PROCEEDINGS

4th International Conference on Technical and Vocational Education and Training (TVET)

Theme:
Technical and Vocational Education and Training for Sustainable Societies

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FOREWORD

Welcome for all respected scholars, researchers, post graduate studentsand especially Keynote Speakers to the 4 ICTVET. The theme of the conference focus on Technical and Vocational Education and Training for sustainable societies and consist of six subthemes. i.e Development of learning model on TVET, Workplace Learning and entrepreneurship, Innovationon applied engineering and information technology, Management and Leadership on TVET, Vocational and Technical Teaachers education, and Assessment and Evaluation on TVET.

Sustainable society shoul be followed by the improvement of various factors that have impacts to the quality of vocational and technical education and training, particularly to overcome the competitiveness of the world business. As we have already known the rapid change of technology as well as the change of demography, having a great effects to the life of peoples in this world, The competitiveness need a collaborativeness to survive the life of millions peoples who lost their jobs. Young peoples as aproductive generation have to be creative and innovative to face the competitiveness. So this prociding contents consist of various findings of research in the field of vocational and technical education as well as applied technology and mainly based on the subthemes of the conference.

Finally, we would like to thank a million for all participants of this conference and all parties who support the success of this conference. Hopefully the seminars and scientific work of this seminar can be a reference material for basic education and elementary school teacher education in Indonesia.

Padang, July 2, 2018

Tim Editor

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CONDUCTING LABOR MARKET ASSESSMENT IN ENGINEERING CURRICULUM DEVELOPMENT

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ABSTRACT: Engineering education is one of the most significant components of the human resource development. In order to achieve competitiveness with advanced countries, human resource development policies have to be changed. The curriculum has to be made dynamic to take into account in changes of technologies and lab our demand. The curriculum Development based on labor market assessment is the key factor to make the dynamic curriculum. Labor market assessment can be done through four approaches, that are: employer surveys, extrapolation, the econometric and job vacancy. Based on labor market assessment we can identify the technology development at workplaces and competency profile of engineering manpower and determination of the strengths and weaknesses of the engineering system. Through the design and developing process that is translated into the curriculum which stronger links between the worlds of education and work**.**

Keywords: Labor Market Assessment, Curriculum Development, Occupational Analysis, Engineering Education

1. INTRODUCTION

Engineering education is one of the most significant components for the human resource development spectrum which has great potential for adding value to the products and services, contributing to the national economy and improving the human quality of life. Each country develops its education system through considering specific socioeconomic and cultural identities to fulfill the times changing to ensure that the outcomes reach all sections of society [1].

The number and type of Engineer manpower requirements depend on the state of development in a particular country. In developing countries, the required labor is innovators, engineers and technicians engineers proportion is comparatively larger than underdeveloped countries. While in a developed country, number of innovators, managers and technician engineers is still greater as compared to developing country. The globalization of markets is accelerating the diffusion of technology and the pace of innovation. New occupations are emerging and replacing others. Within each occupation, required skills and competencies are evolving, as the knowledge content of production processes and services is rising [2].

In order to achieve competitiveness with advanced countries, human resource development policies have to be changed. The curriculum is to be made dynamic to take into account changes in technologies and labor demand. That means curriculum is the key factor in engineering education.

The philosopher Hoffer (1973) once reflected that “In a time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists”[3].

Curriculum was defined by many authors in varying contexts. A review of literature produced by various writers reveals marked differences in the way each perceives and defines the term curriculum as follows.

Bobbit (1918) defined curriculum in two ways. The first is as the range of experiences directed to develop skills in the individuals. The other one is as the series of training experiences that schools utilize to complete and perfect that development. Tyler (1949) assured that curriculum is all the learning experiences planned and directed by the school to reach the school’s educational goals. Similarly, Arrieta (1995) defined curriculum as the series of things that children and teenagers have to perform and experience to develop abilities that would form them to decide upon issues in their life as adults [**4**].

Taba (1962) stated that a curriculum usually contains a statement of aims and objectives, it indicates some selection and organization of content, it either implies or manifests certain pattern of learning and teaching, because the objectives demand them or because the content organization requires them. Finally, it includes a programme of evaluation of the outcomes. [1]-[4].

