Understanding The Study of Light and The Image Formation by Low Cost Teaching Aids

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Abstract- Learning science is an intellectual search for truth in nature. Innovation in teaching physical science needs some effective methods. Activity centered learning is now accepted as an innovative method for imparting physical science in school curriculum. Today's students are mark's oriented. They are neither thinking independently nor analyzing the concepts or facts. Their rational attitude and imagination are not developed properly. These essential qualities can be well developed among the students by using innovative teaching aids and simple experiments on physical science. While teaching of chapter 'light', properties of light and images form by lens and plane mirror becomes more difficult for students to understand. For well understanding of all the concepts , we make some simple experiments by using working Models which have very low cost . They are very easy to prepare and portable. Development of low cost teachings aids from our surrounding not only arise curiosity and interest but also provide an opportunity of self study to the learners .Students really enjoyed it. They can't realize that they are learning a difficult part through it. As per my experience, these instruments, innovative teaching aids and simple experiments played a major role in teaching of physical science in school curriculum.

Index Terms- Light , image, mirror , lens ,reflection, refraction .

I. Introduction

"Nature gives a valuable Gift to man , that he May enjoy the Beauties of Form , color and motion , made possible by light "

Light is everywhere in our world. The world usually refers to visible light , which is visible to the human eye and is responsible for the sense of sight. The main source of light on earth is the sun. Observation of images in various mirrors is related to light .It is only due to the presence of light that all of us can enjoy various natural wonders like sunset, sunlight ,rainbow, etc. Students already have ideas about light , but the study of light still have magic for them.

When the teacher teaches study of light viz .. direction of light , reflection , refraction, images formed by plane mirror and lenses only with the help of chalk on black board , he face some crisis to make it understand for the students. Though some school belonging to city area have practical facilities, but those instruments are kept only for decorum purpose at the laboratory. Further the students are not allowed to touch the instruments due to high cost , As a result the emerging skill of student is blocked. Rural area school doesn't have the facilities to show these experiments .Its a big challenge for teacher. So inventors decide to study the properties of light problems ,image formation problems. He started to prepare an image model and innovative simple experiments which gives practical experience to students.

II. Objective of Study

1. Preparation of model, to see various properties of light and their experiments.
2. Preparation of image model , to see various images due to lens and their experiments.
3. Preparation of model , to see the dispersion of light..
4. To see the path forming light rays.
5. To see the path of refracting light rays by using convex and concave lens.
6. To see the laws of reflection of light rays by using plane mirror.
7. To see the types of reflection of light rays .
8. To see the images in two parallel plane mirrors.
9. To see the images at different angles by using two plane mirror.

III. Null Hypothesis :

No change was found in mean of pre-test and post-test .

IV. Methodology

For this research ,We have selected the students of New English School, Kamothe where I am working . We have select students from 10^{th} – C class . We use one group post test sampling method. So we selected 30 students as sample by a test (upper level average marks) .

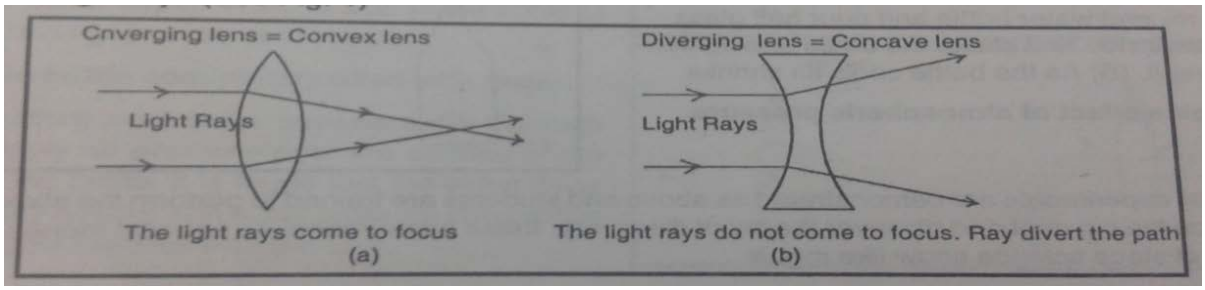
We use experimental method for this paper, first .The specific properties of light of std.8^{th} to 10^{th} are taught for group by regular method by using drawing board, help of chalk and some instruments . An evaluation test (Pre-Test) taken using by traditional method and after some week evaluation test (Post –Test)on same concept taken when student used new teaching aids making by teacher for understanding properties of light and image formation . Scores have been recorded and compared. All this process completed in 3 months .

