

TEACHING SCIENTIFIC CONCEPTS THROUGH SIMPLE MODELS AND SOCIAL COMMUNICATION TECHNIQUES

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ABSTRACT

For science education, it is important to demonstrate to students the relevance of scientific concepts in every-day life experiences. Although there are methods available for achieving this goal, it is more effective if cultural flavor is also added to the teaching techniques and thereby the teacher and students can easily relate the subject matter to their surroundings. Furthermore, this would bridge the gap between science and day-to-day experiences in an effective manner. It could also help students to use science as a tool to solve problems faced by them and consequently they would feel science is a part of their lives.

In this paper, it has been described how simple models and cultural communication techniques can be used effectively in demonstrating important scientific concepts to the students of secondary and higher secondary levels by using two consecutive activities carried out at the Institute of Fundamental Studies (IFS), Sri Lanka.

1. INTRODUCTION

In Sri Lanka, general attitude of students towards science distracts them from studying in science stream. They believe science is a very boring and difficult subject. Present trend of Sri Lankan school students is to pursue commerce or arts education. According to the Ministry of Education, only 22 % of the General Certificate of Education (G.C.E.) Advance Level (A/L) students study the science subjects, while 25 % follow commerce stream and the rest (53 %) follow arts stream. According to the published statistics of the Department of Examinations of Sri Lanka, science knowledge of Sri Lankan students at G.C.E. Ordinary Level (O/L) is not adequate. The percentage of students passing with science subject at G.C.E. (O/L) in the year 2009 was 48.3 %.

Science Technology & Innovation Strategy Report of Sri Lanka (2011-2015) states that "The low number of students opting for science careers and a high failure rate in science and mathematics at G.C.E O/L examination need to be addressed through focusing

on science and mathematics education at schools and career development programmes. The lack of trained teachers in science, particularly in rural areas, makes this challenge more difficult. This needs to be addressed by a well coordinated, concerted effort by state institutions, universities, professional organizations and the private sector."

2. METHODOLOGY

Introducing new ways to study science in interesting manner is important. One way of doing this is to show students the relationship of science with nature, and show them how to use science in day-to-day life.

The following two activities were held at IFS that can be considered as examples of interactive and interesting ways of teaching science.

2.1 Activity-1

In order to highlight the importance of relevance of scientific concepts with students' day-to-day experiences, a review was carried out through an island wide competition for students. Objectives of this activity were to gather information regarding students' knowledge and ability to explain the basic concepts of science in a simple non-scientific language, as well as to train them how to apply scientific knowledge in analyzing the occurrences in day-to-day life.

In this competition, students were given options to express their capabilities in their native language (in Sinhala and Tamil languages). The activity was conducted for two age categories; 12-14 years & 15-16 years (i.e. grades 7-9 & grades 10-11). In this exercise, six topics were specified and students were given the option of selecting three topics among them. They needed to find the scientific concept relevant to each topic and to explain it. The topics are given in Box-1.

One of the major challenges of this activity was that students had to explain all the scientific words and concepts in a very simple way where a person with non-scientific background could understand. The standard target audience chosen for the students to

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Box-1: Topics that Students were Required to Find the Relevant Science Concept

Topics for age category 12-14 years

- Electrical/Telephone wires sag in the summer.
- A well grown tree can be considered as an ecosystem.
- Watery liquid ooze from chopped tree trunk.
- Footprints of pointed heels are deeper than those of shoes with flat soles.
- Hopper batter (a special type of local bread) will not rise when old baking soda is used.
- A gas was emitted when lime was added to ash of the kitchen hearth.

Topics for age category 15-16 years

- It is dangerous to leave a car engine running when the car is in a closed garage.
- Damaged Tin plated iron get rusted quickly, but damaged galvanized iron is rust resistant.
- Gasoline transport trucks have chains that hang down and drag on the road at the rear end of the truck.
- Closing a window by pulling window lock is easier than pulling from the window hook near the hinge.
- If you shine a flashlight or headlights into dogs/cats eyes at night, their eyes glow but this will not happen with humans. However people have red eyes in flash photographs.
- If you get a chance to go to the deep sea, you will see tiny blue-green lights appearing and disappearing. Explain the incident.

address for the activity was nine years old children.

A total of 1,562 students of the age group 12-14 years (1,007 Sinhala-medium and 562 Tamil-medium students) and 684 students of the age group 15-16 years (384 Sinhala-medium and 300 Tamil-medium students) participated in this activity. An island wide participation was experienced for this activity and the

district-wise distribution is given in Figure-1.

2.1.1 Observations

The following observations were made:

- Students had used different instruments of communication such as posters, drama scripts,

