான மேற்பரப்பில் மட்டும் நடைபெறும். _____

33) கருநிழல் என்பது ஒளி முற்றிலும் எட்டாத மிக இருண்ட நிழல் பகுதி. _____

34) நிழல் எப்போதும் ஒளி மூலத்தின் எதிர்புறத்தில் உருவாகும். _____

35) படுகதிர், எதிரொளிக்கப்பட்ட கதிர் மற்றும் குத்துகோடு வேறு தளங்களில் உள்ளன. _____

36) ஒளியின் நிறம் எதுவாக இருந்தாலும் நிழல் எப்போதும் இருண்டதாக இருக்கும். _____

37) உலகின் எல்லா பகுதிகளிலும் மக்கள் சூரிய கிரகணத்தை ஒரே மாதிரி காணலாம். _____

38) சமதள கண்ணாடி என்பது பிரதிபலிப்பு இல்லாத சமமான மேற்பரப்பு. _____

39) வெள்ளை ஒளி அனைத்து நிறங்களையும் கொண்டது. _____

40) சந்திர கிரகணம் நிலா பூமிக்கும் சூரியனுக்கும் இடையில் வந்தால் ஏற்படும். _____

41) இரண்டாம் நிலை நிறங்கள் மெஜந்தா, சையான் மற்றும் மஞ்சள். _____

42) சமதள கண்ணாடியில் உருவாகும் பின்பம் பொருளை விட பெரியதாக இருக்கும். _____

43) அமாவாசை நிலா சூரியனுக்கும் பூமிக்கும் இடையில் இருக்கும் போது ஏற்படுகிறது. _____

44) நிலா நிலைகள் பூமியின் நிழல் நிலாவில் விழுவதால் ஏற்படுகின்றன. _____

45) பௌர்ணமி ஒவ்வொரு 15 நாளுக்கும் ஒருமுறை நடைபெறும். _____