DOCUMENT RESUME

ED 405 467 CE 073 657

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TITLE The Industrial Vocational High School Teacher Training Program Cooperating with the Enterprises.
PUB DATE 7 Dec 96
NOTE 12p.; Paper presented at the American Vocational Association Convention (Cincinnati, OH, December 7, 1996).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cooperative Education; Cooperative Programs; *Education Work Relationship; Foreign Countries; Higher Education; *Metal Industry; Preservice Teacher Education; Program Implementation; Secondary Education; *Teacher Education Programs; Teaching Methods; Technical Occupations; *Vocational Education Teachers
IDENTIFIERS *Taiwan

ABSTRACT

Training of vocational education teachers should be closely linked to the industries in which the teachers are preparing to instruct students. A teacher training program in Taiwan has been designed with the cooperation of the metals manufacturing industry. In this four-year program, students are assigned to the industry to learn the product process and technology. They get real work experience along with general education and teaching methods. A feature of this program is to teach students how to design projects and write technical reports. Through this training program, all students become very strong in the practical aspects of working and achieve high skill levels that will make them better teachers. (Contains 10 references.) (Author/KC)

The Industrial Vocational High School Teacher Training Program Cooperating with the Enterprises

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ABSTRACT

As needing for the economic development and the industry, the vocational industrial teacher or instructor training is very important, so the training program should be close to need for the industry. There is one teacher training program in Taiwan, R.O.C., which has cooperated with the industry. In the four year study program, students are assigned to the industries to learn the producted process and technology, and also to get a real working experience, besides the general and pedagogical education. In this Training program, another feature is to create in the students the skill of designing projects and making products by themselves, and also writing technical reports. Through this training program, all students become very strong in the practical working and are possessed of highly levels of skill, even have the potencial competence in future, that would be useful in their teaching or professional career.

The key words: Vocational Industrial School Teacher Education, Cooperative Education with Industry

The Industrial Vocational High School Teacher Training Program Cooperating with the Enterprises

1.Introduction

For the challenge facing the world competition in economic development, it should have the vocational education and training to establish a world-class workforce to achieve productivity and superior quality levels.(Valija M. Axelrod and Stuart M. Niven,1996) The workforce of higher productivity and quality levels should depend on high quality training instructor or vocational and technical teacher. So the vocational and technical teacher training and training program become very importment.

Taiwan is now the 13th largest trading nation in the world with a per capita income of $12,000US. One of major factors to lead such success is the outstanding development of technological and vocational education,(Chaur-Shin Yang,1996) including the vocational and technical teacher education. In order to face the world competitive challenge and to update the technology, it should have a wide variety of educational program and new strategies to improve the overall quality of workforce from the vocational technical teacher training and training program. For the science and technology developing very rapidly and the industrial producting process also changing very fast, the vocational technical teacher training program can be combined with the industries to provide a work-based element, that can enable a planned program of job training or experiences, paid work experience, workplace mentoring, and instruction in general industry workplace competencies. (Frederick G. Welch,1996).

From view point of economic power, it is dependent upon its human resources, thus how we prepare and maintain our workforce by restructuring. In facing this new, high performance workplace, workers need to have a different set of skills. Quite often they are interpreted as thinking and reasoning skills, team skills, interpersonal skills, and problem-solving skills, along with technical competence to do whatever job needs to be done. (Frederick G. Welch,1996). For all this skills and competence to job needs, the training program can be alternately arranged cooperating with the enterprises.

There is one of the vocational and technical teacher training program cooperating

with the enterprises in Taiwan, R.O.C.. From the aspect of school model, according to an U.S. national report, "American's Choice: High Skills or Low Weges" there is an assertion that in the U.S. we must relate workbased learning and integrating academic and vocational skills. Schools in the United States are being challenged to move closer to the European and Japanese models, and will requrie more partnerships with both industry and labor in the future.(Frederick G. Welch,1996). This training program cooperating with industry is very closer to the European and also integrating academic and vocational skills. Students are all required to write technical report and to perform some projects by themselves.

The following I want to discuss this training program, from its framework of the curriculum, how it can be cooperated between school and industry, and its result.

