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International Cooperation in Industrial Technology Education at Aichi University of Education

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Abstract

Aichi University of Education has been making a remarkable contribution by many activities to the development of industrial technology education for developing countries. Those are the training course of industrial technology education implemented with the cooperation of JICA from 1999, the International Cooperation Symposiums hosted by our university with the JICA Training Courses in 2003 and 2008, International Forum on "Making Things and Education" project at the World Exposition 2005 in Aichi, and the International Cooperative Initiative Project in the Ministry of Education, Culture, Sports, Science and Technology which has done with the theme of "Model Creation of Core Curriculum Sharing System to Support the Industrial Technology Education in Developing Countries" lasted for three years from 2007 to 2009.

Keywords：Industrial Technology Education, JICA Training Course, International Cooperative Initiative

1. Introduction

Following the Second World War, Japan accomplished rapid economic growth through advances in industrial technology along with science and technology in general. As a result, Japan's GDP（Gross Domestic Product）reached high levels internationally in recent years. In particular, the production of electronic products and industrial technology products including those related to automobiles has been consistently strong. Development and sales of these industrial technology products have made a significant contribution to Japan's economic activities and are expected to maintain the current level or continue further growth.

Japan is proud of establishing and implementing one of the best education systems in the world following the Second World War. The current net enrollment ratio is 100% in primary education and 99% for male students in secondary education and 100% for female students, while the ratio of students advancing to high school remains high, increasing from about 70% in 1965, to about 90% in 1974 and then to 95-98% since 1990, indicating the high level in quality as well as in quantity.

In the history of industrial technology education, our university has made continuing contributions to the educational community by turning out a large number of capable teachers. In addition to this background, our university has a mission to make its physical resources such as libraries as well as human resources available beyond Aichi Prefecture. Then the department of technology education in Aichi University of Education takes a leadership role in various programs for Japan and all over the world.

This paper deals with the efforts of the department of technology education during the past ten years or so, especially those concerning international cooperation, namely JICA（Japan International Cooperation Agency）Training Course, International Cooperation Symposiums, International Forums and International Cooperation Initiatives.

2 JICA Training Course

2. 1 Goals of the Training Course

Aimed at the creation of improvement plans for teacher training curriculums and textbooks for industrial technology education and the coordination of their basic direction within the organization, the training expects the following from its participants:

1）to sort out problems in the current situation of the education system, content, method, evaluation, etc. in their country and their further clarification through discussion;

2）to learn the current situation of Japan's school education and explain the current situation of its industrial technology; in addition, to explain the contents and methods of Japan's industrial technology education as well as teacher training and material selection for

industrial technology education in Japan;

3）to explain companies and facilities involved in Japan's industrial technology as well as Japan's industrial technology and industrial technology education;

4）to create an improvement proposal and action plans for its implementation concerning teacher training curriculum and textbooks for industrial technology education in their country based on the training, and;

5）to examine the feasibility of the improvement plan in their organization.

2. 2 Training Items

The following training items are implemented to accomplish the training goals listed in 2.3 above:

1）Course orientation

Before starting the course, the objective and outline of the course are confirmed during the orientation so that participants can keep the objective always in mind and apply what they have learned with respect to their own country.

2）Country report presentation

After participants have presented the current situation of their country, participants and lecturers exchange their opinions and conduct discussions based on an understanding of the current conditions of the industrial technology education in their country including that of the presenter.

3）Survey of education and industrial technology

As an introduction to the training, participants learn the current status of Japan's school education and general knowledge about an industrial technological society.

4）Industrial technology education

Participants learn specific content and methods of actual education in junior high and high schools in order to develop the capability to think about the need and applicability of industrial technology education in the midst of diversification and increasing complexity of industrial technology education.

5）Teacher training

Participants develop an understanding of teacher training for industrial technology education and learn to develop effective educational administration plans as an administrator or researcher who is a leader in industrial technology education.

6）Industrial-technology society

Participants develop an understanding of Japan's industrial society through visits to companies, facilities, etc. involved in industrial technology; participants are expected to improve their understanding of Japan's industrial technology and discover applications to their country through a number of visits.

7）Technology in general

Participants broaden their view of technology in general and their understanding of Japan's industrial technology and industrial technology education through workshops and lectures concerning various technologies.

