

DESIGN AND CONSTRUCTION ON A SIMPLE MAGNIFYING GLASS USING
RECYCLED BOTTLES.

BY

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ABSTRACT.

Human eyes have limitations of visibility because not all objects in focus give brighter and sharper images needed to access quality. Some objects appear smaller. In order to view smaller objects, a magnifying glass is used to make the objects bigger to the eye hence it can reduce the cost of purchasing spectacles. Therefore, the project is about design and construction of a simple magnifying glass using recycled bottles (relatively equal disc cuttings), glue, syringe, a sharp knife, a pair of scissors, left over part of cello tape or bottle top made hollow and a marker.

DECLARATION:

I **Mbonyimukiza Andrew** solemnly declare that this research report is wholly my own work and has never been produced or submitted to any institution of learning or university.

.....~.....

MBONYIMUKIZA ANDREW

.....18/03/2022.....

DATE

APPROVAL

I certify that **Mbonyimukiza Andrew** has done this research project titled design and construction of a simple magnifying glass using recycled bottles, under my supervision and with my approval it is highly recommended for submission for the award of bachelor's degree of science with education Kabale university.

.....~

ACADEMIC SUPER VISOR

MR. OPIO PHILLIP

18/03/22
.....
DATE

DEDICATION:

This piece of work is dedicated to my dearest parents, my brothers and sisters, relatives and friends for their endless support and prayers they offered to me towards this work.

ACKNOWLEDGEMENT

In the first place I would like to thank almighty God who has given me a gift of life, good health and courage throughout my endeavors.

Further appreciation went my dearest parents for their moral and financial support throughout my earner.

Special appreciation goes to my research supervisor **Mr Opio Phillip** for his academic support and guidance as I do this research may God richly bless you.

Great thanks also go to Kabale university lecturers especially those in the department of physics for skills and knowledge they have imparted in me may God bless you.

My friends for their support and guidance may God bless you all.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

1.1 Background.

A magnifying glass is a convex lens that is used to produce a magnified image of an object. Magnifying glass is also known as a microscope used to view small objects as mineral samples or plant cells typically magnified.

Magnifying devices help people with low vision engage more easily in activities such as reading standard print, enjoying a hobby, or viewing a presentation by increasing the size of text and objects. Magnifiers come in many weights and styles. They may be fastened on a stand or a handle or attached to a headset or neck cord. Prices vary based on factors such as the material and strength of the lens and the type of illumination (if any). Historical records of the magnifying glass are harder to come by than the records of co-existing magnification technologies. Some of the first optical tools beside the magnifying glass were spectacles and microscopes, which exploited optics for a specific purpose. The spectacle may very well be considered as a form of magnifying glass, utilizing a frame to hold a lens in place to increase the magnification of the eyes. Amati is traditionally credited with the invention of spectacle in 1280 in Florence, although it is in certain. This followed Bacon's utilization of glass sphere as magnifiers in 1267. By sixteenth century, the idea of holding a lens a certain distance from the eye in order to produce a magnified image was well developed and began to manifest itself in optical instruments.

Marvellous are the conclusions that may be performed by glasses concave and convex circular parabolic forms. By these kinds of glasses or rather frames of them placed in due angles, Yee may not only see out the proportion of the whole region ye shall descent any trifle. One of the first conception of a multiple lens magnification system was by francastoro of Verona in his homocentrica of 1535, detailing the use of multiple lenses to further increase magnification properties. By 1590, it is probable that compound microscopes had been developed. Their invention had been credited to Zacharias Jansen.

Antony van Leeuwenhoek, un known and in trained in the world of optics developed a single lens microscope by late 1600s which had better resolve power than compound microscopes. New and interesting specimens placed greater demands on microscopes of the 1600s, and the 1700s microscopy was propelled forward by invention of new optical tools.

Nonetheless, the magnifying glass has remained a constant throughout the history optical instruments. It is not an antiquated instrument but has remained in use for hundreds of years remaining constant yet also expanding into new forms and functions. As the magnifying glass has changed throughout history, it has in doubted ben affected by the technologies briefly acknowledged. The question which these technologies raise is why the magnifying glass has persisted.

