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Workshops in Creative Education for Students and Teachers in the United States and Japan

ABSTRACT

The authors Barry and Kanematsu have initiated an international program to develop students' creative thinking skills in science and engineering. Their program (which is beneficial to students of all ages in the U.S. and Japan) has the main goals of turning students onto science and engineering, and to preparing them to be creative problem solvers. This creative education program is carried out through workshops, using several innovative teaching techniques developed by the authors. A variety of workshops are being conducted in the U. S. and Japan to diverse groups such as elementary students, middle school students, college students, and teachers. It is important to turn young students onto science and engineering, so they will pursue further studies in these fields and make career choices to be scientists and engineers. Of equal importance is the preparation of teachers (especially at the elementary levels) to turn children onto science, to promote creative thinking, and to encourage students to express innovative ideas. Creative education workshop activities and results, included in this successful program, are presented and discussed.

Keywords: *Creative Thinking, Problem Solving, Science Workshops, Innovative Teaching Techniques*

1. Introduction

Educators and researchers in the United States and Japan have initiated an international program [1] to develop students' creative thinking skills in science and engineering. This unique project, led by Barry and Kanematsu, includes the preparation and use of innovative teaching techniques and tools. It is sponsored by the Northern New York section of the American Chemical Society and Suzuka National College of Technology in Japan. The program's main goals are to turn students onto science/engineering and to prepare them to be creative problem solvers.

This successful program is carried out through workshops, using three creative teaching techniques developed by the authors. One method, the Multisensory Teaching Approach, takes advantage of students' senses and is designed to meet individual student needs. Another technique, which involves Science Fair Projects, allows students to creatively solve and share the results of their exciting investigations. The third approach provides students with an opportunity to develop critical thinking and problem-solving skills by reading stories and solving mysteries. A variety of creative workshops are being conducted in the United States and Japan to diverse groups such as elementary students, middle school students, college students, and teachers. Some workshop activities and results are presented and discussed. Also a brief description of creativity/creative thinking is provided.

2. Creativity/Creative Thinking

The terms creativity and creative thinking are briefly defined (by the authors) to provide a better understanding of the program. Creativity is the ability to produce original work and ideas. It also includes the combining of existing work and objects to create new items. A good example is the motor bike, which is composed of a motor and a bike. The creative process starts with a creative person (ex. scientist) and results in a creative product (ex. new medicine). It includes the thinking and acts that take place to produce an original item. Creative thinking is part of our total thinking process, which is explained in a simple way by Ebert's Cognitive Spiral Model [2]. The creative thinker explores, looks for relationships, and develops many original and diverse ideas.

The teachers' important role in creative education is to promote creative thinking and to encourage students to express innovative ideas. They should be open-minded, value originality, and seek imaginative solutions to problems. Educators must prepare the younger generation

(our future leaders, scientists and engineers) to think for themselves so that they can creatively solve the new and challenging problems in our ever changing world.

3. Workshop Activities and Results

3.1. Multisensory Teaching Approach

This method, known as the Chemical Sensation Project [3], takes advantage of students' senses. It is designed to meet individual student needs and requires teachers to incorporate visual, writing, listening, and laboratory activities into their science lessons.

3.1.1. Student Workshops

The authors' creative Chemical Sensation Project rceived a National Award of Excellence (ChemLuminary Award) from the American Chemical Society in 2004. The program was carried out at colleges and high schools in the United States and Japan. Materials used in this project were prepared by Barry and translated into Japanese by Kanematsu. They include a music CD of science songs [4], overhead transparencies, pictures to serve as visual aids, hands-on science experiments, science questions, and evaluation forms. Students begin each multisensory lesson by viewing the activity picture and words to the selected science song, while listening to the song. Next they perform an exciting hands-on activity that complements the song. Finally they answer activity questions and complete the evaluation forms.

One multisensory lesson is about the Periodic Table [5]. A class first views a Periodic Table, while listening to the song titled "Periodic Table." Next they carryout an activity in which they design a new Periodic Table for a given set of items such as coins, food, and toys. The students closely examine the various items, design a Periodic Table for them, and then write a brief description about their table's layout and organization. At the end of the workshop, they answer science questions about the activity and complete the evaluation forms.

Project participants include Clarkson University, Edwards-Knox High School, and Canton High School in the United States and Suzuka National College of Technology, Takada High School, and Kanbe High School in Japan. They found the workshops to be useful, challenging, and fun. Also more than 96% of the U.S. student participants answered the science activity questions correctly.