8）Action plan presentation

To sum up, participants, under the guidance of the lecturers, create, present and discuss future programs for the better application of training by their organization based on their understanding of the current conditions of their country compared with those in the international community.

2. 3 Content and Material of the Training

Concrete content of the training is as follows:

1）Survey of Education/Industrial Technology: Japan's education system, Japan's science education, energy education in Japan, school education and safety in Japan, industrial hygiene and safety education in Japan, Japan's industries, Japan's technology, current state and problems of Japanese universities;

2）Teacher Training: Japan's education colleges, vocational technical education, wood working, metal working, electronic, machinery, cultivation, information;

3）Industrial technology Society（company visit）: Automobile-related companies, machinery companies, electric equipment companies, electronics companies, tool companies, education-related companies;

4）Technology in general（training）: Japan's timber building technology, Japan's contemporary architectural technology, museums, company show rooms, show rooms of administrative organs, Japan Textbook Research Center, technical textbook publishers.

A large number of materials of the course include those provided by lecturers and those given by the company/facility visited. Major materials used in the course include the following:

- Industrial Technology Education for All
- Technology Education in Pacific Rim Countries
- Japanese Government Policies in Education
- The Basis of Industrial Technology Education
- The Basis of Industrial Technology Education, Experiment and Practice

2. 4 Training Evaluation

In addition to the unit evaluation and overall evaluation conducted by JICA, our university evaluates training on a daily basis through the distribution of a questionnaire for each lecture, visits and presentations in presentation

meetings, based on a five-grade evaluation of the contents and methods. The questionnaire is used to improve lectures and examine the selection and manner of visits and presentations of trainees for the next year.

2. 5 Past participants

Participants for the past 11 years came from the regions listed below. We stay in touch with many of them through e-mail, etc.

They were from 37 from Asia, 3 from Central Asia, 2 from Oceania, 28 from Middle East, 28 from Africa, 2 from Europe, 16 from Latin America, then 116 in total.

3 International Cooperation Symposium

3. 1 The 1st International Symposium in July 2003

As a concrete result of the symposium we could identify and understand from various points of view problems in industrial technology education faced by the countries of the participants. Problems deeply involved in industrial technology education included those concerning:

1) teacher training,
2) development of curriculums and teaching materials, and
3) cooperation with the industrial sector.

What came to light were: concerning 1, issues such as the improvement of the quality of in-service teachers and the securing of teachers; concerning 2, the current need for curriculum formation and facility/equipment improvement, and; concerning 3, dissociation between educational institutions and the industrial sector. In order to solve these problems, we felt a need for dedicated efforts to improve the workplace environment and work conditions to recruit excellent teachers while at the same time expand and reinforce teacher training at teacher training institutions and reeducation of in-service teachers. We also recognized the need for the development of effective and efficient teaching materials/aids tailored to the content, pursuit of learning effectiveness, and consistent evaluation, all according to the situation of each country. As regards to cooperation with the industrial world, the importance of improving communication both in quality and quantity was suggested as an obvious precondition.

Looking at these issues from the viewpoint of international educational cooperation, we can form a matrix of problems and their solutions. For example, Country A can solve the problem of "curriculum development" through domestic improvement efforts whereas Country B can solve its problem of "teacher quality improvement" with support and cooperation from abroad. We reached an opinion that it would be effective to actively assemble a database for sharing information of individual countries including those on human resources, curriculums, teaching materials/aids and evaluation methods in order to provide suitable solutions for the problems.

3. 2 The 2nd International Symposium in July 2008

Day 1: Opening ceremony, Keynote speech (JICA), Workshop (International Cooperation Initiatives of the Ministry of Education, Culture, Sports, Science and Technology: Development in the Aichi University of Education, Commemorative lecture I (PTC), Lecture presentation I

Day 2: Exhibition, Commemorative lecture II (CPSC), Lecture presentation II, Panel discussion I (current problems), Commemoration lecture

Day 3: Panel discussion II (presentation of accomplishments made by past trainees), Commemorative lecture III (ITEA), Closing session and send-off tea party

Participants of the Symposium were 200 in total including 50 participants from 25 foreign countries in Africa, Asia, Europe, Middle East and North and South America.

