PROVIDING COMPETENCY-BASED EDUCATION FOR INDUSTRY AND ITS EFFECT ON CLASSROOM EDUCATION

Chin-Yen Lin
Director of Graduate Institute of Technological & Vocational Education,
National Taipei University of Technology

Tsung-Juang Wang
Associate Professor, Graduate School of Architecture & Urban Design
National Taipei University of Technology, Taiwan

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Abstract: This paper is set upon the scenario of a synergy from two leading technical education institutions in their joining exercise of providing an industry-oriented curriculum for a university level degree course. A course model of Pro-Trainer One is devised to foster this initiative at the first evaluation year in which the result was demanded to be effective. The strategy of developing material toward this exercise is demonstrated and the evaluation of this synergy is also examined. The newly established Taishan Training University was meant to become a model in which prospective collaboration among many institutions can follow.

INTRODUCTION

This paper aims to evaluate how to establish mentoring strategies for higher education system, particularly those technical and scientific curriculum based universities to provide their teaching expertise directly to industry. In the year of 1998, a synergy was formed by merging from two leading institutions, National Taipei University of Technology (NTUT) and Taishan Vocational Training Centre, to found the Taishan Training University (TTU) in Taiwan, the first of its kind in this country. The goal of this program is primarily to be in line with the government’s policy in developing domestic high-tech and advanced cooperation from education and training expertise, and also raising the best technical manpower both in theory and skill. This joint strength in both academic and industrial institution will provide degree courses for prospective trainers and develop techniques that are interchangeably leveraged from academic system and real world practice. The strength and weakness of this model are examined and some spin-offs received by participants in this course are also addressed. Due to the fact that a correlated nature of technical education and industrial curriculum developing system, many advantages from this collaboration also give birth to many developmental tools that can be utilised by these two institutions.

Upon the completion of training cycles, the professional trainer would be able organise, execute and evaluate professional industrial training programmes and elevate the level of professional ethics and encourage an attitude of respect for one’s work so as to become an instructor or a person who can carry out teaching in training institutions or particular field of industry.
Current Professional Education at the University level in Taiwan

As far as Electrical Engineering (EE) is concerned, the distinction between general-purpose universities who offer degree courses in EE and the technical universities is that the technical universities have more number of departments dedicated to the same wider theme of professional education, such as in EE. In other words, EE department in technical universities is often split into more than one departments, from Electrical Engineering, Electronic Engineering, and even Computer Engineering, to name a few. The EE degree is a general course that covers disciplines in Electricity, Electric Machinery, Communication, Computer, Control, Semiconductor, Electronics, Electric-Optics, etc., An example of Electrical Engineering Department run by NTUT shows that it tends to cover Electricity and Control, while Electronic Engineering Department tends to include Electronics, Computer, Communication, etc. This will often result in the situation that the students in Electronic Engineering have less experience and poorer picture of wider applications of Electrical Engineering. Same thing also happens to Electrical Engineering students who also lack knowledge in Computer and Communication. This presents a major problem in the modern technology the integration from many technologies is highly pursued and each discipline is correlated. As a result, students are confronted with the challenge when they are in the midst of re-inventing their career by exploring other related professions.

The EE program in the Taishan Vocational Training Center aims to integrate these two curriculums and offer a higher level of competency in the physical jobs environment. Based upon the current resource in NTUT, this program not only inherits the benefits from each Electrical Engineering and Electronic Engineering can offer, but also creates courses opportunity of their integration in which students can opt for modules from both categories. The program also shortens the length of study from three years to two years, but the time of actual course hours is remaining the same in total.

A Degree Ready for Industry

“Meet up with Real World Practice” is another vision targeted by both NTUT and Taishan Vocational Training Center, although NTUT is much more involving with laying down a firm foundation in theory. On the other hands, Taishan Vocation Training Center admits students who must have a two-year college degree and most students admitted reveal that they can enter the industry directly and smoothly after this comprehensive degree program, while the students in NTUT might consider to enter a higher level of research in post-graduate study. This offers two different perspectives that the synergy from the two institutions must take into account thoroughly. Therefore, this program has a higher percentage of lab works and on jobs training and this forces students to be imposed to the real world.