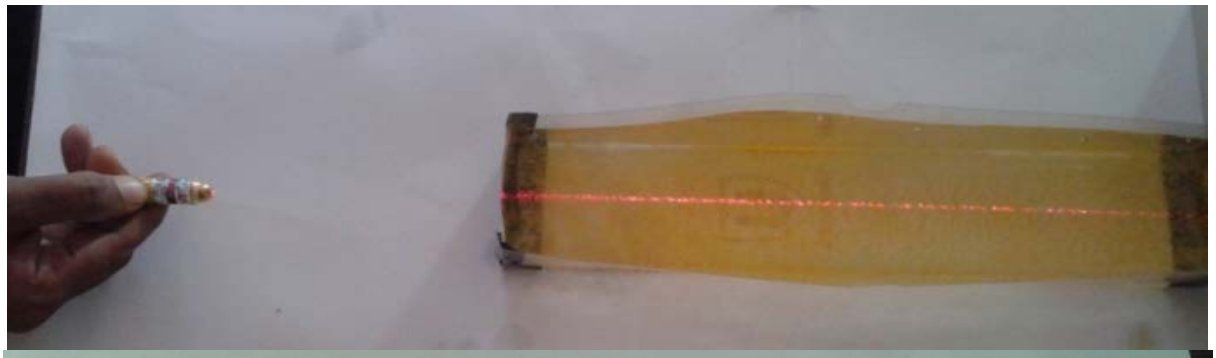
Construction and working of model (Teaching Aids) :

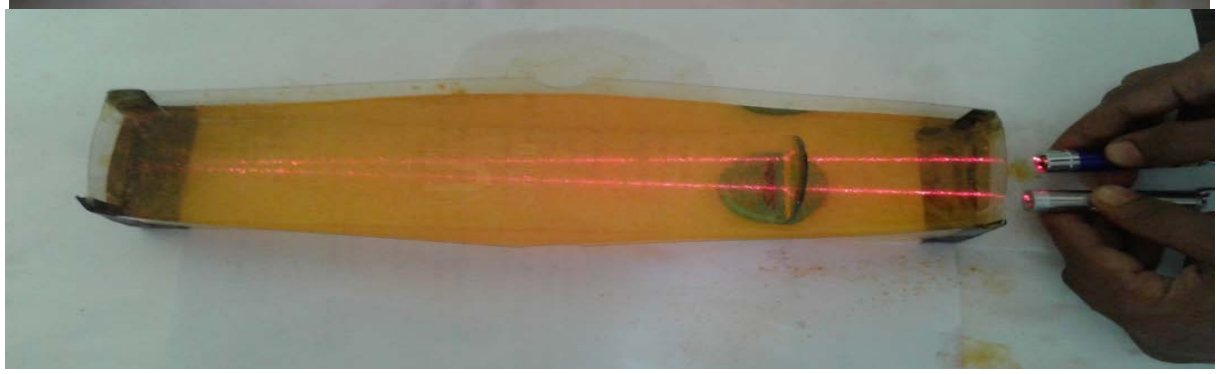
1) Model 1 : Take any wastage plastic box of rectangular shape. Fill the box with water . Convex and concave lens , plane mirror , glass slab, prism and laser torch are used for viewing the light rays .