The chart (on the article's last page) shows student reactions to the science activities and songs. The results show that 94% of all the student participants had a neutral – very positive reaction to the activities and 84% of them had a neutral – very positive reaction to the songs.

3.1.2. Teacher Workshop

The preparation of teachers (especially at the elementary levels) to turn children onto science, to promote creative thinking, and to encourage students to express innovative ideas, is of great importance.

An intensive all day multisensory workshop was carried out in New York State on December 8, 2006 for teachers of grades 5-12. They performed several multisensory lessons (which addressed required areas of the National Science Standards) and prepared one for use in their classroom. The workshop was successful and very well received. Additional workshops have already been scheduled for the spring, summer, and fall of 2007.

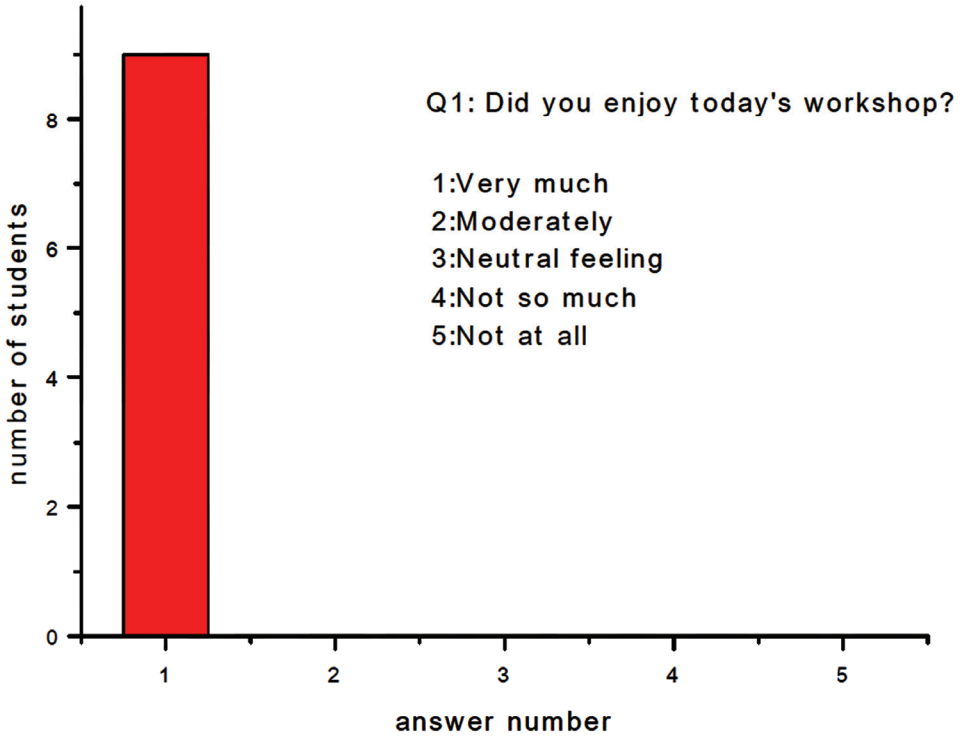
One multisensory lesson was about Chemicals. It began with the teachers viewing a picture of some chemicals, while listening to the song titled "Chemicals." Then they carried out an activity to analyze and determine the physical properties (including density and volume) of apples, oranges, and potatoes. They used items such as tape measures, graduated cylinders, magnifiers, and digital balances, and the water displacement technique. The teachers recorded, organized, and shared data. They also described their own multisensory lessons to the group. At the end of the workshop, the participants completed survey forms.

Teacher comments about this workshop are written below.

1. "We gained lots of creative and fun ideas that we can take back and use in our classrooms. I appreciate all the materials and handouts."
2. "Today was a super way to regroup many things that I already do. Plus I also got some new good ideas."
3. "I did pick up some really good ideas."
4. "Great day and great ideas!"
5. "Today is a reminder that science is activity. Do science, with simple activities as often as possible, in conjunction with readings."

Teacher survey questions and results are provided.