A Degree and also a Certification in Industry

To develop an effective training model for the unique program, the Pro-Trainer One curriculum has a special emphasis on the acquisition of certification that is highly favored by industry and trainees. A survey of the trainees in this program on the shows that more than 50 percent of students wish to acquire professional certification which is offered as a feature in this program.

The program can end up with university degree in EE and/or Pro-Trainer One degree. However, it has been a policy administered by Education Ministry that 72 credits hours are compulsory while for students also within Pro-Trainer One degree have to pass 1800 hours of on-jobs exercise which is also specified firmly by the country’s Labor Ministry for anyone wishing to obtain a certification in teaching as a trainer and therefore this makes a total hour of 2500 within one year. This results in a very intensive course arrangement in this trial scheme. Students almost have to study from Monday to Sunday, in which Monday to Friday morning, courses are conducted at Taishan Vocational Training Center and Friday afternoon to Sunday at NTUT.
EVALUATION

Evaluation and observation of this program at Taishan Vocational Training Centre will be shown it to be a very useful and systematic method in developing material.

Feedback from the students:
A questionnaire is designed to understand how effective the program can deliver to the student. Among the valid 112 samples, the following fact is revealed (Lo and Hwang, 2000):
1. The level of satisfaction of the overall program: Over 60 percent of students has a satisfactory feedback;
2. Over 60 percent of the students feel that the course hour is too intensive the loads on the student is very heavy;
3. Over 90 percent of the students acknowledge the program can be organized in two year of length.
4. Theorem-based courses should be instructed by NTUT while lab-based course to run by Taishan Vocational Training Center to reduce the overlap and thus the load for the students.

The Synergy of provision Pro-Trainer Degree
At Taishan Vocational Training Centre, with its Human Resources Training and Development team, this initiative is continually provided the opportunity of growth and update as the relationship established based on reasonable subsidiary scheme. For example,
(1). The purchase of software: This scheme allows the unit to purchase software in the light of teaching and compatibility between software usage at two sides
(2). A grand opportunity of mastering professional drawing systems, such as AutoCAD.
(3). Due to the founding nature of this scheme and the high allowance of budget available form government, this unit has been introduced to some of the state-of-the-art training facilities.
(4). Classroom styles and techniques are taught at Taishan Vocational Training Centre. Instructors received better skills of presentation skills.
(5). On of the greatest benefits in working at Taishan Vocational Training Centre is given the opportunity of access and see the first-handed types of electrical and electronic engineering technology that is prevalent nowadays.

These are only few of the advantages working with Taishan Vocational Training Centre. The tests of our abilities and providing knowledge and dependability have also been a challenge. This is rewarding and worthwhile experience for all the staff and experts out from NUTU who devoted themselves in this initiative.

DEVELOPING PRO-TRAINER ONE CURRICULUM FOR THE FEEDBACK

Taishan Training University (TTU) and National Taipei University of Technology (NTUT) are going to set up with the strategy to develop a training model for the prospective education system in this country. This involves with the study to devise course materials that must be highly effective. Pro-Trainer One thus comprises the following steps (Analoui, 1993):
1. Constructing a Task Analysis;
2. Performing a Behaviour Analysis;
3. Writing up Criterion Tests;
4. Selecting Instructional Strategies  
5. Developing instructional materials  

When the above tasks are comprehensively studied, a trainer should be capable to demonstrate their proficiency in producing sound and well-organised programs that will meet the specific needs of selected groups in electrical engineering facility. The following is a brief account of how each of these items works and an explanation of further usage in Pro-Trainer One.