2.The framework of the curriculum for the industrial vocational high school teacher education

For the demand of the vocational and technical teachers in the vocational industrial senior high schools, we can find out the total 4,775 classes in the industrial occupation in vocational senior high schools, in them there are 225,108 students in academic year 1993-94 from the statistic of education, the Ministry of Educcation, R.O.C.. From above figures we can estimate, that the need of vocational and technical teachers would be about over 10,000 person, even with retired about 70 person or more per year.

From near five years, the change of industrial occupational students is from 215,508 in academic year 1989 to 225,108 in academic year 1993, the average increased 1.1%. It shows that, the demand of new graduated teachers seems no more need, because the youngers more like to learn service occupations and from now the need of those teachers will be decreased. So that the framework of our curriculum should be considered not only for the teacher training, but also for suitability to work in industry.

The new Act of Teacher Settlement enacts, the graduated from any field of universtiy all can be a teacher, only if one has finished 26 credits of required educational subjects and has passed the first stage of qualified examination, then has the right to teach as a practicum in the school. After finishing one year practicum teaching in the school, one can be approved one's ability and attitude by the school authorities, then can be allowed to join the second stage of examination. In

performing to pass this final examination, then one shall award a qualified teacher. According to this Act, if anyone want to become a teacher, he must study this 26 credits of required educational subjects, which will be arranged in our curriculum.

Based on oven reasons to construct the curriculum, which may be classified as general and educational philosophy subjects, professional core subjects and related subjects. The professional core subjects consist of the professional theories, professional practices including experiments and outside shop/enterprise practices. The related subjects can be used to extend or to supplement professional core subjects to strengthen stuedent's professional ability. These professional core subjects and related subjects are mostly constituted depending upon specialities, such as mechanical manurfacturing, electronic engineering etc.. Here I show one of these constitutions of curricula, for example, in mechanical manufacturing training program, some of its major subjects showing as in the following table 1.

Table 1. The constitution of curriculum in mechanical manufacturing training program with its major subjects

General and Educational Philosophy Subjects	Professional Core Subjects	Related Subjects
◦ **General Subjects:** • Chinese • English • National Constitution & Esprit and • Intro. to Social Sciences or other subjects ◦ **Educational Philosophy Subjects:** • Intro. to Education • Educational Psychology • Educational & Vocational Guidance • Principles of Teaching Instructional Materials & Teaching Methods	◦ **Professional Theories:** • Calculus • General Physics • Intro. to Computer Science • Introduction toVocational Industrial Education • Shop Layout & Management (Oven subjects are common demand subjects, then according to each speciality to arrange subjects, for instance, the **Mechanical Manufacturing:**) • Mechanism • Applied Mechanics • Strength of Materials • Engineering Mathematics • Engineering Graphics • Engineering Materials	◦ **Related Subjects:** (There are many subjects providing students to select, for instance, they are:) • Die Design • Heat Treatment • Gear Design and others

• Practicum	• Pneumatic-Hydraulic Control	

The constitution of curririulum in mechanical manufacturing training program with its major subjects (Conut.)

• Secondary Education • Audio-Visual Education and others	Technology • Thermodynamics and others ◦ **Practices/Experiments:** • Basic Machine Technology • Mechanical Machining Technology • Precision Manufacturing Technology • Professional Skill Evaluation • Evaluational Methods of Skill • Study of Project Design & Manufacturing • Technical Report and others ◦ **Outside Shop/Enterprises Practices:** • Study of Production Skill in Cooperative Industries • Study of Skill Teaching in Cooperative Industries	

Students should study at least 136 credits of course requirements for getting degree within four year study. So besides general and educational philosophy subjects, there are offering many core courses and related subjects, that students can freely select to amount the require of credit hours. The core courses and related subjects are emphasizing to create student's professional ability. How these subjects have been planned to effectuate student studying, drawing a simple flow chart showing as following figure 1.