Saylor (1966) stated that curriculum encompasses all learning opportunities provided by the school. Johnson (1967) described the term curriculum as structured series of intended learning outcomes. Burns and Brooks (1970) stated that a curriculum is a plan for the arrangement of information and experiences which educator consider necessary for children to cope with successfully in life. It is further stated that

curriculum is defined as everything that is planned to happen to a learner with a view to enhancing, investigating or modifying predetermined behavior.

Jenkins et. al., (1976) expressed that a curriculum is the formation and implementation of an educational proposal, to be taught and learned within a school or other institution, accepts responsibility at three levels, its rationale, its actual implementation and its effects.

Rubin (1977) stated curriculum to encompass the total impact of the school environment on the learner. Lawton et. al., (1978) defined curriculum as all the learning which is planned and guided by the school, whether it is carried out in groups or individually, inside or outside the school. He divides the curriculum into four aspects: curriculum objectives; knowledge; learning experiences; and curriculum evaluation.

Doll (1978) expressed that curriculum emphasizes guided, preselected experiences to which children and youth should be exposed; plans for learning; ends and outcomes of being educated and system for achieving educational production.

Harris et. al., (1978) stated that the term curriculum is used in a broad sense to include the totality of what is to be taught in school, the relationship between subjects, teaching materials, teaching methods, technological and other aids and organization of teaching-learning.

Tanner Daniel (1980) stated that curriculum is planned action for instruction. Burshoff (1981) stated that curriculum is an education project defining goals, aims and objectives of an educational action; ways, means, activities employed to achieve these goals; method and instruments required to evaluate the success of the action.

A publication of CPSC (1982) stated that curriculum of a course has been defined as an educational programme designed and implemented to achieve specified educational objectives and Choate (1987) stated that the curriculum is that set of courses and instructional experiences afforded to students.

Taking above into consideration, the curriculum is viewed as a plan of intents about the learning outcomes, the processes, and resources, designed and implemented to attain the specified goals of an educational programme for specified learners. In other words, curriculum is a written document of an educational programme which states educational objectives, details out the integrated sequence of curriculum areas(subjects) and detailed contents, recommends learning experiences to be given to students and methodology of student evaluation for achieving the objectives in a stipulated period for a specific group of learners.

So that curriculum of a programme is an important document based on which entire teaching−learning process is planned to prepare suitable technical human resource. Curriculum is important for the learner to understand the scope of study; for the teacher to know what and how to teach and select appropriate learning experiences to be given to student for developing desired competencies in them, industry to understand the type of manpower and competencies possessed by the pass outs from a programme and to facilitate Universities for planning physical, human, informational and financial resources for effective implementation of the curriculum

2. CURRICULUM DEVELOPMENT

Curriculum development typically focuses first on curriculum policy, including frameworks, learning areas, associated syllabi and learner outcomes to be assessed [5].

Jnanesh and Hebbar (2008) stated the general model for curriculum design requires four matrices. The first matrix is needed matrix. Here the customer's needs for the course is developed. In order to satisfy those needs, a set of required skills should be developed and the relationships between the two sets are evaluated. Once it is validated the skills can be carried into the second matrix namely skills matrix, to match a set of primary topics. On the development of topics matrix, the primary topics are broken down into secondary topics and this now creates subjects for which the instructional hours are assigned. This becomes the third matrix. The fourth matrix will be on delivery of the subjects and knowledge [6].

The curriculum design and development model recommended for adopting in the engineering college, shown in Figure.1

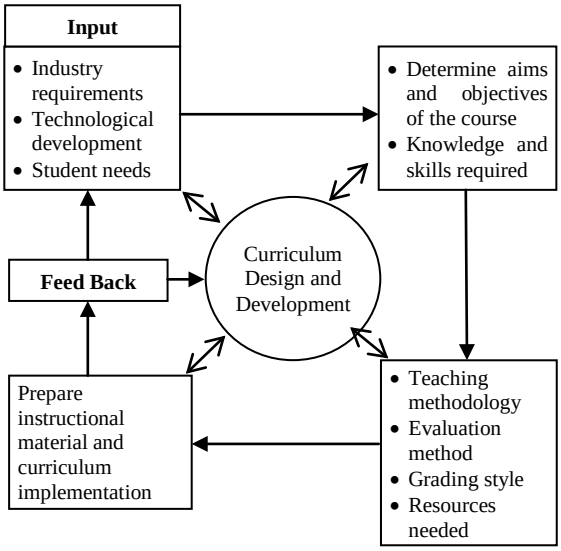

Fig.1. curriculum design and development model recommended for adopting in the engineering college.