**Constructing a Task Analysis**

A task analysis is an instructional tool exploited by developers or trainers, which would assist them identify which major task that a trainee must carry out and what subtask that will help trainee accomplish within one parental task. This coherent approach will offer an insightful analysis to each specification and a clear picture of what the trainee is expected to accomplish in succeeding any given course, (Dryden, 1999; Birnbraver, 1985)

The most effective method that can also be employed in commencing a task analysis is by means of querying: *What do I want the trainee to do or perform after getting through the training program or one unit of instruction?* The program courses units must be broken down to tasks and subtasks following by the analysis of target population (trainees) who will be going through the materials that are being developed. One can start by identifying those most relevant and stop at the point where one wants the learning to begin (Milano, 1998; Arwady, 1987).

**Performing a Behaviour Analysis**

Behaviour analysis is one of the more sophisticated tools that are applied in the Pro-Trainer One developing process. Principally, it is to measure or determine the proficiency of a person’s skills associated to a performance specified by the task analysis (Somekh & Davis, 1997; Esseff, 1986). It is therefore, in reality, that behaviour analysis acts as a bridge between the task analysis and criterion test items. The behaviour analysis poses the question: *What behaviour is required to fulfil the task?* The major types of behaviour that can be analysed: Cognitive, Psychomotor, and Effective. Cognitive behaviours are the intellectual or mental skills, which fall into the hierarchy of behaviour in this category (Rae, 1997). They consist of:

1. Recall;
2. Recognition;
3. Multiple-discrimination;
4. Concepts/principles;
5. Problem solving.

Effective behaviours are commonly referred to as *Emotions, Values, Attitudes*, and *Feelings*. However, effective behaviours can have an effect on the cognitive and psychomotor behaviours (Esseff, 1986).

Effective behaviours may comprise, but are not limited to:

1. Leadership;
2. Responsibility;
3. Initiative;
4. Resourcefulness;
5. Bearing and behaviour (body language)

In Pro-Trainer One, it is essential that each of the behaviours of trainees be assessed, especially in jobs, which deal with interpersonal contact with customers, clients, etc. The behaviour analysis is then integrated into the task analysis to determine the most appropriate means to effectively test learners (Esseff, 1986).

**Writing up Criterion Tests**

The term criterion test is often normally regarded as criterion-referenced test item. The word
referenced is used to clarify its meaning. The word criterion means standard. In the criterion test items, the standard is the performance set by the task analysis.

A criterion test item is referenced to one specific task, which is readily identifiable. Hence, when a trainee looks at a test, which is made up of this sort of question, he or she should be able to determine precisely which task is measured by each test item. The value of the criterion test items stem form two points:

1. The item refers to, or mirrors, one predetermined task.
2. It measures the directed learning, which has taken place.

The criterion-test item can be best described by the following guidelines: Teach (a) only what will be tested, and (b) everything that will be on the test; and test (a) only what has been taught, and (b) everything that has been taught.

Selecting Instructional Strategies

This topic plays a critical part for learners’ retention, and deals with instructional strategies. Instructional strategies refer to a mixed-use of modes, media, and environment selected to carry out instruction. Instructional strategies are used to present the information identified in the task analysis, collect the response from the learner, and provide feedback to the learner. In deciding the appropriate instructional strategies, there are three questions the instructors/developers must query themselves: (a) in what modes that an effective instruction can be ensured, (b) with what media can yield an effective instruction, and (c) in what environment that an effective instruction can be obtained. Instructional modes are described as methods for presenting information, collecting responses, and providing feedback (Henerson, Morris, & Fitz-Gibbon, 1987; Feldman, 1985).

Instructional media are those resources that are used to present information (stimulus), collect responses, and provide feedback. They also act as a reinforcement to supplement other methods of delivery. Certain media are more appropriate than others for presenting tasks. For example, generally, tasks ad subtasks fall into three main categories: (a) People-to-People tasks; (b) People-to-Paper tasks; and (c) People-to-Machine tasks.

Each media has its own advantages and disadvantages and this needs considerable investigation to find out the best media. Statistics today shoe that a combination of all of these media is required in order to maximise learners’ retention (Ashton, 1999; Feldman, 1985).