Summary of the results of the symposium and future issues:

As a concrete result of the symposium we could identify and understand problems in industrial technology education faced by the countries of the participants from various points of view. Major problems deeply involved in industrial technology education included those concerning:

1) promotion of technical education, industrial education and professional education,
2) development of concrete contents and methods for the industrial technology education above, and
3) accumulation and exchange of information concerning industrial technology education

What came to light was the importance of the development and enhancement of an education system tailored to individual countries for 1; the formation of core curriculum, syllabus and educational grades for 2, and; the establishment of the cooperative framework and partnership with the industrial world for 3. In order to solve these problems, we felt there was a need for dedicated efforts to improve work conditions in order to recruit excellent teachers while at the same time reinforce teacher training suited to individual fields of education. We also recognized the need to introduce effective and efficient teaching methods suited to educational content and the situation of each respective country. With regards to cooperation with the industrial sector, the importance of improving the

communication both in quality and quantity was made clear as an obvious precondition. Looking at these from the viewpoint of international educational cooperation, we can form the following matrix of the problems and their solutions.

For example, Country A may be able to solve the problem of the "promotion of technical education, industrial education and professional education" by domestic reform, Country F may be able to solve the problem of the "development of concrete content and methods for the industrial technology education" through support and cooperation with the Ministry of Education, Culture, Sports, Science and Technology, while Country J may be able to handle the issue of "accumulation and exchange of information concerning industrial technology education" at the personal level. In order to find suitable solutions for problems in the future, it may be useful to assemble a database of the information related to industrial technology education, develop a core curriculum, syllabus and educational grades and provide them through print media, disc information or electronics information, for example. We hope this will serve as a momentum for the development of the framework for international cooperation in education.

4 International Forums

4. 1 International Forum on the 6th day, July 30, 2005

On July 30 (Sat.), we held an international forum for exchange in making things and education with 10 participants from 9 countries. The theme was "Making Things and Education" for all participants. Below are the names and countries of the presenters and the sub titles of the presentations if available:

1) Dr. Clarence H. Preitz (Canada)
2) Mr. The Augustin Kouadio (Cote d'Ivoire)
3) Mr. Mario Alfredo Majano Guerrero (El Salvador)
4) Ms. Sahar Mahmoud Mohamed Abouzid (Egypt)
"Industrial Technology Education and Making Things in Egypt"
5) Dr. Gerd Hoepken (Germany)
"Making Things-Using Methods of Technology"
6) Mr. Elisha Ndinya Abeka (Kenya)
7) Mr. Cesar Augusto Sena Ruiz Diaz (Paraguay)
8) Mr. Mehmet Yazar (Turkey)
9) Dr. Richard A. Boser (United States)
"Lasers and Wood: Applications in Technology Education"
10) Ms. Anna Sumner (United States)
"SIMP Pre-Engineering Program Making Things and Education"

After the forum, the presenters and other participants worked together to make woodwork using thinned wood, lighting equipment using LED/light without battery, and key holders using the metal that melts at lower temperature.

4. 2 Asian Forum on the 7th day, July 31, 2005

On July 31 (Sun.), we held an international (Asia) forum for exchange in making things and education with 9 participants from 7 Asian countries. The theme was "Making Things and Education" for all participants. Below are the names and countries of the presenters and the sub title of the presentation if there was any:

1) Mr. Choeun Tauch (Cambodia)
2) Dr. Jin-Soo Kim (South Korea)
3) Mr. Muhammad Nor Zaini Bin Jaafar (Malaysia)
4) Mr. Hazrat Hussan (Pakistan)
"Making the Knowledge to work for Organisational Excellence in TEVT"
5) Mr. Tariq Mahmood (Pakistan)
6) Mr. Ghulam Abbas Channa (Pakistan)
7) Ms. Martha Farolan (The Philippines)
"Creativity in Education and Technology"
8) Mr. Amin Badra (Syria)
9) Dr. Chih-Yang Chao (Taiwan)
"Design of the Liquid Cooling System with CPU"

After the forum, the presenters and other participants worked together as on the previous day to make woodwork using forest thinned wood, lighting equipment using LED/lights without battery, and key holders using metal that melts at low temperature.