The curriculum will be designed by considering the inputs such as industry requirements, technological developments, and students' needs. After identifying this, the next step is to determine the aims and objectives of the courses and to decide about the intended knowledge and skills to be developed in the students. This would help to decide about the design of teaching methodology, students evaluation methods, students grading pattern and identify the resources needed for teaching-learning process. This decision will lead to the preparation of instructional material and curriculum implementation process. A feedback will be collected from the industries and students and further the process will be continued once again from the beginning. This is a continuous improvement of curriculum design and development process.

The curriculum development comprises of the four stages, there are need analysis stage, curriculum design stage, curriculum implementation stage and curriculum evaluation stage.

The first stage in curriculum development process is the need analysis stage. This stage deals with the diagnosis of needs which involves conducting market surveys for determining employment opportunities for the specific target group, technology development at workplaces and competency profile of technical manpower, keeping in view the present and future employment trends. This also includes determination of the strengths and weaknesses of the system of engineering education [1]- [7].

The curriculum design stage involves devising or planning the intents of the curriculum. At this stage, decisions regarding curriculum objectives for specified target group are spelled out. From these objectives, curriculum areas (subjects) are identified. Detailed contents are worked out to match the competency profile of specific target group. Alter working put time requirement for imparting desired knowledge, skills and attitudes, study and evaluation scheme is worked out, selection of appropriate methods and media for various curriculum areas is also detailed out. At this stage resources required (i.e. physical, human and informational) for effective implementation of the curriculum are also spelled out

Once the curriculum document is ready it will call for the development of appropriate resources for the successful implementation of the curriculum. This stage deals with the harnessing of resources and their utilization for providing appropriate learning experiences to students for developing desired competencies in them. Networking with industry and other organizations for sharing resources is one of the important considerations for effective implementation of the curriculum.

The last stage of curriculum development is evaluation stage. The evaluation is considered in two stages. The first stage is monitoring during the implementation stage. During this stage, corrective measures are taken to improve teaching−learning process. Once the system has undergone corrective process for some time and got improved, a summative evaluation is undertaken for making changes at different stages for increasing the effectiveness and bringing improvement in the curriculum and the processes at different stages

In this article, the review focuses on the first phase of curriculum development, which is one of the fundamental parts of curriculum development, which is the labor market assessment.

3. LABOR MARKET ASSESSMENT

Beside to achieve competitiveness with advanced countries, the human resource development of engineering is also related to the mismatch between employers and job seekers. The difficulties the employers face can be grouped into two kinds of mismatch: one based on a lack of job seeker interest and the other on a lack of skills. Interest mismatch characterized by a gap between what job seekers are looking for and what employers are offering. Skills mismatch characterized by either too few people with the required skills to meet employer demand, or when highly skilled people are not being matched with the right jobs [8]. Therefore, labor market assessment is important to solve the problem

Labor market assessment processes to assessing current and future manpower supply and demand. Labor market assessment may be done on a large or small scale. In small scale, the labor market assessment is conducted to find out some information, such as:

1. What industries are there in the region
2. Any company related to the existing industry in the region
3. How much labor needs are appropriate for the graduates of the study program
4. Where there are substantial opportunities for specific courses not available in universities do they have the resources to develop the program.

In the context of instructional programs, the labor market assessment is usually a local endeavor and is essential to:

1. Assess the need for a program in a specific community.
2. Assess the extent and type of education needed.

Demands projected beyond four to five years may often lead to inaccurate decision making and will result in developing inappropriate curriculum. However, this situation should not stop the assessment. As argued by Tyler (1949) developing curriculum and plan of instruction will be answered some fundamental questions in educational process, that are: what educational purposes should be attain?,

what educational experiences can be provided that are likely to attain these purposes?, how can these educational experiences be effectively organised?, and how to determine whether the purposes are being attained? **[9].**

Different tools and techniques are used for collecting information regarding employment opportunities, competency profile and type of present and future technology trends etc.