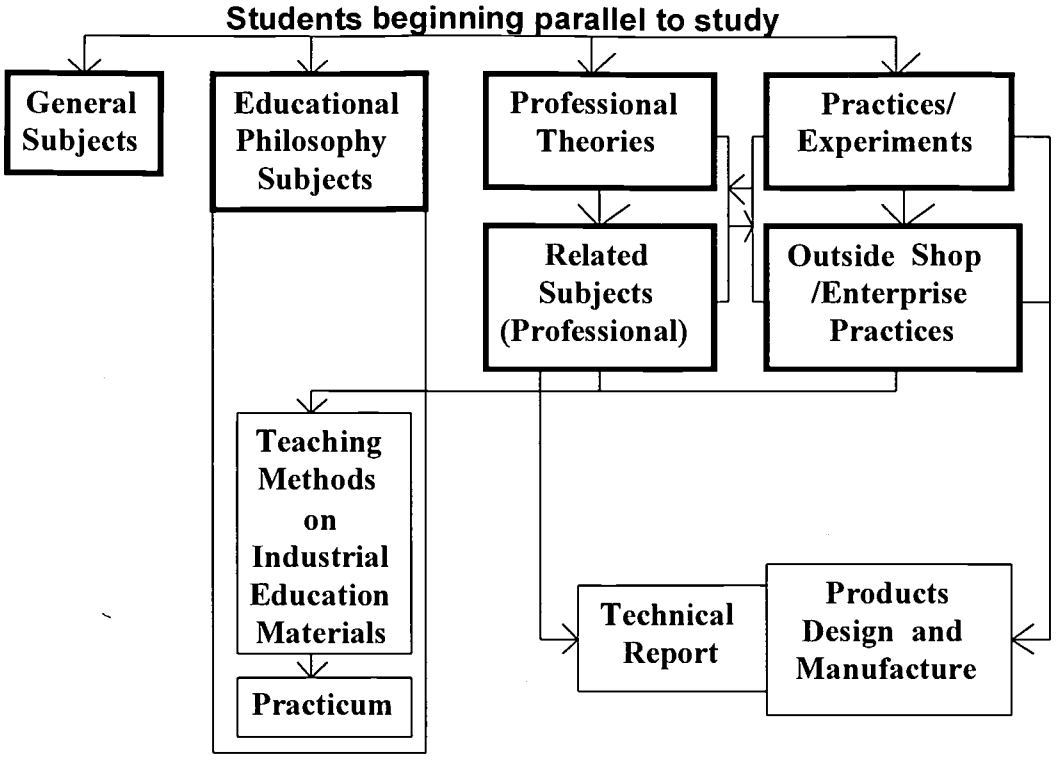

Fig.1. The interact of the core courses and related subjects to creat the professional ability, and also for rising teaching ability

3.The requirement of the ability in the basic industrial technology and fundational related theories

The aim of the industrial vocational senior high school is to train students to be a junior qualified workforce, who can be able to work in the industries. As the teacher wants to teach these students to be adequate to work, he must to learn the basic industrial technology, fundamental and related theories, besides teaching approach. Our students have a bachground of graduated industrial vocational high school and already learned basic (entry) vocational skill and now will learn the basic industrial technology and professional theories, that could lead to integrate academic and vocational skills. The basic industrial technology and fundamental theories are arranged in core courses and according to different fields of occupations are organized various course groups, for instance in mechanical manufacturing, their course group had mentioned above in table 1. The basic industrial technology, that includes the subjects of basic industrial skill, engineering graphics, industrial technique and trade technique. After students had finished these subjects, they would be tested and evaluated, if they passed or are eligible, their skill level is similar or above the level of competent of "B class" Technicians License, which is issued by the National

Commission of Labor Affairs. It is not only needs for the professional knowledge but also for promoting further study to learn fundamental and related theories. The basic industrial technology, fundamental and related theories are instructed very close coordinatly each other, as showing in Fig. 1.

4.For learning the producted process and manufacturing arranging the students to the cooperated enterprises

After students had finished the courses of basic technology and professional industrial theories and be evaluated their achievement, which are all approved and adequate to work in industry, then they are assigned to enterprises, where they join in the actual producting work in order to learn producting process and manufacturing. They would take there at least 4 months, with this experience they could acquire the study of production skill and the study of skill teaching. Besides, it could also develop the students to creat their ability of project design, manufacturing process decision, producting management, finding any problem in production or in management, which would be of benefit to write technical report and to plan the whole producting work in later.

