Exploring Optics

Optics is one important branch of physics; however, it was not esteemed as classical mechanics or electromagnetism in most high school. In many high schools' education system, physics is the topic that students touch in senior year, and it is split into half-and-half for classical mechanics and electromagnetism. There is not much reserved for other topics such as optics and thermodynamics. In addition, there are not enough optics questions on the college entrance tests to make students pay more attention to it. This phenomenon makes many students blind to optics before entering college.

In this project, we designed a complete course that is aimed at introducing optics to high school students, to give them knowledge about optics and hopefully draw their interest to optics. The students we worked with come from Girl's Inc., and the course we designed for them is for summer school. Through this project, we hope they could understand and remember some ideas in topics before entering high school. This will be a good preview if they are going to study optics in high school; or serves as a formal introductory course if they will not have optics class after this. The experiments are the main part of this course and the topic introductions are designed according to them. We have chosen several simple but interesting experiments that could be conducted with materials that can be easily obtained. All of them relate to make a device that is used for observation, and each of them has a practical application. We hope that during this process they could understand the basic ideas, and then develop an understanding of the mechanism of the devices that use these ideas in practical.

The experiments we chose contain most topics needed for introductory level college optics, and were categorized into two parts, the property of light as waves and geometric optics. For the property of light waves, we talked about interference, diffraction, and polarization as properties of waves. Then, we illustrated the spectrum of sunlight and emphasized on the two unseen lights, ultraviolet and infrared. After that, we moved on explaining geometric optics: reflection, refraction, lenses, and

resolution. Lenses and images formed by them are the essential part of this geometric optics course, and this also the part we want them to fully understand. Consequently, we made more experiments and presented more practical application in this part.

The flow of topics is in the order same as the way we listed the topics above. Provided that this is an introductory course to students who have not been exposed to optics, from the property of light waves in graphical and verbal description to geometric optics with simple calculations added is more reasonable for them to absorb more knowledge. Students are encouraged to work in group, and every experiment recommends them to share and discuss the results. Group members are also encouraged to try every role in an experiment, if they are specialized for certain part of the work. Communication is one essential part of this course. The student who gets the best result or understanding is able to help others much more than any instructor since she perceive things in a manner closer to other students; therefore, she can explain things in a better way and reinforce her understanding in this process. Other than the communication among students, the way the instructor communicates with students is also important. The instructor should be able to conceive more examples to help students understand, but avoid using too much terminology which may confuse them. Since the goal is to introduce to them the knowledge in optics, the instructor should not go too deep on each topic so that they will not be overloaded with new information.

In summary, the way this project is developed is aimed to better help high school girls understand topics in optics. Following the outline with proper instruction will help them gain knowledge with high enough efficiency. By doing this project, we improve our skill as instructors or course developers, and provide assistance to high school girls who need and may show interest in optics. By participating as students, they could gain some knowledge via fun handwork and amazing observations.