Some of the important approaches include employer surveys, extrapolation approaches, the econometric approach and job vacancy which may be of great help in making decisions regarding manpower forecasting.

4.1. Employer Survey Approach

The most widely used approaches in assessing labor demand data are through employer surveys. This approach basically involves contacting the employer in order to assess the current and projected manpower needs. The strength of this approach is in the collection of meaningful data. However, the employer survey approach has certain limitations because employers may be reluctant to share employment data with strangers.

Data should be collected regarding current and projected manpower needs and the instrument used should accomplish both purposes. Several approaches may be used in the collection of data from employers. The two primary methods are:

a. Distribute a survey instrument to potential employers, either the entire population or a representative sample. The information payback of a survey is valuable because of the number of employers included. A survey might be mailed to several hundred potential employers. Identifying who should receive the survey and collect their addresses is time-consuming
b. Convene a focus group of potential employers to collect information through a strategic group interview. Focus groups may provide a smaller picture of the community market but can be easier to implement. Arrange a one- to two-day meeting with approximately 15 to 20 industry leaders whose reputations indicate they are knowledgeable about the field as well as the community.

Regardless of the strategy for collecting data, the following types of information should be requested:

1. Type and size of the organization as well as its products and/or services
2. Type of applicable jobs and number of that personnel employed by the organization (both full- and part-time)
3. Wage for entry-level personnel
4. Minimum level of education required for employment
5. Required work experience for employment
6. The degree of difficulty finding qualified personnel
7. Projected number of full-time and part-time job openings in the next one to five years
8. Types of skills and training the organization needs for entry-level personnel
9. Future trends in the industry

4.2. Extrapolation Approach

This approach of projecting future manpower needs is based on the assumption that past and current trends will give an indication as to what will happen in the future. The strength of this approach is that it is relatively easy to perform and can be done in a short time.

4.3. Econometric Approach

The econometric approach of manpower forecasting appears to be the most sophisticated approached for manpower forecasting in use. The projections are developed in a series of five steps, each of which is based on separate model. These are as follows:

(a) Labour force projection: based on future age, sex, racial composition and migration of population
(b) Aggregate economic projections: projects the Gross National Product (GNP) and major categories of demand and income
(c) Industry output projection: Industry output projections are estimated using input-output data associated with the expected GNP
(d) Industry employment projections: given the final output expected from the identified industrial sectors, estimates are then made of the occupational structures needed in the industries required to produce that output
(e) Occupational employment projections: an industry − occupational matrix is developed showing the distribution of employment, which will be helpful to project the manpower needs

As with other labor demand forecasts, the econometric technique has several limitations. Among the major drawbacks are that economic activity fluctuates widely and can greatly influence the manpower needs, thus projections can be inaccurate. Other limitation centers around the unpredictable rate of technological advances and the attempt to predict the educational requirements for occupations that now are few in number but in future may represent a sizeable share of workforce.

4.4. Job Vacancy Approach

This approach to manpower forecasting is based on current job vacancies. Job vacancy approach depends heavily upon information obtained and

compiled by employment exchanges. The strength of this approach is that immediate needs of an area can be quickly ascertained.

Job vacancy as a means of forecasting manpower needs does have some limitations. First, are the vacancies of long-range nature or seasonal jobs? When a particular vacancy remains vacant for quite some time, it is essential to inquire the type of qualification and experience desired for the fulfillment of such vacancies

The above manpower demand approaches may help to choose one or more approaches for collecting relevant information. The selection of approach depends upon the purpose, resources and the time available to the planner. All four approaches have distinct advantages and limitations

5. UTILIZE LABOR MARKET ASSESSMENT FOR CURRICULUM DEVELOPMENT

The application of labor market assessment for curriculum development is done in three stages, that are occupational analysis, design curriculum, and development curriculum. However, before reaching the stages, several steps of the labor market assessment must be ensured has been done, that is:

a. Specify the area will be surveyed. This area can be around the university or away from the university location
b. Identify the industry/project/company in the survey area which relevant to the field of study
c. Identify the core business of the industry/ project/ company, such as mining, cement factory, manufacturing, petrochemical, pulp and paper, oil and gas, palm oil mill, etc
d. Identify the production capacity of the industry or scope of the company
e. Identify the field of works found in the industry/ project/ company, such as managers, supervisors, planners, head of the production, etc
f. Identify the required requirements for each field of works
g. Identify the amount of labor available today
h. Extrapolate the number of industrial/ project/ company workforce for next 5 or 10 years based on its production capacity or scope of the company
i. Extrapolate the number of workers in each field of work in the industry/ project/ company and requirements needed.