4. 3 Results and Summary of the Forums

Our university had a valuable opportunity to expand its activities in "Making Things and Education" through the citizens' projects at the Aichi Expo. In this project, a variety of events were planned and implemented as described above, impressing the importance of "making things and education" on the people of Aichi, Japan and the world while promoting the event with participation of both children and adults.

Further activities are required to apply what we learned here to education, research, etc, in the future. Fortunately, our university was chosen for "2005 Support Program for Distinctive University Education: Themes mainly concerned with improving support of student study and extracurricular activities" of the Ministry of Education, Culture, Sports, Science and Technology. The "Making Things Project" was proposed for this program and has been implemented with strong commitment. The program

allowed us to use the experience and results of the Aichi Expo for further efforts in the future.

In carrying out the events of the Aichi Expo., we enjoyed the help and cooperation of about 350 people including persons from institutions concerned, organizations, companies, interested persons outside of the university and the university officials/faculties.

5 International Cooperative Initiative

5. 1 The First Year (2007)

5. 1. 1 Goal

The first goal was to examine the content of the textbooks, materials and information from trainees, develop curriculums using these and add content currently needed in developing countries to expand the existing content. Next, we created a model system for effective and efficient provision of the core curriculum of industrial technology education developed for individual countries. For this purpose, we actively built a network with developing countries focusing on those that sent trainees in the past to explore measures together. Lastly, we compiled printed, disc and communication information to support and promote industrial technology education in a comprehensive manner using the project budget, build a system to enable their provision and provide that information around the world.

5. 1. 2 Organization

As the project was to be based on the "Industrial Technology Education" course, a group training of JICA that had been held for eight years, the "International Education Cooperation Committee for Industrial Technology Education" was set up in the Aichi University of Education as a body to lead the project. The committee was formed by the collaborators (teachers and officers) of the group training "Industrial Technology Education" course within the university with additional teacher/officer members who were to cooperate in the project. Teachers of other universities and staff members of the JICA Chubu International Center who had helped the industrial technology education course were also asked for their support. We also asked for the support of Senior Specialists for Subjects Related to Vocational Education from the Elementary and Secondary Education Bureau, Ministry of Education, Culture, Sports, Science and Technology.

5. 1. 3 Deliverables

- We developed various sorts of curriculums by gathering and organizing the contents from the past Industrial Technology Education course, etc.
- Contents were added and expanded based on the results of a survey on the industrial technology education conducted in Malaysia that was chosen from among the past participating countries, at the same time we developed core curriculums tailored to individual countries.
- We explored a system to provide core curriculums of industrial technology education and proposed concrete measures.
- While the deliverables above were provided as printed, disk and communication information, they were also compiled into a database to be used through a network as a common base for developing countries.

Concrete deliverables were textbooks for technical education and training of industrial education teachers, discs that store the content of the textbooks and a website to enable delivery via the Internet.

5. 2 The Second Year (2008)

5. 2. 1 Goal

The first goal was to examine contents concerning "specialized technical education" based on the past textbooks, materials and information from trainees, and compile courseware using them as a reference; then to expand this by adding content currently needed in developing countries; develop core curriculums, etc. of industrial technology basics tailored to the developmental stage of the individual countries and build a model system for their effective and efficient provision. Verification surveys were conducted targeting people involved in vocational training institutions in Kenya and people involved in vocational training in the member countries at the Colombo Plan Staff College that played an important role in specialized technical education in Asia. Meanwhile, we promoted partnerships with developing countries and built a system to provide printed materials, disk media and electronic data for the promotion of Industrial Technology Basics.

5. 2. 2 Organization

Following on from the first year, the organization that led the project was the department of technology education in Aichi University of Education. In addition to the nine members who carried out the activities in the first year, we asked for the cooperation of people who were well-versed in international education cooperation and industrial technology education such as experts in providing deliverables as communication information, an expert who had achieved major results in regional partnerships in international cooperation of developing countries in the field of engineering (with experience of residing in Kenya), an editorial department manager of a publisher

that is a leading provider of textbooks for specialized technical education, a staff member of JICA Chubu International Center, Senior Specialists for Subjects Related to Vocational Education of the Elementary and Secondary Education Bureau, Ministry of Education, Culture, Sports, Science and Technology and a spokesman of the World Bank.

