During the June 1999 school holidays, three Raffles Junior College students conducted experiments, discussions, and literature searches to better understand the physics of the humble light bulb. The project was conducted under the auspices of the Technology, Engineering research project (TERP) scheme of NTU. The project was designed to introduce the students to the methods of research through the study of the light bulb.

In particular, the students in the project wanted to determine the relation between power emitted by the bulb to the input power, and how much of the emitted energy actually corresponds to visible light. The bulbs used had outputs of 6W and 9W.

By the end of their first week, the students had found that brightness was related to voltage and temperature of the filament, though not in a simple way. In this manner they verified the Stefan-Boltzmann equation and learned along the way how temperature could relate to power dissipated by the bulb.

After establishing the basic relations, the students attempted a deeper investigation into the efficiency of the light bulb. This required an understanding of the electromagnetic spectrum and more importantly, a criterion for efficiency. The question that had to be understood then was, what is wasted energy?

The students answered this question by relating it with everyday experience. In the case of the light bulb, the students had to determine which part of the bulb's emission fell outside the visible spectrum.

At the end of the third week it was becoming clearer that the bulb's efficiency depended a good deal on the inclusion of a gas into the bulb.

Two important lessons were gleaned from this exposure to research. One, here is a marked difference between clear concepts and actual measurements. Two, advances in research do not proceed in a linear way.

In the course of their work, the students picked up a number of skills and research pointers: rechecking results, taking care of statistical discrepancies, displaying relations graphically, and relating different aspects of the project.

During the last two weeks, the students studied the literature, their results and wrote a report. A good deal of the material required to go over the literature had not been studied previously, so this provided an opportunity for learning new ideas. The students went away with a desire to spend more time on the project if another opportunity arose.

Email address: jmartin@nie.edu.sg