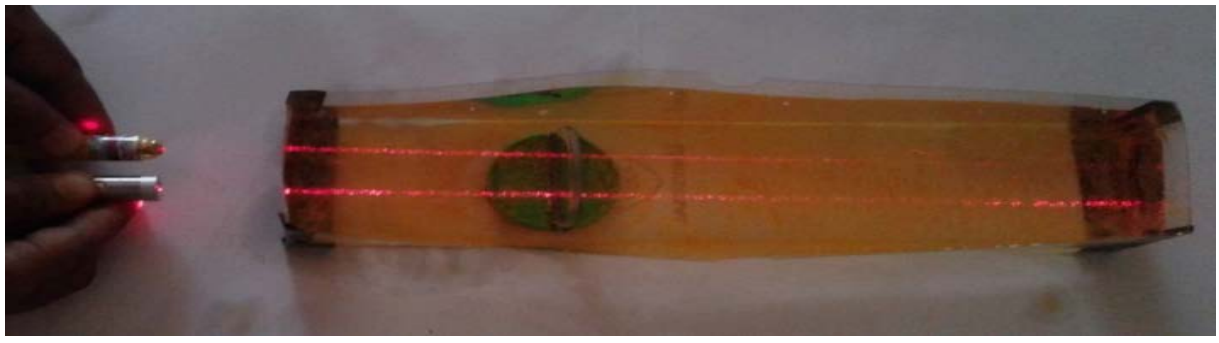
Working: Inventor prepared a model . By entering the light ray through laser and some optical instruments by which one can easily understand following experiments in very short period.

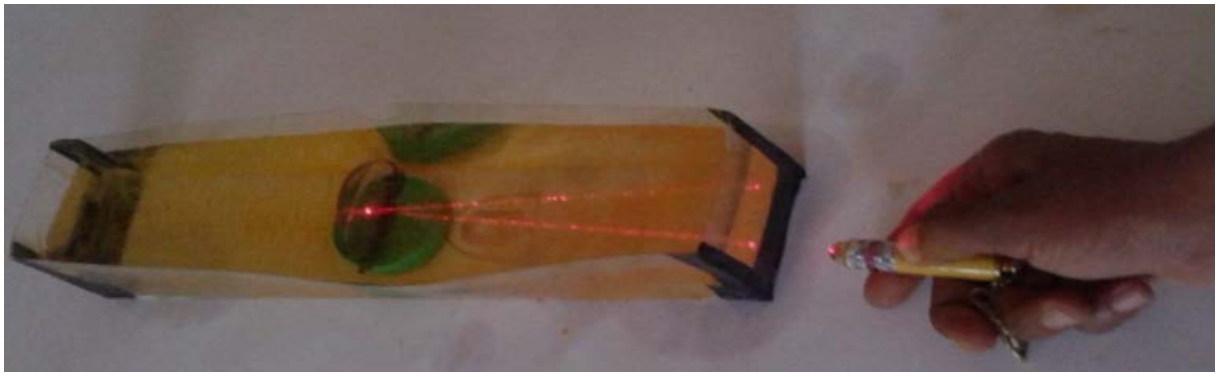
1. Path of light ray 2. Refraction by convex lens . 3. Refraction by concave lens 4. Laws of reflection . 5. Types of reflection. 6. Refraction by glass slab or prism.