1. Did you enjoy today's workshop?
   1). Very much (9)
   2). Moderately (0)
   3). Neutral feeling (0)
   4). Not so much (0)
   5). Not at all (0)
2. Do you feel that the workshop was successful?
   1). Very much (7)
   2). Moderately (2)



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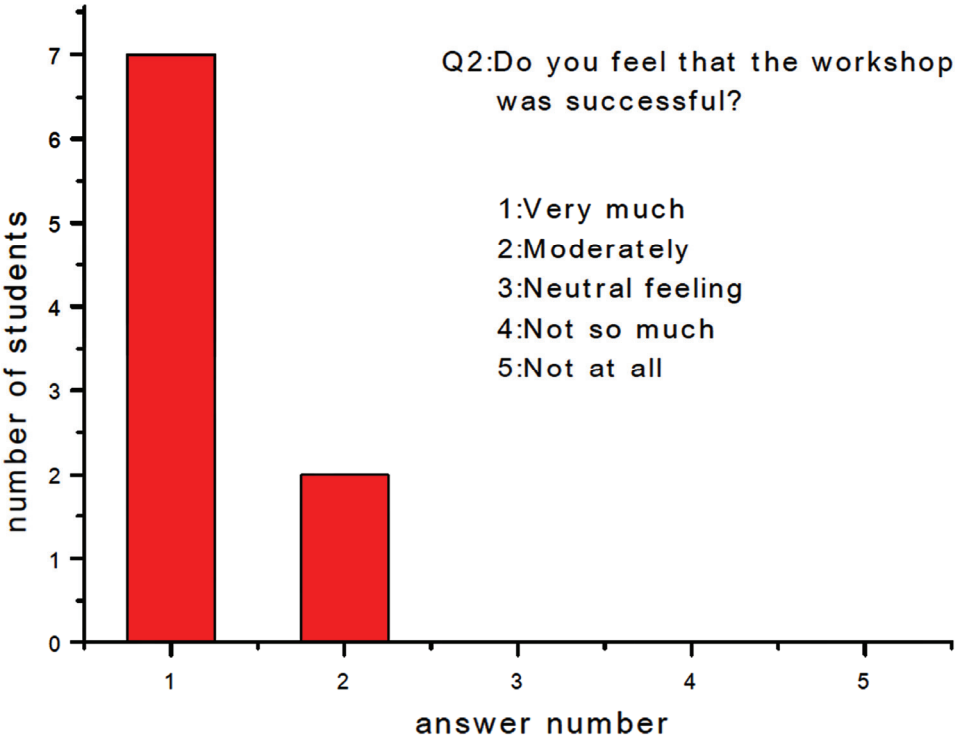

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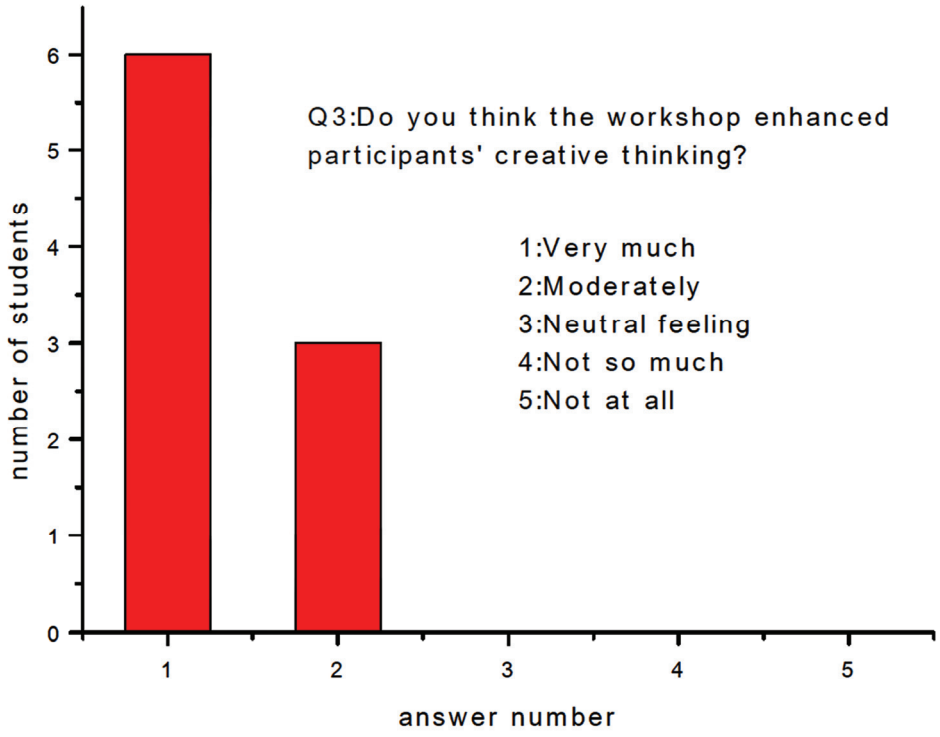