As for the newest producting process or new technology, it is always used first in the factories to compete with others , so the students go to there and have the opportunity to touch the new facilities, even to get new idea, that would compensate the shortage of equipments or learning in school. After students have received this arrangement and finished learning, they become to be independent working ability, therefore they possess the abilities of thinking and reasoning skills, team skills, interpersonal skills and problem-solving skills.

5.The students achieving their designs and fulfiling their designing products

From the above description on outside shop in industry, after finished those practice, students have familiarized with professional knoledge and technology, and also have relative working experience in factory, then they would be able trying to plan a project or some products in the beginning of senior academic year. The projects can be done by teams or by individual. Almost projects are in cooperating with enterprises, that provide us their cases of improving their producting equipments or developing their new products. The team of our professors from various experts obligate to direct students carrying out projects, which are deputed by enterprises. It normally spends an half year (one semester) for collecting technical data, developing

individual idea, generalizing concrete construction and finishing production design. In remain of last half year, students would continue to do analyzing job to distribute work, which includes to decide mechanism-elements or to select suitable machine pàrts, to manufature and to assemble the whole elements, to test running or to adjust machines or equipments, until they are all in order, then to decorate or to paint their products. In the student graduate ceremony, the whole those products, which are made by students themselves, are exhibited and evaluated by the partnerships of enterprises and authorities of experts. This cooperative educational achievement is highly commended by the enterprises and benefit to both the enterprises and school. Some actual efforts of projects in each year are showed in following figure 2 and figure 3.

6.Writing the technological report for the professional technology

Parallel with study of designing project and fulfiling disgning product, students would also write the technical report according to their outside shop experience and their professional speciality. They can find out some cases in the production process or management, that are worthily inquired and from those they can choose one using as their topic for study. At first, students would decide a theme and explain their motivation of study, present the outline of their report, then it let the directing professior rivise, until it is admitted. After the report was admitted by professor, students proceed their theme to search and to collect the documentary materals, to investigate and to observe the production process or management in indusries, to analyze and to summarize the studies. At last, they would finish their report and deliver them to professor.

From this study, students can realize the importance of the study and know, how to do the study, that would have advantage in their teaching and professional career.

7.Openning the seminar between schools and enterprises

It is also openning the conference of cooperative education with interprises for this result of successful cooperative education once a year, and many delegates of enterprises, scholars and journalists are invited to join this seminar and to discuss, then it could get the conclusion with including some suggestions, that would impel us to improve our cooperative educational system more better.

8.Conclusion

As it had already mentioned in above, the vocational industrial teacher training program cooperating with enterprises can be assured the one of the most efficiency of vocational industrial teacher education. In this model, students are not only learning in the school, but also learning practice from factories, where they can get the newest producting technology and management. From the real working experience, they can create their potential abilities and practical working ability, especially they are joyfully accepted by the vocational industrial high schools and industries after they leave school.