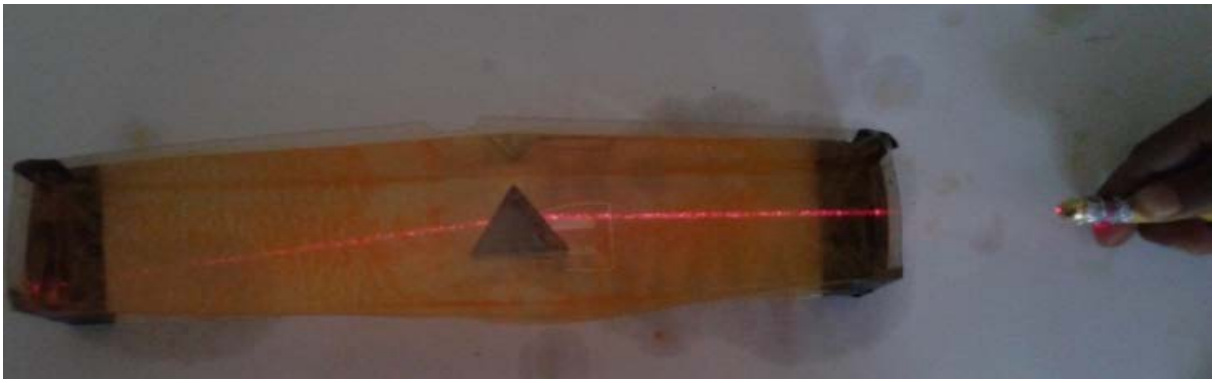


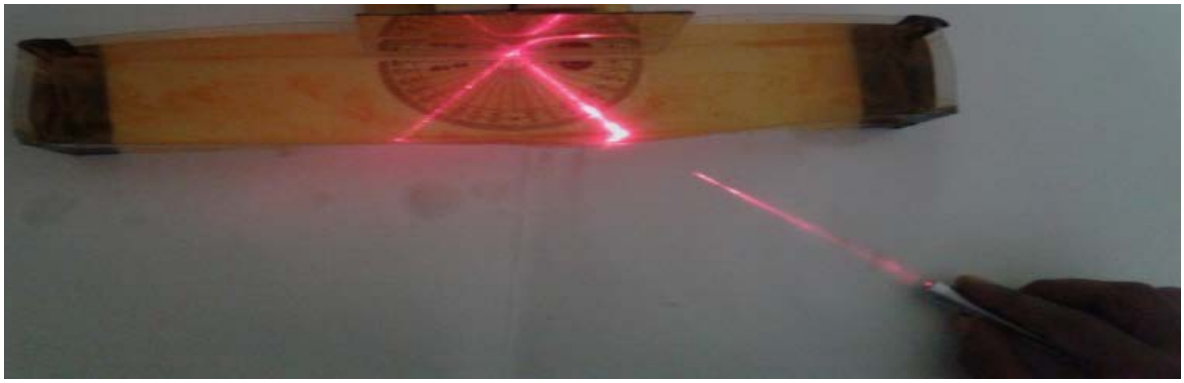


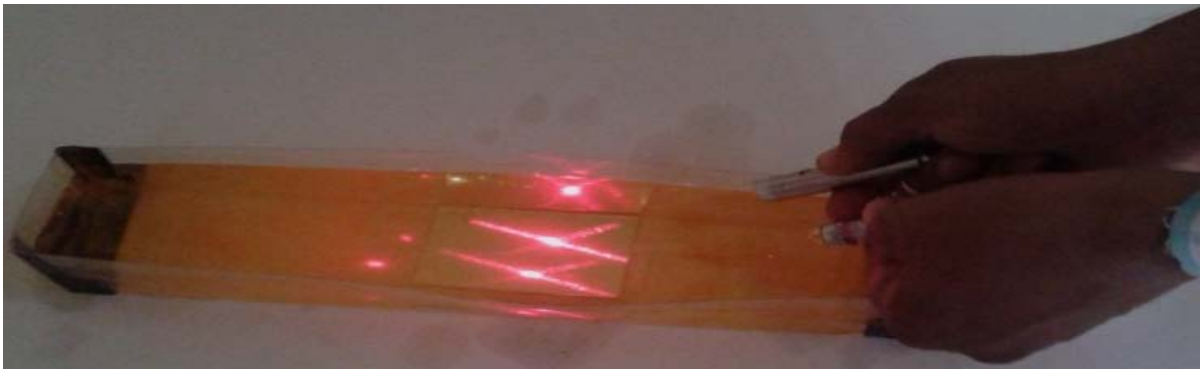


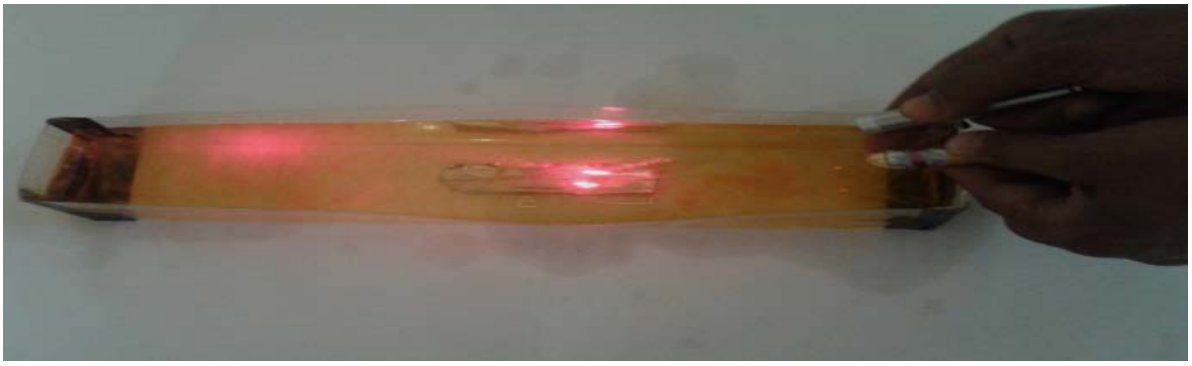








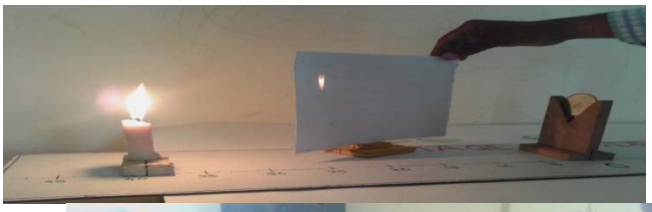




2) Model 2: Image model - Take a piece of wastage plywood of rectangular shape. Draw a horizontal line on it. Mark a center point noted as '0' . Then draw a marking scale at both sides of center by using permanent markers. Use candle and different optical instruments as convex lens , concave lens, concave mirror.

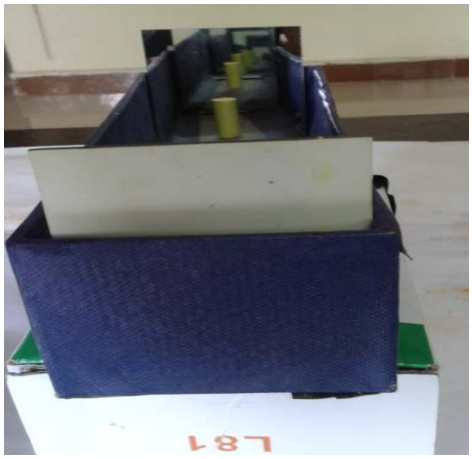
Working: Inventor prepared an image model . By entering the light rays of burning candle on optical instruments by which one can easily understand the following experiments in very short period. Here object means flame of candle and F_1 means focal length of lens.

1. Position of the object : At infinity
2. Position of the object : Beyond $2F_1$
3. Position of the object : At $2F_1$
4. Position of the object : Between F_1 and $2F_1$
5. Position of the object : At focus F_1
6. Position of the object : Between F_1 and and optical center O



3) Model 3: Take two rectangular shaped plane mirrors . Put both mirrors in parallel position keeping some distance in the box . To see images, use piece of colored chalk.

Working : Put a small piece of colored chalk at the center of two parallel plane mirrors. Then observe the images of colored chalk.