1.1 Statement of problem.

Many people in low-income communities are faced with a challenge of sight with many failing to buy eye glasses which are on market for sale. As a result, many have given up and accepted to be what the condition has made them to be. In 2018 the government of Uganda through the Ministry of Health launched a new initiated to test older people for eye disease and sight loss (MoH, 2018). The project was aimed at screening adults above 64 who were identified as the most at risk of eye problem. Though the initiative was promising, majority of the aged adults were not given glasses even after the screening but were advised to buy on their own. This left many people on suspense because they could not afford glasses on their own. This project therefore proposes to design and construct magnified glass that will be used as a blue print for construction of more magnifying glasses using local available material which are anticipated to help the poor adults suffering from eye problems. The magnifying glass being a simple microscope would also be used by doctors to view small organisms that cannot easily be seen by naked eyes most especially the harmful organisms which cause diseases and hence the drugs for diseases they cause can easily be made. This magnifying glass was also anticipated to help research biologists who are interested in making investigations about plant cells for it can easily magnify the plant cells

1.2 Objective of the project

1.2.1 General objective of the project

The main objective of this study was to design and construct a simple magnifying glass using recycled bottles.

1.2.2 Specific objective

- (i) To determine methods and materials to use in making a magnifying glass.
- (ii) To design and construct a magnifying glass using local materials
- (iii) To test the functionality of a constructed magnifying glass using recycled materials.

1.3 Scope

The scope of this project was divided into three that is, time scope, content scope, and geographical scope.

1.3.1 Time scope

The project was conducted in the period of two months that is from February to march 2022. This time included data gathering, material collection and project design, construction and implementation.

Many people have used a magnifying glass and sun light to ignite piece of Paper. When the lens is held at exactly two focal lengths from the paper, all of light Will be concentrated into a tiny point, generating enough heat to start afire

2.1: How does a magnifying glass make things appear larger.

A magnifying glass is actually the simplest of basic microscopes. It consists of a single convex lens that magnifies an object when the glass is held up to it.

1.3.2 Content scope

Historians believe a scientist called Alhazen created the first magnifying glass in 1021. Since Alhazen's time the principles of optical physics that make magnifying glasses work so well have been the foundation of great advancements in science, particularly biology and astronomy. Today magnifying glasses can be used for simple tasks, such as making small magazine texts easier to read, to complex, scientific tasks such as studying microscopic organisms. The study was supported by the three specific objectives of the study and included to, determine methods and materials to use in making a magnifying glass using recycled bottles, design and construct a magnifying glass using local materials, and test the functionality of a constructed magnifying glass using recycled materials.

1.3.3 Geographical scope

In addition to simple, hand-held magnifying glasses play important roles as part of other of other devices including binoculars, cameras, telescopes and microscopes. Without the ability to magnify tiny objects, we would know much about tiny bacteria and viruses or far away things like stars and galaxies. This project was conducted in the physics laboratory at Kabale University under the supervision of research supervisor Mr. Opio Philip.

1.4 Significance

Magnifying glasses make objects appear larger because their convex lenses refract light rays so that they converge. In essence, magnifying glasses trick your eyes into seeing something that is larger than it really is. Hence the project was to reduce the cost and time of the project. When light rays travel parallel to each other. When they pass through a magnifying glass, the lens bends the parallel rays so that they converge and create a virtual image on your eye's retina. Besides, the project was to give confidence to the researcher on the use of local materials that are available and cheap to make magnifying glasses. This project was also to help the researcher to attain a required educational level or qualification. To the academicians, this project was to be used as a reference for further studies by other scholars who may wish to explore more knowledge on the area of light especially on making glasses. Most magnifying glasses are double convex lenses and are used to make objects appear larger. This is accomplished by placing the lens close to the object to be viewed. In this way the light rays are bent towards the centre of the lens. When these bent rays reach the eye, they make the object appear much larger than it actually is. However, if the object is far enough away from the lens, the image will flip, appearing smaller and upside down. The distance at which this flip occurs is twice the focal length (the distance from the optical centre of the lens to the point where light rays converge) of the lens. The focal length of any lens is determined by the amount of the curve on the lens faces. The magnified image is called a virtual image while the smaller, inverted image called the real image.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 Introduction

A magnifying glass is a lens that produces an enlarged image, typically set in a frame with a handle and used to examine small or finely detailed things such as finger prints, stamps and fine prints.

The lens is usually mounted in a frame with a handle.

A magnifying glass can be used to focus light such as to concentrate the Sun's radiations to create shot spot at the focus for fire starting.