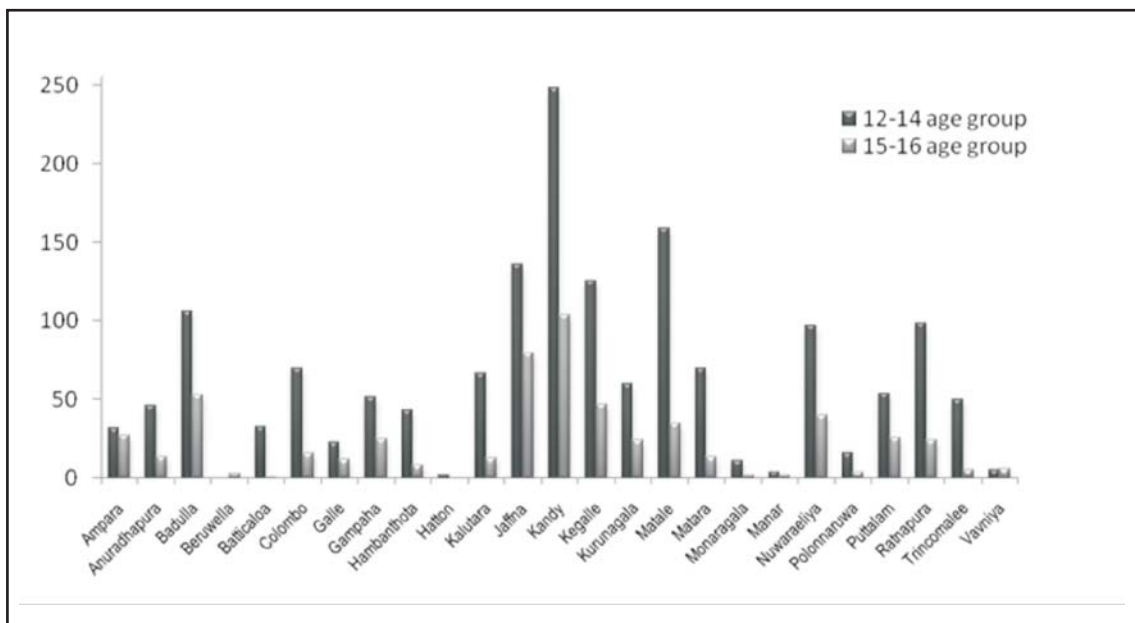


Figure-1: District-wise Distribution of Participants (Black Colour Columns Represents the 12-14 Age Category and Ash Colour Columns Represents The 15-16 Age Category)

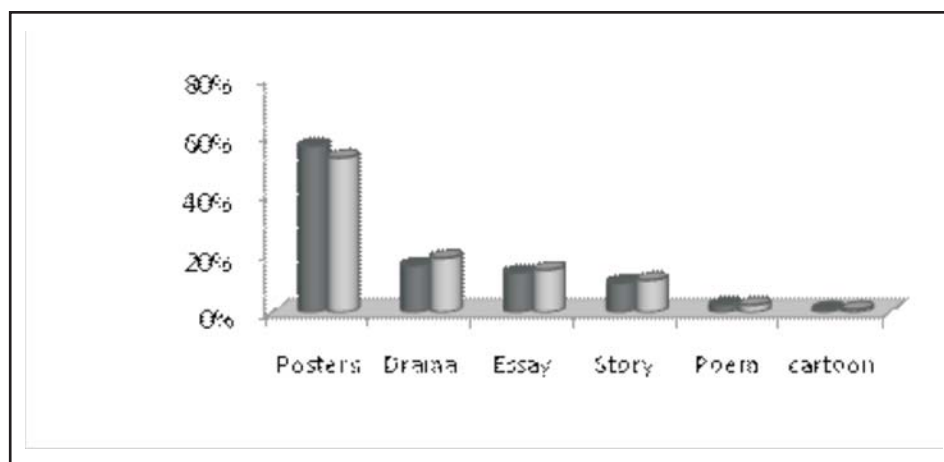


Figure-2: Distribution of the Instruments of Communication that Students used to Explain the Topics (Black Colour Columns Represent the 12-14 Year Age Category and Ash Colour Columns Represent the 15-16 Year Age Category)

essays, stories, poetry, and cartoons to explain their topics (Figure-2).

- Students added cultural flavour to illustrate science concepts in a simple and attractive manner.
- Although students had the option of selecting three topics out of six, only a few selected all three topics. Some selected two topics and most took up only one subject.
- Contrary to what was expected, it was surprising that some of the schools having best facilities and opportunities failed to perform up to their standard.
- It was evident from the presentations made by the students that have good imagination and creative abilities, but poor presentation skills. Their presentation skills were poorer as compared to their writing capabilities.
- Despite the fact that they had learnt the science concepts at school, it was difficult for them to relate those concepts with their daily activities and surroundings. In this competition, students easily gave text book examples to describe scientific concepts but they had a hard time using real life examples (other than what is found in text books) for describing them.

2.1.2 Feedback

Last part of this activity was to gather feedback from students who participated in this activity. Following is some of the feedback received from the participants.

- After taking part in this activity, students realized that they have become interested in finding the

science concepts in daily events and occurrences in their surroundings.

- Some of them informed that they had used heavy scientific words to describe scientific concepts in the past, but now they realize the importance and beauty of explaining things in simple words and with simple examples.
- Students felt that science is closer to them and they can now look at science in a different angle.

2.2 Activity-2

In the second activity, simple models were created to explain various scientific concepts. For example, to familiarize students with the periodic table: wall clock with elements of the periodic table, card games, desk calendar, etc., were introduced. Similarly, to teach the electrochemical series/reactivity series: snakes and ladders game, wind chimes, and posters, etc., were used as simple models. Flip-flop and origami was used as easy ways to memorize science concepts.

All of these models were introduced to the students. About 90 % percent of the students responded positively towards the models and desired to use those with their fellow students at school. Five percent of the students stated that the models were good. Rest were not keen to make any response. However, most of the students wanted ready-made models rather than making their own. They were reluctant to spend time in constructing even the simplest model using origami.

3. CONCLUSIONS

After reviewing the Activity-1, it was realized that using native communication techniques and adding cultural flavour to express the science concepts in a simple and attractive manner is not only important in improving science communication skills, but also making science more relatable.

Introducing simple models needs more attention, and mass scale survey is needed. Financial constrains limited the vast scale analysis of the applicability of simple models.

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