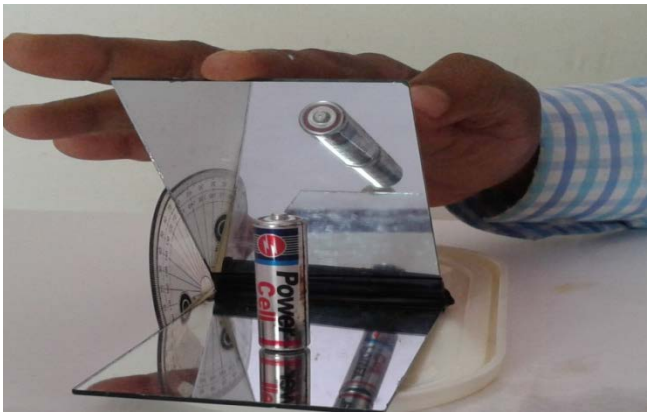



4) Model 4: Take two rectangular shaped plane mirrors, one plastic plate and protractor. Join these mirrors by a electric tape . Then fix the protractor vertically at center 0 in between two mirrors. Use wastage dry cell of clock , toys etc and see the images at different angles..

Working : Put a dry cell (object) vertically on the center of horizontally placed plane mirror.

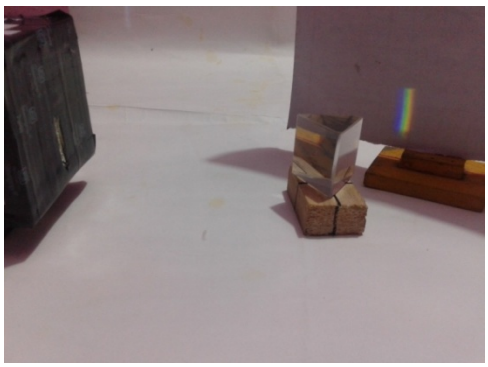
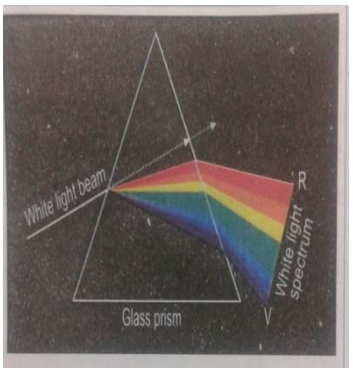
I) Then observe the images of dry cell at 90^0. .

II) Then observe the images of dry cell at 60^0. .

5) Model 5: Take one paper box . Make a slight cut on one side of box. Also make a plane white paper stand . Use small torch and prism to see the dispersion of light.

Working : Put a torch in a box. Put a prism in front of a cut side of a box . When one switch on the torch , we see colors spectrum on white paper.

V. OBSERVATION

i) Verification of laws of reflection by using plane mirror.

Sr.No.	Incident Angle	Reflected Angle
1.	30^0	30^0
2.	50^0	50^0

ii) Nature of image formed by convex lens for various position of object.

Sr.No.	Position of object	Position of image	Size	Nature of image
1.	At infinity	At focus F_2	Highly Diminished, small size	Real and inverted
2.	Beyond $2F_1$	Between F_2 and F_2	Diminished	Real and inverted
3.	At $2F_1$	At $2F_2$	Same size	Real and inverted
4.	At focus F_1	At infinity	Infinitely large and Magnified	Real and inverted

iii) Images formed by two parallel plane mirrors.
- We see infinite images of object.