5. 2. 3 Deliverables

Listed below are the deliverables of the year's activities that we carried out as planned:

- We developed an example of courseware for Specialized Technical Education (specialized education) and a core curriculum of Industrial Technology Basics that is an example of the former. The core curriculum covers eight fields of "drawing," "wood working," "metal working," "electricity," "machinery," "information," "technology ethics" and "health and safety."
- We compiled the textbook "Industrial Technology Basics" which compiled the contents of the individual fields that constitute "industrial technology basics."
- We developed deliverables (printed matters, disc media and electronic data) applicable according to the developmental stage of industrial technology of the developing countries based on the Specialized Technical Education and the Industrial Technology Basics above.
- We published printed textbooks and CDs of the same content to be used on a computer. We also prepared electronic data to enable information to be delivered through the internet and created a website for this purpose. As a result, users can obtain a variety of information anytime and anywhere.

5. 3 The Third Year (Fiscal 2009)

5. 3. 1 Goal

The goal was to compile core curriculum and contents of the Industrial Technology Basics practical textbook based on the deliverables of the project and the opinions and proposals gathered from many countries and experts gathered through the Industrial Technology Basics textbook developed in the previous year. The contents currently needed in developing countries were added to complete the textbook. Next, we built a model system for effective and efficient provision of the Industrial Technology Basics practical textbook according to the developmental stage of the industrial technology of each country. The workshop would be held for people who involved in industrial technology education in the Colombo Plan Staff College that played an important role in industrial technology education and encourage the use of the practical textbook. Then, we completed the [Industrial Technology Basics] practical textbook and build a model system for its provision through printed matter, disc media and communication.

5. 3. 2 Organization

The organization to lead the project was the department of technology education of Aichi University of Education continuing on from the previous year. We invited to the implementing team experts of other universities and an editorial department manager of a publisher that is a provider of textbooks in the field of specialized technical education so that we could provide the deliverables in the form of printed matter, disk and communication information. In addition, we asked people who were well-versed in international education cooperation and industrial technology education such as a staff member of JICA Chubu International Center, Specialists for Subjects Related to Vocational Education of the Elementary and Secondary Education Bureau, Ministry of Education, Culture, Sports, Science and Technology and a spokesman of the World Bank for their cooperation as we did in the previous year.

5. 3. 3 Deliverables

Listed below are the deliverables of the year's activities that we could carry out as planned:

- We developed an example of courseware for "specialized technical education (specialized education)" and a core curriculum for the Industrial Technology Basics practice textbook. The courseware covered eight fields of "drawing," "wood processing," "metal processing," "electricity," "machinery," "information," "technology ethics" and "health and safety" and was compiled in the same way as the "Industrial Technology Basics" textbook.
- We compiled the "Industrial Technology Basics" practice textbook gathering the contents of the individual fields that constitute "industrial technology basics."
- We developed deliverables (printed matters, disc media and electronic data) that are applicable according to the developmental stage of industrial technology of the developing countries using the content of the specialized technical education (professional education) and the Industrial Technology Basics practice textbook.
- We created printed textbooks and CDs of the same content for utilization and distribution using computers. We also prepared electronic data to enable information to be provided via the Internet and created a website (http://www.auetech.aichi-edu.ac.jp/ici/) to provide project information. As a result users can obtain a variety of information in English anytime and anywhere. We are now considering a user registration system for the provision of electronic data.

6 Conclusion

A MUSES-C Probe（asteroid probe hayabusa（falcon））was launched on May 9, 2003 by JAXA（Japan Aerospace Exploration Agency）from the Kagoshima Space Center（Uchinoura）, landed on and took off from the asteroid Itokawa and, after a journey of seven years, a capsule that was a part of the probe returned to earth in the Woomera desert in Australia.

Although Japan is a pioneer with regard to science and industrial technology as mentioned above, it is facing difficult challenges in contemporary society, which does not allow ease and simple discussion of the industrial technology of today and in the future. Closing the world in these days, industrial technology needs to enhance the industrial technology in every country. Challenges and strengthens of industrial technology and industrial technology education faced by individual countries may be solved within the country, but it is necessary to improve and cooperate communication together by approaching the distance between countries.

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