

Science Course Program for Girl's Education Leaders in Afghanistan Involving In-service Rehabilitation

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Abstract

Under the regime of Tariban in Afghanistan, girl's education was prohibited. But, the urgent support and rehabilitation for girl's education were considered to be necessary in the new democratic regime. The consortium composed of 5 women's university in Japan started the teacher training program for girl's education leaders of Afghanistan. Twenty female principals and university teachers in Kabul came to Japan for rehabilitation program.

The authors carried out science course program of in-service teacher training in two parts. In part 1, the discussed subjects were effect of computer development on science education, meaning of experiment in science fields, practice on measuring mass and volume, some experimental advices to science teachers, the chemical clock reaction as an exercise. At Ochanomizu University Senior High School, team teaching of experimental chemistry class was carried out on the subject of the relationship between pH and the color change of natural dye extracted from red potato. In part 2, follow-up seminar of teacher training program in part 1 was carried out in Kabul. Chemistry experiments using color change of dye extracted from red potato were also demonstrated at 3 senior high schools.

In the present paper, the fundamental concept of science program for teacher training and the results carried out in Tokyo and Kabul, and important points in the program are discussed.

1. Introduction

Girl's education in Afghanistan was not free after the invasion of Soviet Union, and was prohibited strictly under the regime of Tariban. The new democratic regime started at November, 2001, and many rehabilitation and reconstruction plans were started in Afghanistan, including fortunately the fundamental education for boys and girls. The Japanese supports to developing countries are now strongly carried out in many fields such as economics, education and so on. At that

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time, Japan Ministry of Education, Science, Sports and Culture convinced that some Japanese support for the rehabilitation of girl's education in Afghanistan should be needed urgently.

2. Background of the study

The support program for girl's education in Afghanistan was constructed in March, 2002 by the consortium composed of 5 women's universities in Japan^{1), 2)}, which have long history for girl's education and keep each characteristic tradition. Generally speaking, the science education should be the most important field in girl's education, because the scientific thinking or knowledge is indispensable for a clever mother to educate her children and to make good home management and so on. From habit in Afghanistan, a class is not coeducational from 4th grade of elementary school to senior high school. Female teachers are necessary for a girl's class. For the reason, very speedy and active support of in-service training for female teachers was necessary. In any science class from an elementary school to a university, they have no experimental teaching materials owing to a long state of war, in which all the materials and experimental devices were destroyed. Therefore, the authors convinced that the rehabilitation of logical thinking by science education should be necessary in the teacher training program.

3. In-service training program

This paper is composed of two parts. Part 1 was carried out at Tokyo for girl's education leaders from Kabul. Part 2 was carried out as seminar and chemical demonstrations at Kabul.

Part 1: Ochanomizu University, Faculty of Science and Senior High School

Twenty female leaders in Kabul, 10 principals of junior and/or senior high schools and 10 lecturers in the teacher training college or university, came to Japan for 5 weeks from the beginning of February, 2003 to take a direct part in the program³⁾. Ten leaders joined the science training program, composed of 4 days in the chemical laboratory. The fundamental concept of experiments was also discussed. The actual program was reflected in the latest living situation of Kabul, such as electric power and water supplies and so on.

First day:

- (1) "Afghanistan Research Society for Science Education Collaborated with Japan"

The organization was proposed and the approval of it was gained.

- (2) Recent development in Science and Industry, and the Effect on Science Education

The most important development is a Computer. It influenced on academic research field as experimental equipments and measuring apparatus, and also as railway, airplane, automobile, robot, networks, database, television, video systems, telephone, washing machine, electric rice cooker, vacuum cleaner, and many devices. The necessity of basic knowledge in science education was emphasized.

- (3) What happens in a computer ?

Hardware and software, CPU, memory, OS, binary and decimal, integer and real number, digitization, and signal flow in internet. Some demonstration was carried out by Dr. Noriko Asamoto.

- (4) Why experiment is necessary in natural science and science education ?

The following keywords were discussed: experimental method, measurement, instrumentation,

meaning of observed values and theoretical values, error, analog and digital, and numerical expression in natural science.

(5) What equipments are recommended in a laboratory ?

For the sake of new construction in Afghanistan, a desirable laboratory recommended by old famous chemist was discussed.

- a. Laboratory: laboratory stage, draft chamber, shed, deionizer.
- b. Measurement room: microbalance, computer, precise and accurate measuring systems.
- c. Preparation room: desks for teaching staff, reference books, and so on.
- d. Other specified rooms: RI (radio isotope) laboratory, stock room for waste substances, work shop if possible.

(6) Practice on measuring mass and volume

Fundamental concept and meaning of measurement in natural science were discussed generally in the relation to such an experimental field as chemistry, physics, biology, pharmacy, medicine, agriculture, engineering, home economics and so on.

