2006-455: SCIENCE FAIR PROJECT FOR DELIVERY CLASSES IN ELEMENTARY AND SECONDARY SCHOOLS AND ITS SIGNIFICANCE IN JAPAN

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Abstract

Science Fair Projects were recently introduced to Japanese elementary and secondary schools to enhance creativity and the creative thinking skills of Japanese students. The authors of this paper prepared a unique textbook titled *Science Fair Fun in Japan* for this purpose. It was used in DELIVERY CLASSES (those taught by college faculty) by Suzuka National College of Technology in Japan to turn young students onto science and engineering through exciting science fair projects. The book is great for developing creative thinking and problem solving skills, which are needed by the Japanese society in order to remain a world competitor of the 21st century. This paper describes delivery classes, and discusses in detail the science fair project and its significance to Japan.

Introduction

Over the past few years, colleges and universities in Japan have been required to give DELIVERY CLASSES for secondary and elementary schools. A DELIVERY CLASS is a special class for elementary and secondary school students, provided by higher education teachers. It refers to an activity carried out or a lesson taught by college faculty to a class of young Japanese students. Two possibilities exist. Either the young students attend workshops at Japanese colleges and universities (where they experience the atmosphere of campus life) or the college faculty carry out the activities at the schools. Delivery class is called "DEMAE JUGYO" in Japanese. DEMAE means delivery, while JUGYOU means class.

The significance of delivery classes is to develop a good communication and collaboration between post secondary organizations like Suzuka National College of Technology and secondary / elementary schools. They can be used to transfer innovative views and philosophy to secondary and elementary school students and to promote science literacy. In the Japanese society there is a decreasing birthrate, so each educational organization in Japan is working hard to keep up enrollment and survive in the 21st century. The delivery classes are used to attract young students to a particular college, which leads to an increase in student enrollment at that college. Japanese national colleges of technology provide junior high graduates with five and seven year programs for associate and bachelor degrees in engineering fields. Therefore, the target of their delivery classes should be junior high schools and elementary schools. On the other hand universities in Japan, which provide programs for bachelor and graduate degrees, mainly attract high school students (Fig.1).

The authors of this paper published a special textbook (*Science Fair Fun in Japan*) to turn students onto science and engineering and prepare them to creatively solve problems, a necessary skill required for the Japanese society to remain a top competitor in the world. The book and its innovative teaching approach are used in delivery classes representing Suzuka

National College of Technology, a unique college that promotes creative engineering education in Japan.

It is important to mention that in Japanese society, the typical classroom teachers are conservative and prefer the traditional lecture and chalkboard approach to learning, which does not encourage creative thinking. The elementary and secondary school curriculums are completely controlled by the communities' education boards, which are strongly influenced by the central government's education policies. Therefore the course syllabi are rigid, predetermined, and designed to prepare students for the difficult entrance exams required to enter organizations of higher education. This inflexible education format, combined with Japanese students' decreased interest in science and engineering, and the nation's desire to remain a world competitor, has caused Japan to begin modifying its educational system. The Country is focusing on the creativity of science and technology and in preparing its students (future leaders, scientists, and engineers) to creatively solve problems so they can survive in this challenging and ever changing world. Suzuka National College of Technology of Japan is taking a lead in this major effort through its science fair projects and delivery classes.