There are four major environments where learning may take place:

1. Classroom environment: 2. Independent study: 3. Skills labs: 4. On the job: In Pro-Trainer One, the course takes place in classroom, skills labs and also on-the-job and the independent study is left to the trainee to accomplish.

Developing Instructional Materials

Instructing methods are highly associated with learning environment, and the selection of media. Current statistics shows that a mix of media and environments can optimise retention for the learner (Feldman, 1985). When considering instructional materials for Pro-Trainer One, two primary concerns are addressed: (a) How can materials currently available be used or adapted to allow learners (trainees) to carry out tasks designated in the task analysis, and (b) how can new materials be developed from the task analysis?

There are a number of criteria should be aware of when developing instructional materials:

1. The materials must meet the needs of the targeting population;
2. The materials must make use of the design documents developed;
(3). The materials must be interactive;
(4). The materials must state objectives at the beginning of each module.

In other words, if the materials are enough to meet the requirement, there is no need to develop more. In summary each design document and its practical application in document or evaluation is as follows:

(1). Tasks identified in the task analysis will provide the content for programmes and instructional materials;
(2). The behaviour analysis will be utilised to determine what types of knowledge and performance tests required for development;
(3). The sequence of the tasks will be mapping to the learning hierarchies and courses outlines;
(4). The programmes will be modularised and broken down to a number of units in order to make them more accessible under various conditions of time frame limitation and participants interests.

Validating Instructional Materials

The closing step in the development process for Pro-Trainer One is the validation process. It is probably the most important steps since it is the real assessment to ensure that the initial criteria is gained. It is essential to make the courses a success.

In applying Pro-Trainer One, it is to bear in mind that the targets of validation are the materials rather than the trainees. The material might not be fully suitable but it needs people’s feedback and revision until the targeting population of learners achieving a score of 90% or higher of instructional objectives set at the beginning. The main criterion here is to ensure that those items tested are actually covered in the material provided. Often some items of interest deemed necessary and tested are not really covered in the material. Therefore, validation and re-validation may be necessary. One more item to stress in the industrially designed curriculum is to prioritise the arrangement of information by the task analysis and to make sure in the development process that appropriate coverage of the material is provided.

CONCLUSION

The professional methods of planning, developing, and delivering the material has equipped the team at National Taipei University of Technology highly professional within a pretty short span of time. The benefits to NTUT are explicit and the teams have experienced a good teaching atmosphere with more up-to-date software and hardware. The feedback to the academic system and technical education here at NTUT is overwhelming and the opportunity of working in a cross faculties and disciplines also brings to this initiative an enormous benefit and improvement in teaching and research. In the technical education ground, students are more confronted with challenge in job markets where the competition is fierce. However, the road to developing industrial favoured curriculum still has many challenges to overcome. Working with such a multifaceted project, multitalented group of individuals has presented another issue in the realisation of synergy. Though all the phases of delivering a better result, this initiative has always preserved and some other benefits are yet to be realised from establishing the partnership between two leading industrial institutions in Taiwan.

A large number of faculty staff will have the opportunity to take classes, instruct lectures, and develop materials. Though much of this achievement will be reviewed and this type of refresher in
theses processes is of benefit to anyone who was involved. The overall gains in the program for NTUT is virtually not predictable but will be realised through affiliation.

It is the long-term commitments for NTUT for the industry but some of the tasks are beyond normal administration scope and process and that means the gains is still debatable. Though all of the difficulties to date have been overcome. This also had seen a considerable stress on the staff working under this collaboration initiative with the partner institution. Long hours and a lack of qualified or interested personal who would be willing to involve has also put a strain on those of staff working with Taishan Vocational Training Centre. The amount of workload with usually short turnaround time has placed a challenge for team at NTUT, if flexibility had not been factored, could have been avoided.

Overall, this synergy has enabled those staff that worked at Taishan Vocational Training Centre to gain higher capability through delivering the successful result. This also strengthened the academic institution capability in practising vocational education and established a firm link between the education professionals both in academic and in the industry.

REFERENCES