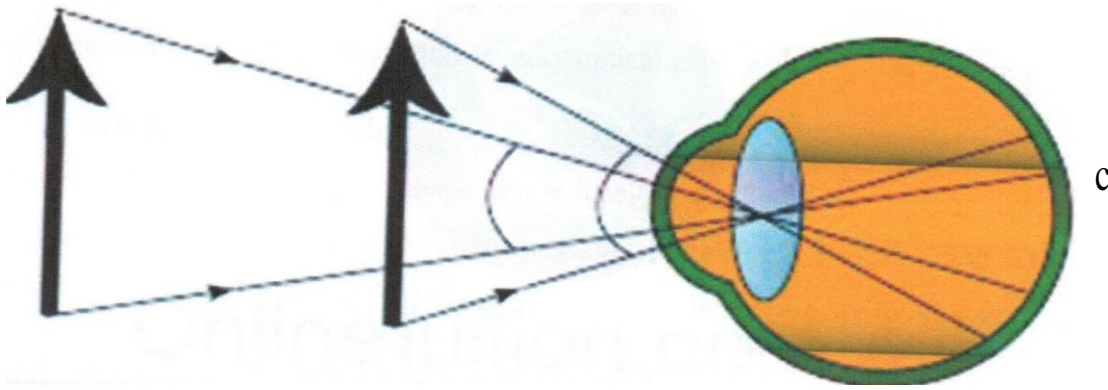
The first magnifier constructed for scientific purposes is believed to have been designed by English philosopher Roger Bacon some time during the thirteenth century.

Most of the magnifying glasses are double convex lenses and are used to make objects larger. The first mention of the use of the simple magnifying glass was in 1268 by Roger Bacon. He adapted its use as a primitive spectacle, allowing scholars with failing eye sight to continue their work.

1.

2.2 Magnification.

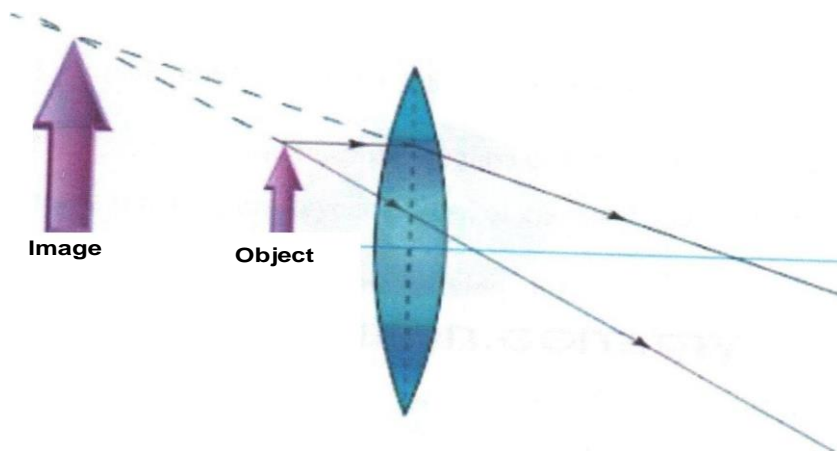
The magnifying glass owed its magnifying power to the fact that the angle subtended at the eye the image was much greater than that subtended by a distant object. This is shown in the diagram below



Magnification means how many times the image is bigger than the object.

Figure 1: magnifying

This is illustrated in the diagram below.



2.3. Some hand-held magnifying glasses.

Some hand-held magnifying glasses include the following

2.3.1: Fancil LED hand held magnifying glass.

This is equipped with three different magnification levels spanning from 2x to 10x, the Fancil hand held magnifying glass is an impressive tool that we think out classes the completion. The oversized lens is 5.5 inches in diameter to give you plenty of room to see what you are

looking at. The magnitude fixation is very clear and free from distortion making it very easy to read the fine print. It is also very light, so even when reading for extended periods.

2.3.2: Insten magnifying glass.

This is the best handheld magnifying glass. It's no frills design makes It easy to use. Your arm also cannot get tired when using this lens. It has more additional features such as LED lights built in. The lens made of high-quality optical glass with a5x magnification.

2.3.3: Magni pros magnifier.

This has elongated rectangular shape that is ideal for reading.it has 3x magnification. It is a bit heavy because of the size and robustness, but it feels very good in hand. The magnifier features two blight LED strips that fully illuminate whatever you are looking at.

2.3.4: Magnifying labs hand held magnifying glass.