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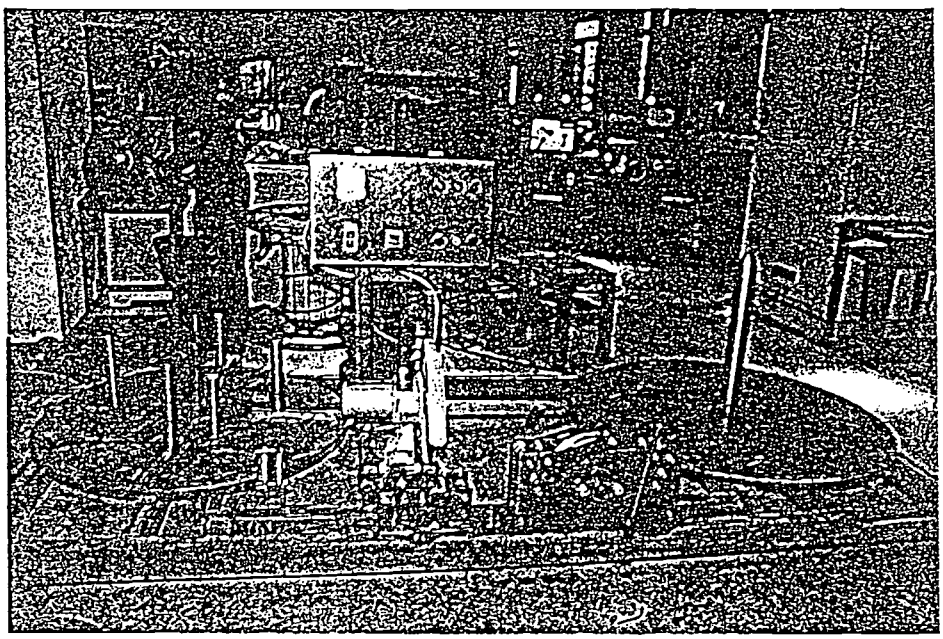
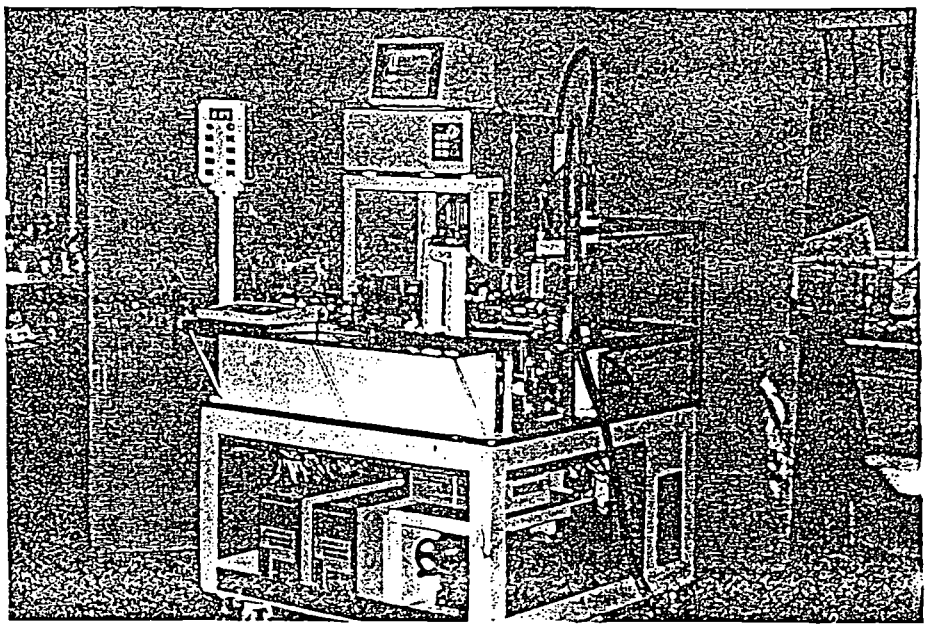


Description:

The cutting of long steel wire has been a waste of time and efforts. This project is aimed at handling the whole process automatically. In addition to steel wire cutting, electric cables can be treated (i.e. rolled and cut) by the cutter.

The operation is quite simple. The only adjustment (setting) needs to be done is the counter which assigns the desired length of wire. However, the cutting command at the end of rolling is given manually for safety's sake.

Fig. 2. It is one of the projects that had finished in 1994, and was made by our students, now using in our cooperative enterprise.



Project Code: 81-ME-02

Project Title: Automatic Welding Machine for E-Gun Inner Leads

Team Members: H.S. Chien, C.K. Jan, C.C. Hsu, C.Y. Chen K.C. Yu, S.C. Lin, H.M. Hsu, and C.T. Weng

Academic Advisors: C.F. Chi, C.C. Luo, C.C. Hsiao, C.J. Chen, Y.P. Hsieh, C.L. Wang, F.C. Liu, and F.S. Chen

Description:

This automatic welding machine has been designed solely for welding inner leads of electron guns. There are eight steps of operation as shown in the following sequences:

Step 1:	Pass (null step)
Step 2:	Electron gun put in position manually
Step 3:	Detection of arrival direction of E-gun and welding of Inner-lead #12 (HC-lead wire)
Step 4:	Identification of E-gun types; position setting data ready for next step; and welding of inner-lead #6 (KG-lead wire)
Step 5:	Fetching and welding of G3-con lead wires by using a robot arm
Step 6:	Pass (null step)
Step 7:	Welding of Inner-lead #10 (HL-lead wire)
Step 8:	Ejection of E-gun from welding machine

Fig. 3. It is another one of the projects that had finished in 1992, now in one of our cooperative enterprises using this machine to produce his products very well.

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