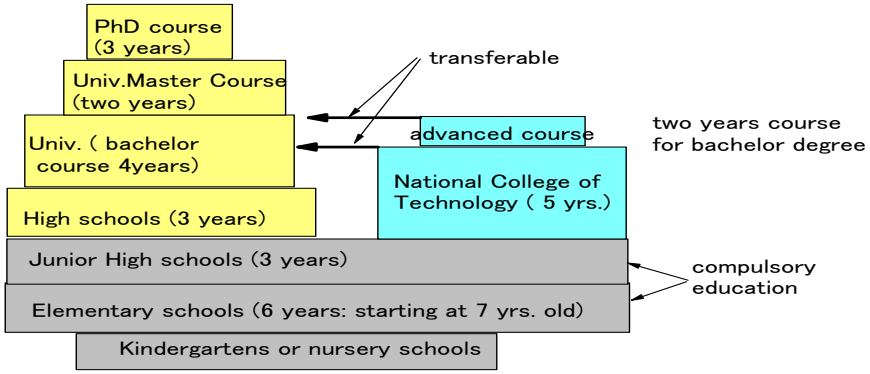

Fig. 1 Japanese Education System

Science Fair Project

Even though science fairs are widespread in the U.S., they are relatively new to Japan. In the past, Japanese educators have not encouraged creativity in the classroom. "Creativity reflects those activities that involve the application of intellectual energies to the production of new ways of solving problems.[(1)]" Therefore, solving problems is one of the essential factors for creativity. Also of importance is the establishment of a problem solving model for young students, to enhance scientific enquiry,[(2)] which is closely related to problem solving skills.

Japan's Science Festival (Kagaku No Saiten - in Japanese), that is carried out by the Japan Science Foundation,[(3)] somewhat resembles the U.S. science fair. However it lacks scientific and problem-solving components. Barry[(4)], one of the authors, previously wrote a book about science fairs that is very popular in the U.S. She recently collaborated with Kanematsu

(the other author of this paper) and published a special book that prepares Japanese children to creatively solve problems.

Science Fair Fun in Japan – Japanese textbook

The authors prepared a science fair textbook, for young Japanese students, which is written in Japanese and published in 2005 by Gendai Tosho of Japan. As previously mentioned, Barry wrote a book in English entitled *Science Fair Projects*[4] that is popular in the U.S . The Japanese textbook for science fairs (*Science Fair Fun in Japan*)[5] is composed of the following sections.

(1) Problem solving model

Problems can be solved creatively. The model includes the following parts: Setting up the problem, establishing assumptions, materials, procedure, preparation, experiments, data collection, discussion and conclusions. The students are encouraged to use scientific enquiry skills when carrying out their scientific activities.

(2) Problem samples

The textbook gives readers many concrete examples of how to propose and state their own problems. It also encourages them to select a topic of interest for their scientific investigation.

(3) Guidelines for preparing, carrying out, and presenting the projects

The practical guidelines for how to make plans, to establish the procedure, to prepare materials, to do experiments, to organize the results, to derive the conclusions and to give oral and written presentations are described in detail, so that students can learn through many concrete exercises.

(4) Abundant list of sample problems

Over 100 sample problems are listed at the end of the book. They are classified into topics such as physics, chemistry, and biology. All of these problems relate to every day life. They show students that science relates to real life and that the problem solving method for science topics can be used in many ways by our global society.

Using Science Fairs for Delivery Classes in Japan

Science fairs give students an opportunity to select an interesting problem to solve for their project. They brainstorm about many topics to come up with an exciting idea for their investigation. The students develop problem-solving skills by performing mental exercises in collecting, analyzing, and interpreting data. Also participants are encouraged to use their imagination and talents to create exciting, multisensory displays of their work.

In November 2005 Suzuka National College of Technology began using science fairs in their delivery classes in Mie Prefecture where the college is located. At this time, Barry joined the classes as a Visiting Professor for Suzuka National College of Technology. The science fair projects in November 2005 were carried out under the special program of the Japanese

government called Science Partnership Program (SPP). The Education Board in Tsu City, Mie Prefecture, invited Suzuka National College of Technology to present delivery classes at Kitarissei Elementary school (two classes for 5th graders) and Katada Elementary school (6th graders in a class). For all classes, the project had to be completed within 90 minutes. Usually science fair projects continue several weeks or several months, depending on the contents and levels. The students used the Japanese textbook (which prepares them to creatively solve problems) to carry out a Science Fair Competition using Japanese coins. They investigated how many drops of water they could put on some Japanese coins using a pipet. Their problem was to determine which Japanese coin holds the most drops of water on its surface. The students expressed their creativity well through their experimental performances and in the preparation of their attractive and unique posters. After carrying out the experiments in groups, they gave poster session type presentations and received awards from the college teachers. The students thoroughly enjoyed the science fair experience and answered questions correctly and enthusiastically. These very successful events (which attracted many teachers, school principals, and members of the media) were featured in prominent Japanese newspapers and on the TV news in Tsu City, Japan. Figures 2, 3, 4 and 5 display highlights of the science fair activities held in both elementary schools.

