

A Way to Further Understanding of Basic Engineering Principle by Supervising Junior High School Students through Sets of Science Experiment

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Abstract

The objective of this project is to cultivate interest among junior high school students toward Science & Technology. Six simple experiments will be introduced to the participants (junior high school students) of this project which is focusing on the basic principles of engineering including law of motion, free-fall, force, energy, friction and work. Our student team has been assigned to design six set of experiment according to the principles. The experiments are easy to understand and simple to assemble by the students of age 13 to 15. Experimental manuals were written by the members using simple words complete with figure so that all the participants can understand the procedure of each experiment. In order to make sure the manuals are practically working, the experiment sets were tested and the results were compared with actual theory. As a result, we believe that the experiments can be done by the students within less supervision. The students are able to set up the experiments by using some simple equipment around them. By doing this experiments, we can further our understanding and explain better the principles of energy, force and work.

Keywords: Science partnership project, Junior high school-University collaboration, Science experiment, Project management

I. Introduction

The Science Partnership Program (SPP) is intended to increase the academic achievement of students (junior high school) in mathematics and to cultivate interest and teaching skills of selected university students. Partnerships between high school districts and the science, technology, engineering, and mathematics faculty in institutions of higher education are at the core of these improvement efforts. Other partners may include state education agencies, public charter schools or other public schools, businesses, and nonprofit or for-profit organizations concerned with mathematics and science education.

As part of the program, two-day camps were held at The University of Tokushima starting from 17th August 2009 to promote basic understanding of science and technology among students of Johnouchi

Junior High School. Five undergraduate students and three teachers from The University of Tokushima including some person from nonprofit company lead teaching sessions in basic science, in which hands-on and problem-solving activities are emphasized. 20 junior high school's students participated in this projects and this project can be considered successful by the result of questionnaire after the sessions end.

II. Objective of the Project Management Training Association

In order to enhance junior high school student's interest in science and to encourage them to develop their inquiring mind, sets of basic science experiment were carefully designed by members of this project with some help from university's staffs.

On the first day during the camp, school students were given lecture by one of university's professor about force that exists around us. The lecture is mostly about basic type of force such as falling object, friction, rotation movement and vibration. It is impor-

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tant to make sure the students understand the basic theory of science before they move to experiment. To make sure better understanding of the theory, the lecture was given in simple words with a help of complete textbook.

On the same time, teaching assistants (TA) responsible to help the teachers conducted experiments and helps facilitate discussion. Sets of experiment were done after the lecture and continued on the next day.

On the last day, another lecture about force and energy were given by the persons from outside company followed by interesting experiment using special tool. A competition also held between the groups of student to design the strongest model of jib using cardboard.

Lastly, to measure understanding of every student, they were given enough time to prepare for a presentation on the results obtained from every experiment. They were assisted by teaching assistant (TA) to make PowerPoint slides and how to give a good presentation. The students have to analyze every data and to think reasons of any results. In this way, they will learn the critical and creative thinking skills (CCTS).

III. Content of the Project

This program is designed to improve the content knowledge of selected junior high school students in the areas of mathematics and science by encouraging them to participate in this camp that:

- Improve and upgrade the status and stature of mathematics and science through some experiments
- Focus on the education of mathematics and science teachers as a career-long process for the university students

In order to make sure this project runs smoothly and meaningful to the students, it is important to prepare a special textbook and manual to help students understand the theory of work, force and energy. This responsibility falls upon the TA and teachers. Therefore a lot of time was spent to complete the manual. On the TA side, they learn how to explain theory of science better and the way to express their opinion.

Below are the content of the two-day program:

Lecture 1: Force Around Us ~Force, Motion, Friction, Centripetal force, Vibration~

Experiment 1: Equilibrium of Force (sets of spring were used to prove the theory)

Experiment 2: Definition of Velocity and Acceleration

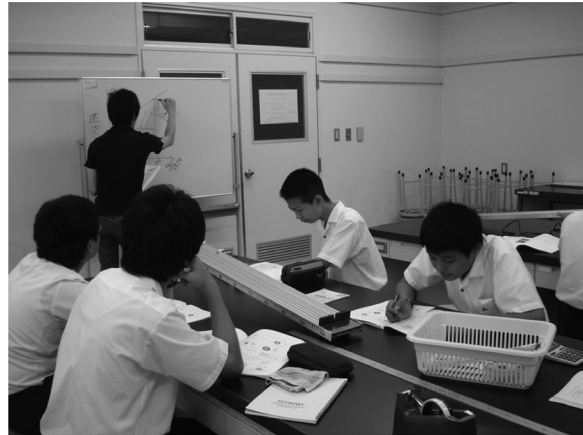
Experiment 3: Free-falling motion (how to calculate the gravity acceleration)

Experiment 4: Motion on inclined plane (see [Photo 1])

Experiment 5: Pendulum's motion (potential and kinetic energy are remains constant)

Lecture 2: Force, Work, Energy

Do-It-Yourself Experiment: What is the shape of stick that doesn't break easily?



[Fig. 1] Experiment on the motion on inclined plane. Experience: Handling the model machine of a crane. They are trying to treat the motion of crane. (see [Fig. 2])



[Fig. 2] Handling the model machine of a crane.

IV. Summary of Questionnaire Responses

The Science Partnership Program questionnaire was conducted on the second day of this program. The questionnaire included four questions mainly about the experience gained from the program. of the respondents who indicated their age, most (50%) were age 15, 36% were age 13, and 14% were age 14.

The first question asked for general comments about the program. 36% of the respondents said that there was improvement of their interest toward science and mathematics after the program. 21% said they become interested in science after taking the program, which is the main objective of this program.

On the next question, respondents were asked whether they realized the importance of this program for their study in the future. The majority (43%) said "yes"; 21% said "no".

The next set of questions was in reference to the experiments conducted during the program. Majority of participants said that the manual for experiments was well-prepared and easy to follow. Most of them really expressed their glad that the result of every experiment was reasonable and not far from the actual theory such as the value of acceleration of gravity. 36% of respondent said that they would like to participate in any program such as this, but with different themes such as internet and supercomputer, global warming and analysis on human cell.

At the last day of the program, all participants were asked to give presentation of the results obtained from all experiments. They were required to make their own slide using PowerPoint based on each result. TA responded for each group to help them with technical assistant. Some of the student was very good at making the slides so that the result of this part of the program runs smoothly.

Additional comments from participants about this program included:

1. Although the content of this program are difficult but we felt grateful to have a chance to participate.
2. We would like to have a chance to design the experiment from the beginning.
3. We surely would like to participate in the next program.
4. We are glad that we have the chance to learn

- something new that were never taught in school.
- This program also gave us many advantages as we are the member of science club at school.
5. The teachers and students were very professional during the whole program.

V. Conclusions

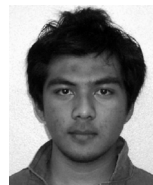
Science Project Partnership is a novel science experience, considered that it has an integral approach characteristic, in which science theory is used in different context, being adapted according to students interest and can be easily absorbed.

With this project, it is intended to bring the understanding of science and technology closer to society through active participation of all members involved in this project.

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