

Future Science Education —— Through the Activity of Science Yumekobo ——

Makoto Kano, Yasuko Oishi, Tota Mizuno, Kiyomitsu Suzuki and *Takeyo Tsukamoto
Department of Physics, *Department of Applied Physics, Science University of Tokyo, 1-3 Kagurazaka, Shinjuku-ku,
Tokyo 162-8601, Japan
Fax: 03-5261-1023, e-mail: mkano@rs.kagu.sut.ac.jp

As an unpretentious resistance to the factor of Rikabanare(the science evasion), we have carried out the activity of "Science Yumekobo(The science dream studio)". Through this activity, we have found that there have been a lot of children whose eyes have sparked with delight. Being faced with the coming twenty-first century, how can we continue to let children have a "science dream"? We will clarify the present situations, the problems and the prospects of the science education, and we will trace the steps of Science Yumekobo.

Key words: science education, case study, science festival, science and technology, courses of study

1. INTRODUCTION

The present educational system in Japan is divided into the primary/secondary education; higher education; and lifelong education. In the educational system, there are social problems such as bullying, school phobias, Rikabanare(the science evasion) and high school dropout have attracted the attention of the world. In addition, some superiors in the department of science and technology have simply been enticed into the traps of cult orders.

While the above problems exist, science should naturally be an exciting subject for children. One can say that science lesson has only been memorization and it regards for a realistic experience.

As a part of the unpretentious resistance to "Rikabanare", we have carried out the activity of "Science Yumekobo(The science dream studio)"⁽¹⁻³⁾. It is one of the science events like "Seishonen no tame no Kagaku no Saiten(Youngster's science festival)"⁽⁴⁾ and "Galileo Kobo(The Galileo studio)"⁽⁵⁾. These simple themes like "Let's try to see and touch the sounds" and "Let's make a loudspeaker" are also included in the activity. It has been impressive with adults and children being inspired alike with such simple themes. We have found that children feel that the real world is irrelevant to their studies in their schools.

It is necessary to increase such activity in order to teach the enjoyment of the real science by leaving a memory work. And it has truly been required that the social circumstance is being made in order to go well in the field of above activity.

As a matter of course, the improvement of the college entrance examination system and the administrative reform in the Ministry of Education, Science and Culture⁽⁶⁾ are important problems. Discrimination against colleges is making rapid progress because of the decreasing a birth rate. We regard this time as an excellent opportunity for the execution of the above reforms.

Being faced with the coming twenty-first century, we want to continue to let children have a true "science dream". We will clarify the problems and prospects of the science education, and we will trace the steps of Science Yumekobo.

2. THE HISTORY OF SCIENCE YUMEKOB0

In order to spread the scientific experience for children to learn the mechanism of nature, we must produce a scientific viewpoint of nature in the children's minds. We must let the children think about the problems of science, technology, humanity and environment⁽⁷⁾. But Rikabanare has actually advanced and the opportunity of the real science experience has decreased.

It is very sad. Hence, an opportunity of an approachable experience of science was held. In 1994, interested professors in the University held an exhibition during at school festival on the Noda campus. It was the beginning of Science Yumekobo. Each of them presented experiments in his specialized field and let children an experience such as "Radiation and electricity familiar to us", "Let's play computer network" and "Let's experience the world at -196°C". They focused on the importance of children having hands on experience.

The next year, it was planned at the Kagurazaka campus. A lot of teachers and students in junior and senior high school participated as volunteers. It has held for another four years on the Kagurazaka campus. And it has held for another five years on the Noda campus. In 1998, it fell on the 50th anniversary during campus festival at the University, and a lot of participants come. It was a great success. Most of it was funded by a grant for Education of Science University of Tokyo. As the cooperation groups, 3groups participated from the university and 9 groups from outside university.

In 1998, there were 18 exhibitions in Kagurazaka and 23 exhibitions in Noda. Adults and primary school children were satisfied with the special exhibitions of Science and Technology Museum of the Science University. The attention of mass media has been deepening, and this time the exhibition of a well-informed man, Dr. Hidemichi Hori, on the program of TV Tokyo "Nandemo Kanteidan(The connoisseur groups of anything and everything)" rose in popularity. In addition, the activities of Science Yumekobo⁽⁸⁻¹⁰⁾ has many varieties such as "Open lecture", "Academic lecture" and "The science classroom for parents and children".