This has a unique diagonal handle that is equally comfortable to use vertically or horizontally. The elongated rectangular shape is Perfect for reading, but the image is not sharp. When reading words come out too blurry. It doesn't magnify as hoped with 3x magnification optical grade glass lens.

2.3.5. Carson handheld power magnifying glass.

This is a perfectly basic magnifying glass over all though it does feature 11.5x spot lens; The main lens is made from acyclic instead of glass and it only magnifies up to 2x.

2.3.6. Dicfeos shatter proof magnifying glass.

The edges of this lens are extremely Blummy and only a very small area in the center of the lens provide any sort of image or descent magnification. Other handheld magnifiers include See zoom lighted magnifying glass and Landnics handheld magnifier.

CHAPTER THREE

MATERIALS AND METHODS

3.0: Introduction.

This chapter consists of steps, materials, procedures and methods that will be employed to obtain data. It consists of research design, sampling procedures, materials and data analysis.

3.2: Research design.

The research employed an experimental design. Various analytical techniques were employed but the use of recycled bottle (equal circular disc cuttings) was used because it was cheap and **precise compared to other methods**

since the materials equipment required were easily found in places near and some in the physics laboratory at Kabale university. Some of other methods of design were costly, some **needed special technical operation or had insufficient sensitivity and selectivity.**

3.3Materials.

The following are materials which were used in the design and construction of a simple **magnifying glass using recycled bottles.**

- (a) **Two-disc bottle cuttings (from a recycled bottle).**
- (b) **A sharp knife/razor blade.**
- (c) **Water.**
- (d) **Syringe.**
- (e) **The left part after the use of cello tape/bottle top made hollow.**
- (f) **Glue.**
- (g) **A marker.**
- (h) **An improvised handle (a wood)**

3.4 Sample size and selection.

4 recycled clean bottles of different types and sizes, 4 leftover parts of *cello* tape of different sizes, and 4 syringes were made available on the day of design and were used to do the experimental designs in the same day.

3.5 Sampling technique.

A non-probability judgmental sampling technique was employed to select the suit recycled bottles, leftover parts of *cello* tape and syringes. These were kept and experimented on the day of Presentation.

3.6 Sampling procedure.

Recycled clean bottles, *cello* tape leftover parts, glue and the rest required materials were obtained from the nearby homesteads around kabale university and some from the physics laboratory. Before the design, samples that required cleaning were *thoroughly* cleaned using clean water to remove adhering contaminants if present. Some of these were used to do the design the same day.

3.7 Data collection.

Primary data was collected using research tool such as experimentation, secondary data was collected by reviewing relevant literature and taking notes where applicable.

3.8 Construction procedure.

3.9 Two equal circular discs were from bottles.

Clean recycled bottles were gathered. Then around the neck of the bottle discs were cut from the round parts until 2 relatively smaller size discs are obtained.

3.0.1 Two discs were glue on the left part of cello tape.

Cut plastic discs were stuck on to the left-over part of *cello* tape such that the two discs were firmly held.

2.

3.1.1.it was filled with water.

Using a syringe, it was filled with water and it was made sure that there was no air bubble inside the material.

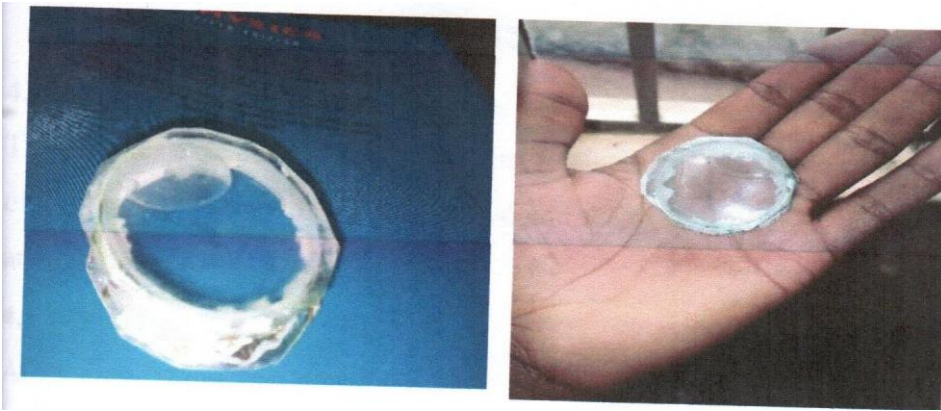


Figure 2:Using a syringe

3.1.2 The handle was then fixed where the syringe was applied.

The handle was then fixed held by glue such that it sticks strongly on to the cello tape leftovers.