Figures 6-9 show the positive results of questionnaires completed after the science fair held in Kitarissei Elementary school. The questionnaires are composed of four questions as follows:

Q1: Are you satisfied with today's class?
1.very much. 2. relatively satisfied 3. neutral 4. relatively unsatisfied 5. very unsatisfied
Q2: Were your teachers friendly?
1. friendly 2. neutral 3. not friendly 4. I don't know. 5 other
Q3: Do you like science?
1. very much 2. neutral, 3. I hate science. 4. I don't know. 5. other
Q4: Do you want to have such a class again in the future?
1. Yes, I do. 2. It doesn't matter. 3. I don't want it. 4. I don't know. 5. other

Since the use of science fairs in delivery classes is a new concept for Japan, the data displayed in Figures 6-9 are only preliminary results. However it is encouraging to note that all results in Figure 6 show students' positive impressions about the science fair. Evaluation results for this event will be tracked for several years in terms of Creative Education, College Enrollment and Technology transfer in communities. The use of the science fair for delivery classes in Japan will continue because it is very useful and rewarding to the Japanese students.

Fig.2 Barry explained the experimental procedure to the students in Kitarissei Elementary school.

Fig.3 Students enjoyed Japanese Coin Contest, making water drop on the coins.

Fig.4 Students are making their posters in their groups.

Fig.5 The award ceremony at the end of science fair project.

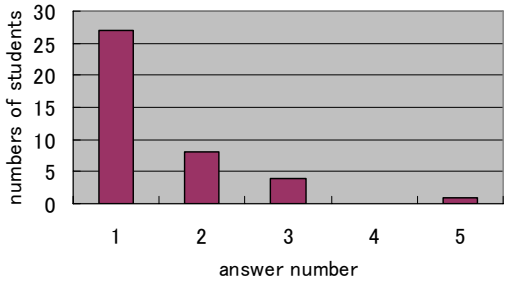

Fig.6 Question 1 – Q1

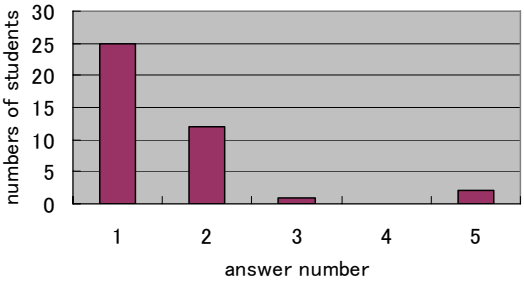

Fig. 7 Question 2 – Q2

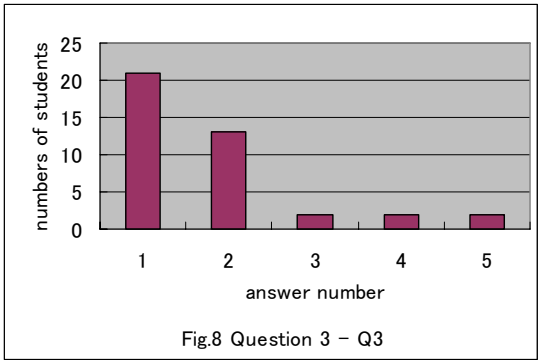

Fig.8 Question 3 – Q3

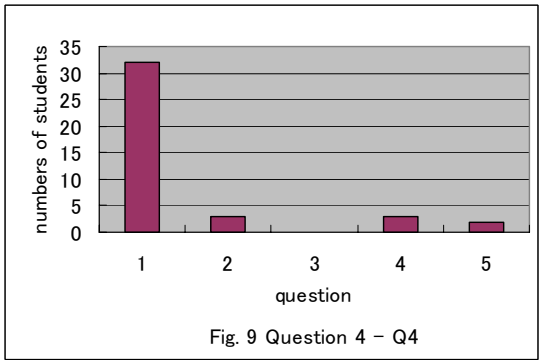

Fig. 9 Question 4 – Q4

Conclusions

It is originally one of the great missions for engineering to enhance creativity and promote creative thinking in youngsters. The authors hope that students develop inventive minds and that their delivery classes (using science fairs) will be a positive contribution to this mission. [6] They also hope their project (which promotes engineering and science education) will prevail and progress successfully into the future.

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