Example 1: Measurement of mass is the best example concerning the meaning of precision and accuracy. Usually, it is easily carried out in a common experimental room.

Example 2: Measurement of volume was demonstrated by using several kinds of glass ware, of which difference was discussed in precision, accuracy, and density of the sample.

Second day:

Two important advices, (1) and (2), were given to the participants from Kabul as an experimental instructor. Then, all the participants joined two experimental exercises, (3) and (4), for which detailed direction was given.

(1) Preliminary preparation

- a. Fundamental knowledge about apparatus and reagents to be used should be understood before the class.
- b. Previous run of the experiment should be carried out. This preparation was done in the third day at chemistry class of Senior High School.
- c. Estimate unexpected phenomena, and provide how to solve them.

(2) Prevention of an injury and an accident.

(3) Chemical clock reaction composed of KIO_3 , NaHSO_3 , and starch solution as indicator.

After we discussed qualitative and quantitative experiments, qualitative experiment was carried out here.

The content of exercise was preparation of necessary solutions, stock solutions of oxidizing agent, KIO_3 , and reducing agent, NaHSO_3 , after weighing each solid substance, measuring the necessary volume of each solution by mess cylinders. Only two sizes of beakers and mess cylinders were used to preventing from confusion of the participants. Starch solution as an indicator was prepared by instructor. Then, two kinds of clock time reaction were carried out, as about 8 s and 12 s. After the experiments, the reaction mechanism was explained minutely by using the related chemical reactions of redox and each rate constant. The clock reaction is well known as a chemical magic. The drastic change of color from colorless to purple was enjoyed very much. Then, the waste, the meaning of which was emphasized as environmental education, was treated by the remaining solution of reducing agent.

(4) Salt solution oscillator as example to make teaching materials by hand

The necessary raw material was only two plastic bottles, 2000 ml and 100 ml, each of which was cutted into two parts. In the bottom of the small cup, a small hole of 1 mm in diameter was drilled by tipping a heated needle. Concentration of the salt water poured in the small cup was ca. 1 M. Oscillation of flow direction, upward and downward, was easily observed. The oscillation mechanism was explained to be very complicated owing to many factors, but it was recommended for teachers to demonstrate at the science class in Kabul.

After coffee break, all the principals were much interested in school administration and management and the discussion was continued about one hour. The main subject was the relationship of mutual trust between principal and teachers, and fundamental rule of salary and bonus in Japan.

Third day:

Chemistry curriculum in senior high school was explained, including experimental practices. It was emphasized that a class teacher of chemistry should keep the knowledge and more detailed know-how about the experiment. Then participants from Kabul carried out the actual experiment before the start of class at 4th day.

The experimental subject was the relationship between pH and the color change of natural dye obtained from red sweet potato. Each pH value of 10 kinds of solutions, such as inorganic substances, hydrochloric acid and acetic acid was measured by a handy pH meter. Then, the dye solution extracted to water was added to each sample solution in test tube. Interesting color order was observed with pH values. Other vegetable dye such as red radish, red cabbage and the skin of purple onion, was extracted to water and/or hot alcohol. The dependence of extraction on the kinds of vegetable and dyes was discussed.

Fourth day:

Team teaching of experimental course was carried out in English at chemistry class of Ochanomizu University Senior High School. The necessary glass ware, materials and pH meters for the class were prepared by Japanese teacher (T. I. in the authors). One of the participants helped translation between English and Dari in speaking, but Dari was used in black board except chemical formulae, because Afghanistan chemistry teacher could not understand English. All the students joined the class on their own initiative.

Part 2: Seminar on Science Education at University of Education, and Chemical demonstration at 3 Girl's Senior High Schools in Kabul

The follow-up seminar sponsored by JICA was held at Kabul for 2 weeks from the beginning of April. Four specialists including SF, one of the authors of this paper, joined to the seminar. The purpose and subject were follow-up and expansion of 5-week seminar held in Japan for 20 female leaders of Afghanistan girl's education. Three subjects, administration and management of school, information education including computer techniques, and science education, were selected from several subjects in 5-week seminar. In this paper, chemistry part in science education is reported. Science education in elementary school was also demonstrated at the same seminar, which is omitted here.

At Kabul, seminar on science education and experimental class at senior high school were

carried out two days and three days, respectively. In both cases, the subject of experimental demonstration of chemical reactions was "Acid-base properties of inorganic salts related to natural dye", which was fundamentally followed to the subject held at the chemistry class in Ochanomizu University Senior High School. But, modification to Afghanistan was necessary for chemical substances to keep easy to Kabul. Hydrochloric acid, acetic acid, ammonia, sodium hydroxide and alcohol were omitted for the baggage through the customs. From other reason, pH meter was changed to pH indicator paper which was commercially available.