3. THE FACTOR OF RIKABANARE

3.1 The school of hours for science lesson

The surrounding of the school education, especially for science, has greatly changed. The number of hours for science lesson has decreased, every time Courses of study of the Ministry of Education, Science and Culture is revised. For example in primary schools, the number of hours for science lesson in the present Courses of study is two-thirds of that in 1968. In junior high school, the number in the present Courses of study is three-fourths of that in 1969. In high school, the number of compulsory science lesson at present has sharply decreased to one-third of that in 1960. Therefore, to take the time to do experiments and practical training becomes difficult. Considering the surrounding of the present school education like a five-day workweek, the number of hours for science lesson will not increase in the future^(6,10,11,17).

3.2 Changes in the interests of primary and junior high school students

It can be pointed out that the shortage of their natural experiences in their daily life causes Rikabanare of school children. It is necessary to give the youth that will become future leaders of Japan the opportunity in which they can experience with nature^(12,13). In order to make their science hearts grow they need to have joyful experience of the natural science through making experiment.

Especially, the content of the science lesson becomes rapid and difficult for junior high school student, after they entered. It does the understanding difficult, and it becomes a result of rapidly losing the interest in the science. So, the loss of intelligent environment must be prevented, because the intelligent interest of the student is easy to be lost in this stage⁽¹⁴⁻¹⁶⁾.

3.3 The black box (masking)

The white paper of the Science and Technology Agency pointed out the following about the cause of the black box^(17,18). (a)the pursuit of the usability of usual science and technology, (b)the upgrading and specialization of science and technology, (c)large organizations of the scientific and technological activity and (d)the extent of the satisfaction for affluent lifestyle in the material sense. It says that the youth utilizes the benefits of science and technology, but they are not interested in the manufacturing process.

For instance, when machines break down, they are not repaired but new machines are purchased. They buy new machinery and renew in the case of repair. Because it is cheaper to buy a new one than replace an old part. They do not try to examine the inner structure and the breaking part of the product in detail by themselves.

And being accompanied by the upgrading and specialization of science and technology, the inner structure which is the operating principle and manufacturing process of the machinery it becomes too difficult for people who are not the specialists to understand it. We live now without completely knowing about mechanisms such as the inner structure, operating principle and manufacturing process of the machinery, because of the advance and specialization of science and technology. We wonder ourselves who

utilize calmly the machinery as "convenient tool". We think this is also one of Rikabanare.

3.4 The social aspects

For the youth with the aim of going on to the university for science and technology, there seems to be fundamentally the yearning to the science. However, the youth has not generally sensed impression and roman, today, in science and technology. This is one of the reasons that the youth does not have the interest in science very much.

In addition, while the students of the department of science and technology are busy, some students of departments of liberal arts take easy. There is also an image that a worker of science and technology gets low salary and is hard to promote. The youth tend to emphasize an acted profit and avoid hardships. As a result, the youth that are good at science tend not to choose the science courses. Some students who study in the department science and technology choose office work after their graduation, because an engineer gets a lower salary. The presidents of most of the enterprises are graduates of the department of liberal arts⁽¹⁷⁾.

A doctor and a lawyer are guaranteed their future standings in spite of their great hardships, these men stay in their departments. It is also clear that if graduates of the department of liberal arts are guaranteed their future standings, then Rikabanare will naturally decrease.

4. FUTURE SCIENCE EDUCATION

we wonder how many children have participated in or visited the events which formed a part of the resistance for Rikabanare (such as "Seishonen no tame no Kagaku no Saiten", "Galileo Kobo" and "Science Yumekobo"). As a result of the questionnaire in Science Yumekobo, most people answered "I have never participated in and visited the event of this kind of the science". A lot of students would not even know that those events existed, existed, if they do not try to know. We should have students realize that they can learn through their experiences if they try to search for science experience in their daily life.

We must prepare an easy-understandable explanation for students. Even if we prepare a lot for a lesson, it often does not go well. It is one to give good explanations, and another to make classes interesting and truly useful for students. One way to stop Rikabanare is to make interesting and enjoyable lessons. This will not be too costly.

On merit and demerit which until now science and technology brought about^(13,14), the review is to advance from the foundation of our life. We must appeal that the informed consent is needed for the science and technology⁽²²⁾. From such a viewpoint, we should make the history and records of science. And we should try to improve the social image of a scientist and an engineer by improving the treatment of a scientific worker, and the information about them through mass media.

We asked the question about Rikabanare in the questionnaire in Science Yumekobo. One primary school child answered with one word, "money". Therefore, we need to image the low status and treatment of a scientist and an engineer. In addition, we need much more education that allows children to have developing

scientific eyes and the true science dream.