3.1.3Magnify.

It was then used to magnify some words and then it worked effectively.

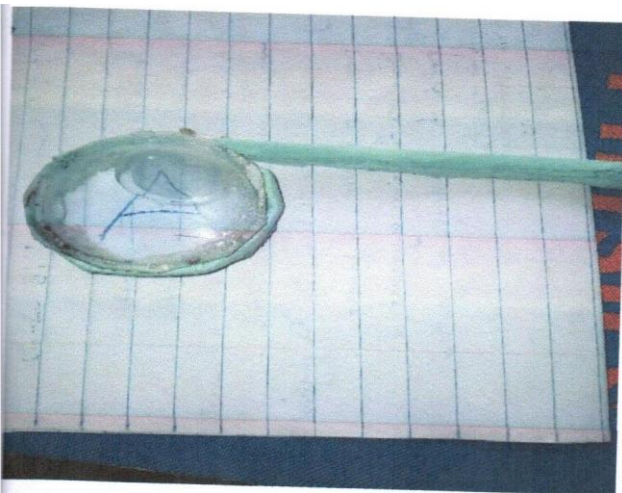


Figure 3 :magnify

3.1.4 Testing functionality of the magnifying glass.

The magnifying glass was tested on the letter "A" which was enlarged successfully, the result of enlargement of the letter shows that the magnifying glass can do the intended work of a lens as required to observe the small letters to appear bigger for clear review and nterpretati onof data.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter explains and shows results obtained from the project. It indicates the objectives of the project that have been achieved and the overall performance of the magnifying glass as the project as a whole.

4.1 Results

After completing the construction of the magnifying glass using recycled bottles which consisted of thickness " t " of "1.0 cm", diameter " d " of "4.0 cm", and the circumference of the magnifying glass was obtained from the formula πd and was found to be 12.6 cm. The uses of a simple magnifying glass are to make the glancing of small organisms, objects materials easy, organisms which may include small organisms in the soil, and also it will help people with visual problems especially those who are not capable of reading very small words mostly the aged adults.

3.

4.2 Obtaining results.

(a) The magnifying glass was used to focus a distant object and a clear image of distance (d) was obtained between the screen and the magnifying glass which shows that the magnifying glass is a converging glass.

$$d = 6.59\text{cm}$$

The setup of the screen, the source of light with the illuminated object and the magnifying glass placed between the source of light and the screen using a retort stand. As shown in the figure below.