(1) Seminar on Science Education at University of Education, Kabul

Ten teacher-training staffs and ten pre-service and in-service students of University of Education were present at the 2-days seminar of science education. The subject written before was teaching materials, and other general information, attention and advice for science class were explained and discussed as those in Part 1. Glass ware and chemicals for chemical experiment were very precious in an experimental class from elementary school to university in Afghanistan. All the participants joined the experiment in pair. The following explanation was written in the distributed paper. The name of substances was written in 9 lines, and name, chemical formula, formula weight, weighed mass in g, observed pH and color in 6 column, of which the last two column were used to write the observed results by the participants.

Subject: Acid-base properties of inorganic salts related to natural dye

Aim of the subject: The color of natural dye extracted from red sweet potato powder changes depending upon pH of the solution. At first, to learn acid-base properties of some inorganic salts, pH of the solution is tested by pH indicator paper. Then, the indicator dye is added to each solution to visualize the acidity.

Reagents: The following aqueous solutions of 0.5 M were prepared to test the relation of pH and their chemical properties. The chemical substances were as follows: ammonium chloride, sodium acetate, sodium carbonate, sodium chloride, sodium hydrogen carbonate, sodium hydrogen sulfate, sodium hydrogen sulfite and lemon. Chemical formulae are omitted here.

Procedure: 1. Extract the purple dye into water from red sweet potato powder.

2. The necessary solid substances, which were already weighed in Japan, were dissolved in 50 ml of water, then each solution was tested by pH indicator paper about 10 mm in length.

3. Each solution was poured into a test tube and then set the tube in the order of pH value. After the dye solution is poured into each test tube, observe the color change of solution.

Results and discussion: The observed pH and color change of solution in test tube could be written in the table of each paper. From the results, the following points were discussed.

D1. What kinds of dissociation could be considered in each salt ?

D2. The combination of anion and cation decided the property of inorganic substance. If the salt is composed of strong acid and strong base, it will be neutral. Is it not contradict with your results ?

D3. Solubility. Is it easy or not to dissolve the solid sample ?

D4. Acid dissociation constant and solubility curve

After short review of concerning technical terms and basic knowledge from D1 to D4, the observed results were discussed. Ms. Rausier, who is lecturer of Teacher Training College of Kabul, and one of the members in Part 1, joined the discussion in Dari.

(2) Chemical demonstration at 3 Girl's Senior High Schools in Kabul

Almost the same subject was used as teaching materials. The demonstration was carried out by 4 students on behalf of the class. Necessary explanation and information were given, and observed results were indicated to share all the class. The selected 3 High School were very high in the intelligent level, of which principal came to Japan as a member of 5-week seminar in this February. In each school, the experimental class was composed of ca. 20 students for about 60 min, every explanation being translated from English to Dari. But many students can understand English and well sophisticated in their study.

4. Results and discussion

In Kabul, distilled or deionized water was not available. Therefore, mineral water was used in the experiments. How to make the pure water as usual in chemical experiments was also explained.

The teaching materials necessary in school classes of current Afghanistan must be requested to touch children's heart without using electric power, running water and gas. The teacher wanted to make simply the teaching materials by their hands. For this reason, the authors tried and demonstrated to make simple test set as salt solution oscillator.

As for chemical reactions, the treatment of waste was very important. Now in Kabul, all kinds of waste may not be considered. However, as one of industrially advanced country, waste problem should be necessary in school education. In Part 2, every glass ware and waste used for seminar and demonstrations were cleaned at the bath room in hotel, because of lack of facilities for running water in schools and university. But, the importance of cleaning glass ware after chemical experiments was emphasized in the relation to chemical knowledge of substances.

All the necessary solid samples were prepared in Japan. Each reagent of 13 times was weighed and packed with desiccant. Four fold of glass ware, plastic tools and others for this chemical experiment were also carried by hand baggage. In each time, the related teacher wanted to keep some reagent, glass ware, tools and so on as a souvenir to try the same demonstration to other classes. Finally, everything was presented as the gift to chemistry teacher of University of Education, except ethyl alcohol which was very difficult to get in Islamic Afghanistan.

In all the senior high school, the actual procedure of chemical demonstration was carried out by students, and observed results were explained loudly. The adaptability to such experimental procedure might be better than chemistry teachers of high school and university. It was considered to us that many students in senior high school could understand English, because children in an elementary school were too small, and professors in university too old for the evacuation to Pakistan, Iran and other country.

When the situation of information technology and supply service of electric power is improved in near future of Afghanistan, we can advance more powerful and close collaboration in the field of science education and other areas. At least, our personal impression, Afghanistan peoples keep very strong patriotic spirit, so they will construct better country than 24 years before by woman's ability of scientific knowledge, if some racial wars will finish within Afghanistan.

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