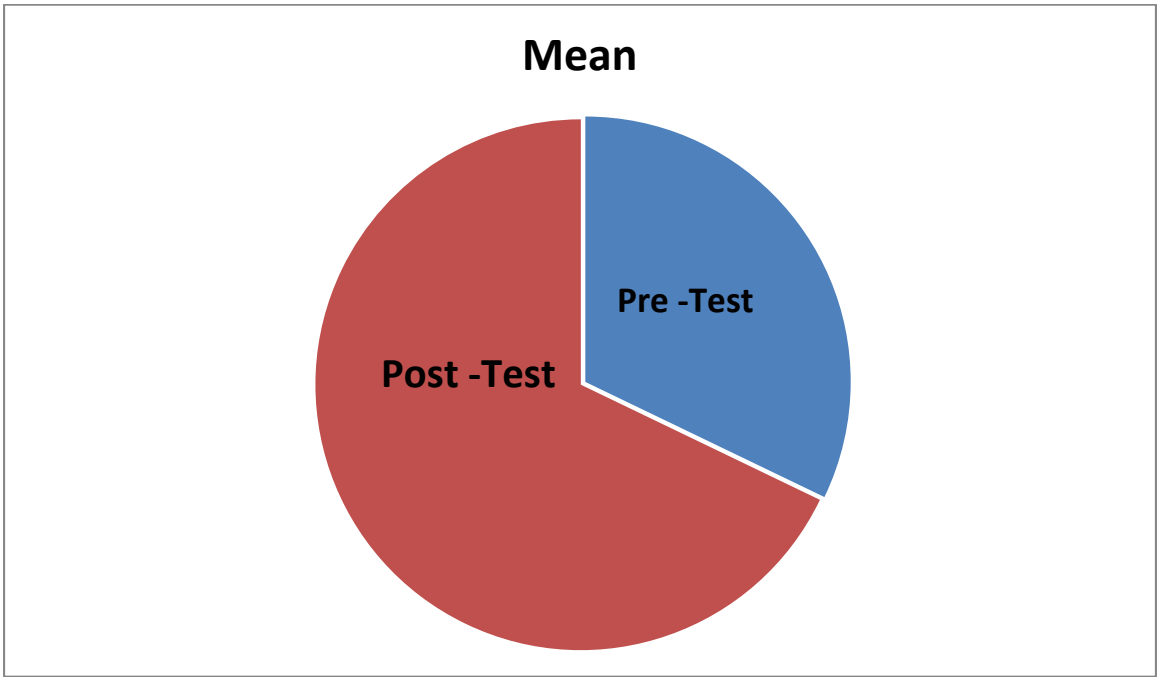
iv) Images formed by two plane mirror.
As $\theta = 90^0$, We see three images.
As $\theta = 60^0$, We see five images.
By this process we got the data by test for this research . We take analysis of this data and wirte difference in regular method and innovative teaching aids method .

Data Analysis :

In data analysis ,we calculated mean of marks for both method . This compare with graphically .

1. Mean for Pre-Test = Sum of marks of all student / Total number of students
   = 200 / 30
   Mean for Pre-Test = 6.66
2. Mean for Post-Test = Sum of marks of all student / Total number of students
   = 422 / 30

Mean for Post-Test = 14.06



VI. Conclusion

In traditional method ,one can be learned properties of light and image formation by using apparatus like using Drawing board and blackboard-chalk . But it took more time at least ½ hr. to 1 hr and also one can't see the light rays visible. He see only drawn path of light rays. These are the main drawbacks of this traditional method .But comparatively with the help of innovative teaching aids, it remove all these drawbacks.

When we compare mean of pre-test and post test. We saw increase of marks in post- test than pre –test .So that our null hypothesis is rejected i.e .We got increases the marks of student in post test by students handling novel teaching aids for understanding the study of light and image formation . Following are the advantages of the low cost teaching aids .

VII. Advantage of the Low Cost Teaching Aids

1. The teaching learning process becomes more fruitful with the help of low cost teaching aids.
2. One can understand all the concepts (primary, secondary and higher level)related with light and optics with the help of novel teaching aids
3. One can see the light rays visible. It is very interesting for learners..
4. Each experiment takes hardly one or two minutes.
5. Experiments are performed in sunlight in daytime without using electricity.
6. It is an easy, superior and understandable method than traditional method.
7. It is low cost teaching aid which costs about Rs.70 to Rs.150 approx.
8. The arrangements of instruments are very easy.
9. It can be made by student and teacher easily.
10. It is portable that it can be easily used in every place viz… classroom, lab, seminars etc.
11. It creates scientific attitude among the students.