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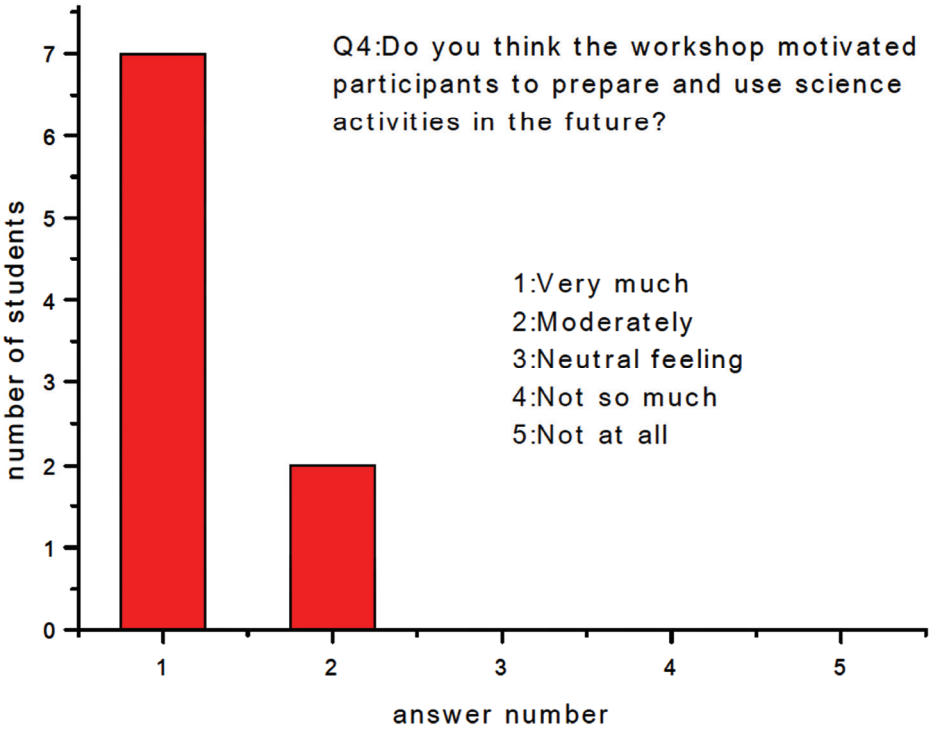

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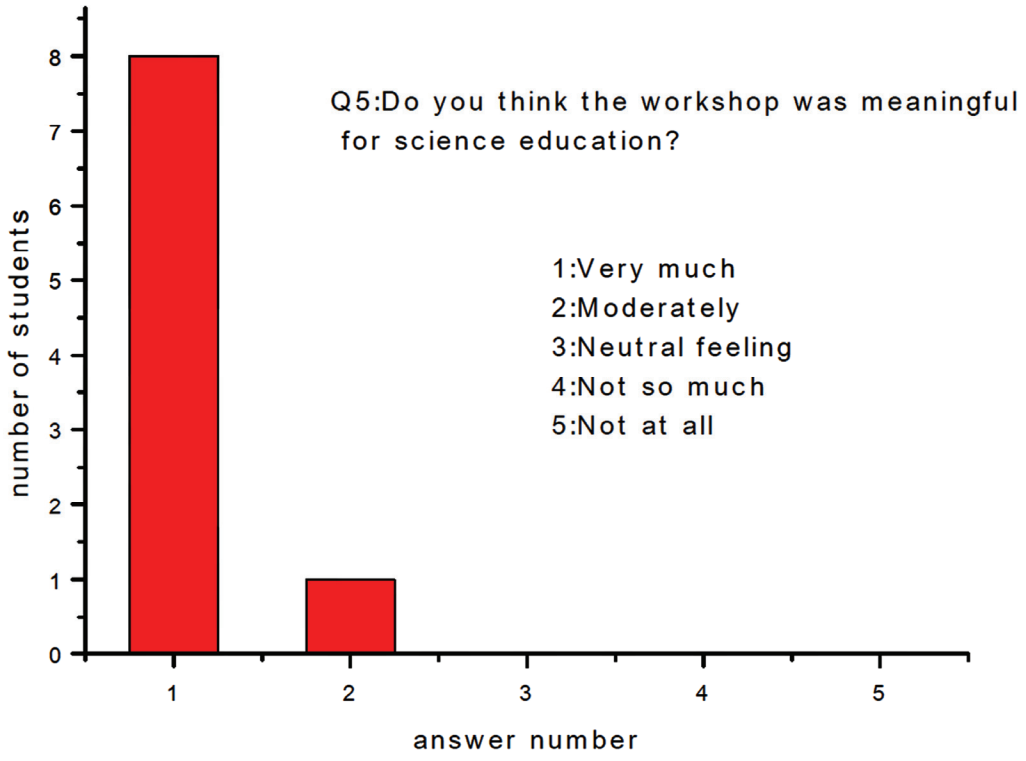

(e)

Figure 1. Teacher survey results.