5.1. Targeted Occupational Analysis

According to Hutchinson and Waters, target needs are what the needs in the target situation. The analysis of target needs can see in three ways such as necessities, lacks and wants [7].

Occupational analyses are intended to be quick, efficient ways to determine job tasks, knowledge, and skills for a targeted occupation.

The goal of the occupational analysis is to develop competency- and performance-based learner-centered curriculum and instructional materials. Specifically, the results are then analyzed and systematically translated into a program curriculum. The occupational analysis is used to:

a. Identify instructional needs and gaps.
b. Plan an instructional program or validate and revise an existing program.
c. Design and develop or revise curriculum.
d. Design and develop or revise instructional materials.
e. Provide teachers with valuable feedback on emerging and future trends in a career field.
f. Provide career guidance for students.
g. Ensure that students will have real-world skills to bring to the workforce.
h. Provide management with qualitative data on curriculum validity.
i. Promote business and industry “ownership” in a university’s goals.
j. Assure employers that students meet business and industry job criteria and performance standards.
k. Network with business and industry personnel who may agree to collaborate with a program by joining an Advisory Committee, donating needed equipment, providing speakers, funding, etc.
l. Use as a public relations tool to show the effectiveness of university-business-industry partnerships

The value of a targeted occupational analysis can be used for developing effective curriculum. It is the critical starting point for the curriculum development process. Detail job competencies, both technical (knowledge, and skills) and general (communication, computer, teamwork, interpersonal skills) becomes the starting point for curriculum design and development.

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5.2. Design

At the stage of design curriculum development, occupational analysis information used as a basis to determine the specific content needed for learning. Create the performance goals, competencies, criteria, and assessment:

1. Analyze each task to determine what specific knowledge and skills are necessary for performing the task.
2. Write a performance objective as a measurable, specific criterion of acceptable performance

3. Identify and sequence the steps a worker follows to complete the task. Include cues, decisions, and warnings
4. Determine the necessary equipment and materials needed to complete the task
5. Write measurable performance criterion for assessing learning outcomes. Ensure that the assessment aligns with the original performance objective

After analyzing process and flesh out the occupational analysis, the information continues to be developed as student performance objectives and is organized into courses. When working on a course, one of the results of design will be the syllabus.

5.3. **Development**

The development stage is to determine how the above content can best be presented. Select and/or create delivery strategies and learning activities that directly support the performance goals and competencies from the design stage.

Delivery strategies and learning activities set based on learning needs, that are what the learner needs to do in order to learn [5]. Through learner analysis, the different types of learning "intelligence" may be found, and can now target as many of these as possible in teaching strategy and related to the course, some of the results of development should be:

1. Content organizations
2. Lesson plan content
3. Delivery methods, such as lecture, reading or writing an assignment, demonstration, discussion, hands-on activity, practice and group work
4. Assessment/feedback mechanisms
5. Pilot testing prior to introduction into the classroom

6. SUMMARY

The developing curriculum process is a structured type of occupational or task analysis that is used to identify knowledge and skills gaps. The developing a curriculum process has three main elements, that are a needs assessment, a data-gathering workshop, and curriculum development.

A needs assessment is simply a focused effort to determine whether the instruction is needed and, if so, in what area; this effort often begins with labor market survey. A data-gathering workshop is held to bring together a focus group of expert workers in a specific field or occupation for a brainstorming session to produce that lists the tasks performed by an entry-level worker in the occupation and the knowledge and skills required. The developing a curriculum is to the identification of instructional needs, program planning, lecture materials development, and career guidance.

Based on labor market assessment we can design and develop the dynamic curriculum which stronger links between the worlds of education and work.

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