VIII. Future Scope

We can make available a plenty of these low cot steaching aids in laboratories, then each and every student will get individual experience of it. Also one will get inspiration from these teaching aids.

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Annexure: 1) Marks of test .

Sr.No.	Name of student	Pre -Test	Post- Test
1	Prajkta Jadhav	4	12
2	Kadam Shruti	6	13
3	kadam Vishakha	6	14
4	Kare Jyoti	8	16
5	Kumbhar Shruti	9	15
6	Lokhnade Pranita	7	14
7	Mane Pratikha	8	16
8	Mane Nikita	6	13
9	Mhatre Sidhika	7	18
10	Misal Shailaja	8	16
11	More Megha	6	12
12	Parkhe Pravini	7	14
13	Patil Ashwini	6	13
14	Roman Rutuja	9	16
15	Rote ashwini	8	14
16	Salunkhe Amruta	6	15
17	Sapkal Shivani	5	13
18	Shinde Sneha	7	15
19	Thitame Smita	9	15
20	Sobale Prajkta	6	14
21	Aher Sanket	5	12
22	Bhosale Abhishek	5	12
23	Chavan Rushikesh	7	12
24	Dhotre Abhishek	6	14
25	Jagdale Sujay	5	14
26	Jagdale Sanjay	6	13
27	karjekar Pravesh	7	14

28	**Pisal Mayur**	**7**	**16**
29	**Khandalgle Pratik**	**8**	**13**
30	**Zore Rushikesh**	**6**	**14**

2) Test paper

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Pre –Test

Std. –10th Sub .: Science Marks : 20 Time: 40min

Q.1. Fill in the blanks . 06

1. Light travels along …….. line.
2. A …….lens always forms erect, virtual and smaller images than the object.
3. Two plane mirror are arranged parallel to each other to get……images.
4. Angle of reflection is always …… to the angle of incidence.
5. When the object is at infinity,a convex lens forms the image at……
6. The splitting of white light into its seven constituent colures is called…….....

Q.2. State whether the statements given below are True or False. 02

1. The image formed by plane mirror is laterally inverted.
   …….
2. Rods are sensitive to bright light.
   ……..

Q.3. Answer the following questions. 12

1. Write the types of reflection?
   …….
2. What is the angle of incidence of a ray if the reflected ray is at an angle of 90^0 to the incident ray?
   …….
   …….
3. When the angle between two plane mirror is 60^0 ,how many multiple images will be formed by mirrors ?
   …….
   …….
4. Write the two uses of concave mirror?
   …….
   …….
5. Which lens are using for correcting Myopia and why?
   …….
   …….
6. Give scientific reason- Letters appear laterally inverted in a plane mirror ?
   …….
   …….

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Post –Test

Std. –10th Sub .: Science Marks : 20 Time: 40min

Q.1. Fill in the blanks . 06

1. Reflection from a rough surface is called ……. reflection.
2. In a plane mirror, the image is …… inverted.
3. When the object is at focus F1, a convex lens forms the image at ……
4. . …… is a natural phenomenon showing dispersion.
5. A …….. lens can form real and inverted images.
6. The phenomenon of light passing through the object is called……

Q.2. State whether the statements given below are True or False. 02

1. The propagation of light is always not straight line.
   …….
2. In periscope two plane mirrors are used.
   ……..

Q.3. Answer the following questions. 12

1. Write the laws of reflection?
   ……
   ……
   ……
2. When the angle between two plane mirror is 90^0 , how many multiple images will be formed by mirrors ?
   …….
   ……
3. Write the two uses of convex mirror?
   ……
   ……

4. . Which lens are using for correcting Hypermetropia and why?
   ……
   ……

5. What is the angle of incidence of a ray if the reflected ray is at an angle of 60^0 to the incident ray?
   ……
   ……
6. Give scientific reason- The image formed in water is of the same size as the object ?
   ……
   ……
   ……