3). Neutral feeling (0)
4). Not so much (0)
5). Not at all (0)

3. Do you think the workshop enhanced participants' creative thinking?
1). Very much (6)
2). Moderately (3)
3). Neutral feeling (0)
4). Not so much (0)
5). Not at all (0)

4. Do you think the workshop motivated participants to prepare and use science activities in the future?
1). Very much (7)
2). Moderately (2)
3). Neutral feeling (0)
4). Not so much (0)
5). Not at all (0)

5. Do you think the workshop was meaningful for science education?
1). Very much (8)
2). Moderately (1)
3). Neutral feeling (0)
4). Not so much (0)
5). Not at all (0)

3.2. Science Fair Project Teaching Approach

This method gives students an opportunity to select an interesting problem to solve for their science fair project. They develop problem-solving and critical thinking skills by performing mental exercises in collecting, analyzing, and interpreting data to draw conclusions about the outcome of their exciting investigations. In addition, they are encouraged to use their imagination and talents to prepare creative displays of their work.

This teaching technique is a relatively new concept in Japan. Therefore Barry and Kanematsu prepared a special book, Science Fair Fun in Japan published by Gendai Tosho, Japan in 2005 [6], for the Japanese students. The authors used it to lead four major science fairs at Katada Elementary School, Kitarissei Elementary School, and Suzuka National College of Technology in Japan. Highlights of these very exciting and successful events appeared in prominent Japanese newspapers and on the TV news in Tsu City, Japan. The initial science fairs held at the elementary schools were carried out as 90 minute workshops. The students had a science fair using Japanese coins. They determined which Japanese coin held

Table 1. Science activities and songs: US vs. Japan

Organization	Total Number Student s	Hands-On Activities Category: Positive		SongsCategory: Positive	
		Number of Neutral-Very Positive Reaction Responses	% (Nearest Whole %)	Number of Neutral-Very Positive Reaction Responses	% (Nearest Whole %)
Clarkson University (US)	28	28	100	26	93
Edwards-Knox High School (US)	20	20	100	18	90
Canton High School (US)	21	18	86	17	81
Total for 3 US Organizations	69	66	96	61	88
SuzukaNationalCollegeof Technology, Japan	43	42	98	28	65
Takada High School, Japan	56	51	91	55	98
Kanbe High School, Japan	39	36	92	30	77
Total for 3 Japanese Organizations	138	129	93	113	82
Total for Both US and Japanese Organizations	207	195	94	174	84

Figure 5. Creative posters displayed at Japanese Elementary School Science Fair.

the most drops of water on its surface. All participants carried out experiments, recorded data, were interviewed by judges, and prepared graphs and attractive posters (which included a title, the problem, the hypothesis, the list of materials, the procedure, the graphs, results, and conclusions). See photo. Awards were presented to the winners.

Results of questionnaires completed by the science fair participants showed that more than 90% of them were turned onto science and thoroughly enjoyed the event. Nissan recently (2006) donated money to continue / expand the science fair activity throughout the country of Japan.

3.3. Reading and Solving a Mystery Teaching Approach

This innovative method (which is in its initial stage) provides students with an opportunity to develop critical thinking and creative problem-solving skills by reading stories and solving a mystery.

The authors recently published two creative science books Develop Critical Thinking Skills, Solve a Mystery, Learn Science by Tate Publishing, 2007 [7] and the Japanese Edition by Pleiades Publishing of Japan, 2007 [8] for use in this project. These books target upper middle school/senior high school students (ages 13 years old – 18 years old) and their teachers. They include a problem-solving model, two short stories, and a detailed science education component. Students master the steps of a problem-solving model by acting as detectives to analyze each short story and solve its crime (problem). Workshops using the authors' creative science books have already been scheduled for teachers and students in both the United States and Japan.

4. Conclusions

The Creative Education Program, led by Barry and Kanematsu, is an international effort to promote creative thinking in students of all ages. Its main goals are to turn children onto science and engineering, and to develop

their creative problem-solving skills. In order to survive in our ever changing world, the younger generation (our future leaders, scientists, and engineers) must be able to solve new and challenging problems. This successful project is being carried out through workshops using innovative teaching techniques and materials, developed by the authors. It continues to grow and to attract new schools and students in various countries.

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