In today's world, science and technology have selfishly utilized "the resources" such as material, energy and information. We believed that they could give us a good life. However, the crisis of humanity and the extinction of the Earth are about to come true in the twenty-first century, as "Rome-club"⁽¹⁹⁾ which was the assembly of the wise men of the world warned us as early as 1972. It does not say too much, even if this situation is called being in the similar blockage situation mentioned above to not only science and technology but also to political situation and culture social conditions. Under this situation, we think just now it is worth raising the youth that bear the future, love nature, respect life, and seek after truth⁽²⁰⁻²²⁾.

ACKNOWLEDGEMENT

We wish to thank the following members, other staffs and students for their cooperation. This research are especially supported by Dr. Tetsuji Nishikawa of the President of the University, Dr. Shigeyosi Kittaka of the former Director of the University, Professor Osamu Tarutani and professor Masayoshi Kato of the former Chairman of Science Yumekobo, Professor Yoshiaki Sawa, Professor Hirofumi Miki and Professor Yuji Murata of the Faculty of Science and Engineering, Professor Toshihide Kioka of the Faculty of Engineering, Dr. Toshio Sugita of the Curator of Science and Technology Museum.

This research could be achieved by the support of the grant for Education of the University. Also, we express our gratitude.

REFERENCES

- (1) Osamu Tarutani and Takeyo Tsukamoto, "Booklet of Science Yumekobo, Let's play Science in College", Science University of Tokyo, Tokyo (1996) [in Japanese].
- (2) Yoshiaki Sawa and Takeyo Tsukamoto, "Booklet of Science Yumekobo, Let's play Science in College", Science University of Tokyo, Tokyo (1997) [in Japanese].
- (3) Yoshiaki Sawa and Takeyo Tsukamoto, "Booklet of Science Yumekobo, Let's play Science in College", Science University of Tokyo, Tokyo (1998) [in Japanese].
- (4) Takuzo Yamada and Yozi Takigawa, "Youngsters' Science Festival", Japan Science Foundation (1997) [in Japanese].
- (5) Galileo Kobo, "Fantastic Physics", Nipponhyoronsha, Tokyo (1995) [in Japanese].
- (6) Tae Ryu, *Journal of Association of Physical Education of Japan*, **96**, 59-70 (1999) [in Japanese].
- (7) Kotaro Kuroda, *Abstracts of the Materials Research Society of Japan*, **10**, 16 (1998) [in Japanese].
- (8) Makoto Kano, Kiyomitsu Suzuki, and Takeyo Tsukamoto, *Abstracts of the Japan Institute of Metals*, **8**, 293 (1998) [in Japanese].
- (9) Makoto Kano, Kiyomitsu Suzuki, Takuhiro Nobata and Takeyo Tsukamoto, *Abstracts of the Japan Institute of Metals*, **9**, 46 (1997) [in Japanese].
- (10) Makoto Kano, Kiyomitsu Suzuki and Takeyo Tsukamoto, *Abstracts of the Japan Institute of Metals*, **10**, 325 (1999) [in Japanese].
- (11) Ikuo Anzai, Yozi Takizawa, Masanobu Itakura and Takashi Yamazaki, "The Truth of Rikabanare", Asahi-shinbunsha, Tokyo (1996) [in Japanese].
- (12) Kazuyoshi Takeda, "Lecture note of the Law of Science Education", Science University of Tokyo, Tokyo (1994) [in Japanese].
- (13) Yasuhiro Sekikawa, *Abstracts of the Materials Research Society of Japan*, **10**, 21 (1998) [in Japanese].
- (14) Masafumi Ueda, *Abstracts of the Materials Research Society of Japan*, **10**, 19 (1998) [in Japanese].
- (15) Yugo Eziri, *The Physics Education of University*, **6**, 12 (1996) [in Japanese].
- (16) Masataka Sato, *The Physics Education of University*, **7**, 34 (1996) [in Japanese].
- (17) Kiyonobu Itakura and Eizi Nagata, "The Educational Argument of Science - a Course of Study 1", Tokyohoreishuppan, Tokyo pp. 432-662 [in Japanese].
- (18) The Science and Technology Agency, "The white paper of Science and Technology", Tokyo (1994) pp. 20-21 [in Japanese].
- (19) Atsusi Katuki, *Abstracts of the Materials Research Society of Japan*, **10**, 15 (1998) [in Japanese].
- (20) Rome-club, "The Limit of Growth", Diamondsha, Tokyo (1972) [in Japanese].
- (21) Makoto Kano and Kazuhisa Morita, *Abstracts of the Materials Research Society of Japan*, **10**, 19 (1998) [in Japanese].
- (22) Shigeo Sugiyama, *Abstracts of the Materials Research Society of Japan*, **10**, 14 (1998) [in Japanese].

(Received January 11, 1999; accepted April 12, 1999)