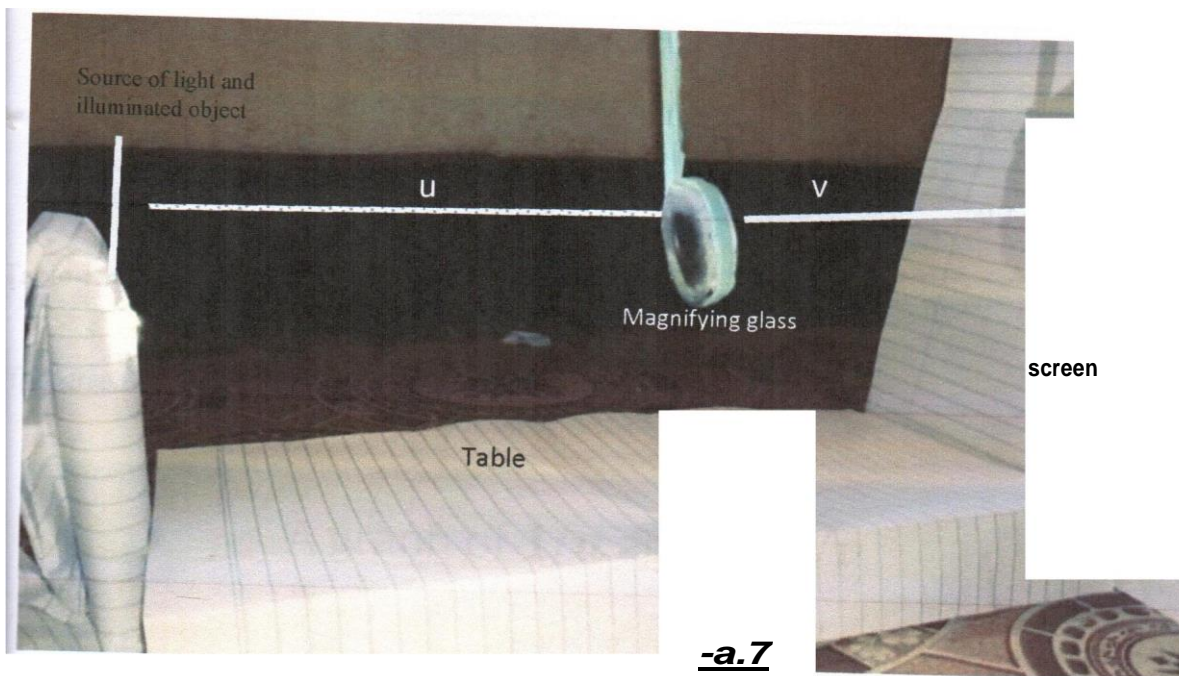


Figure 4: the magnifying glass placed between the source of light and the screen using a retort stand

(b) The object distance "u" was 10.0cm where I obtained the first image distance "v" as 37.0cm.

$$\frac{1}{u} - \frac{1}{v}$$

(c) The values of $\frac{1}{u}$ and $\frac{1}{v}$ were calculated and recorded in 3 decimal places as shown below

$$\frac{1}{u} = 0.100 \text{ cm}^{-1}$$

$$\frac{1}{v} = 0.027 \text{ cm}^{-1}$$

e) The results were obtained and presented in the table as shown below.

```
:role 1 :results
```

$$\mathbf{1}_{U^c}$$


5.

Discussion of the graph

- (i) The above graph to be plotted the following were considered
- (ii) The values which were plotted from the table I considered the scale factor { 1, 2, 5 }, were I divided 2 by 100 to get a convenient scale of 0.02 per 2 units on the graph on both axes.
- (iii) The calculated values of $\frac{1}{u}$ - against $\frac{1}{v}$ - were plotted, following the above scale respectively. and the line of the best fit was obtained by balancing of the points on either side.
- (iv) The slope of the was obtained by $R = \frac{\text{change in y}}{\text{change in x}}$ the value of R was then calculated from the expression. This means that the slope of the graph is equal to the value of R.

g) A slope (R) is obtained from the graph and the focal length (f) of the magnifying glass is obtained from the expression below

$$\frac{1}{R} = -\frac{f}{d}$$

$$\frac{1}{R} = -\frac{f}{6.59}$$

$$f = 7.67\text{cm}$$

) The magnification (m) of the of the magnifying glass was obtained from,

$M \sim \frac{\theta'}{\theta}$, which is the angular magnification where θ' was the angle subtended at the eye by 8

e image with magnifying glass and θ was the angle subtended at the eye by the object with magnifying glass.

For the actual distance 25cm at which the eye is capable of seeing

jeets, $\theta = \frac{y}{25}$ where y was a real size of the object and $\theta' = \frac{y}{f}$

$M = \frac{\theta'}{\theta} = \frac{25}{f}$, and then $M = \frac{25}{7.67}$, and then the magnification or the magnifying came, $M =$

$\frac{25}{7.67} = 3.26$, which was found to be, $M = 3.26$ which implied that the magnifying
s made could magnify objects 3.26 more than real size.

CHAPER FIVE.

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This is the last chapter that gives the conclusive remark of the entire project and it spells out the recommendations for improvement of the project being on the difficulties met during the whole project.

5.1 conclusion

Construction of a simple magnifying glass that is effective for magnification is of great importance. Since the magnifying glass has nothing to do with electricity it therefore effective with no threat to human beings. This is because with the use a simple magnifying glass there are no electric shocks since it does not require the use of electricity.

5.2 Recommendations

- (i) **To the users; The magnification of the magnifying glass depends upon where it is placed** between the user's eye and the object being viewed and upon the total distance between the eye and the object. The highest magnifying power is obtained by putting the magnifying glass close to the eye and moving both the eye and the glass together to obtain the best focus.
- (ii) To the future researcher; Anybody is interested in doing more about the magnifying glass using the recycled bottles should use disk bottles of large diameters which will accommodate too much water so as to obtain a glass of a high magnifying power than this.
- (iii) To policy makers: This magnifying glass should be allowed to be used by people because it is cheap and when tested it worked effectively and lasts *long*

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