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Preparing engineering students to be in-company trainers through an experiential learning approach

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ABSTRACT: In this article, the author examines the preparation of engineering students to become in-company trainers through experiential learning. One of the key concepts was to assign students to develop technical training for a staff development course. The four main steps consist of analysing work tasks and defining requirements, planning and preparing training, conducting training, and evaluation and future development of training. All these steps are part of the development process of training students to understand, and be aware the roles and responsibilities of the in-company trainer based on experiential learning. The results of the assessment of the participants from the developed programmable logic controller (PLC) course by the students was that the average score was very good. Therefore, it was concluded that experiential learning is one of the strategies for preparing engineering students to become in-company trainers.

Keywords: Engineering student, in-company trainer, experiential learning, training for staff development

INTRODUCTION

Why do company personnel in industry need training? The main reasons are generally to support the achievement of planning, increase employee value, reduce attrition rates, enhance operational efficiency and exceed industry standards. Trainers are an integral part of the training process for achieving the objectives. What is the role of a trainer in a company? It is to develop competency and skill sets in an individual to perform effectively and efficiently in the work place. The trainer should communicate to the trainees about what is expected from the training in a simple and professional way. The trainer plays a pivotal role from the beginning to the end of the training that includes the following: training need, training plan, timing of training sessions, choosing the relevant training methods, preparing training materials and aids, conducting training sessions and evaluating the post training session [1-3].

With the rapid change of technology, training is needed in a range of organisations, and the increase corresponds directly with trainer wants. In particular, *Thailand 4.0* is a project in the high-tech strategy of the Thailand government, which is compliant with industry 4.0. However, with the number of existing trainers being insufficient to meet demand of the changing technology, it is necessary to develop new trainers.

The Department of Teacher Training in Mechanical Engineering in the Faculty of Technical Education at King Mongkut's University of Technology North Bangkok (KMUTNB), has a core mission of developing teachers for vocational schools, in-company trainers and industrial engineers. As mentioned above, the Department has developed and prepared manpower training for industry, and it continues to develop and prepare students in the traditional way. When students graduate to work, they will have to re-learn, which wastes time, costs and opportunities. There may be several ways to solve the problem, but in this case, the experiential learning approach is used to prepare in-company trainers. Details of the operation and preparation are discussed in the following sections.

IN-COMPANY TRAINER

In-company trainers in this article refer to all trainers, workers and other personnel whose work involves training/teaching or mentoring other personnel. In-company training in this sense is not restricted to in-company training as part of an education system. It covers all training conducted in the company, be it training of existing staff, standard

training for new employees, on the-job training or training of apprentices and interns [3][4]. The standard was developed using a bottom-up strategy by first defining the actual needs of training and trainers in real work processes. Four main areas of action of an in-company trainer were identified by the group of experts. These areas were arranged into four categories and continuous sequence [4]. The categories and competencies are related to each other and follow a logical order. The categories are: analysing work tasks and defining learning requirements, planning and preparing training, conducting training and evaluation and further development of training.

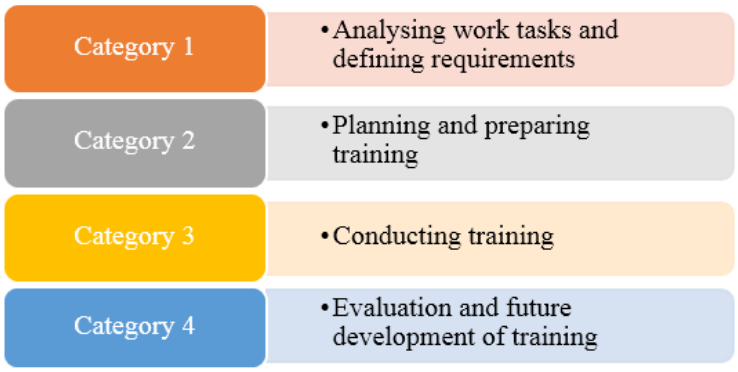

Figure 1: The roles and responsibilities of the in-company trainer.

Analysing work tasks and defining requirements: the in-company trainer should have the following core competencies: prepare to assess, identify performance gaps, determine cause of gaps, identify solutions for closing gaps, validate the next steps and measures, conduct design analysis, establish learning objectives and evaluation, create detailed design and develop materials.

Planning and preparing training: the in-company trainers' competencies in this section should include the following: design for transfer of learning, support implementation, prepare to facilitate and create learning environment.

Conducting training: **c**ore competencies in conducting training should be as follows: engage learners, foster learning and assess learning.

Evaluation and future development of training: competency in this final category that in-company trainers should have are to evaluate learner reaction, evaluate achievement of learning objectives, evaluate transfer of learning, evaluate business results and future development of training.

EXPERIENTIAL LEARNING

Experiential learning is learning that encourages learners to learn from activities or practices that are concrete experiences that lead to abstract knowledge through reflection, analytical thinking, conceptualisation, summarising and applying knowledge to practical situations. The experiential learning cycle consists of four key components [5-7], as shown in Figure 2 and detailed in the following order.

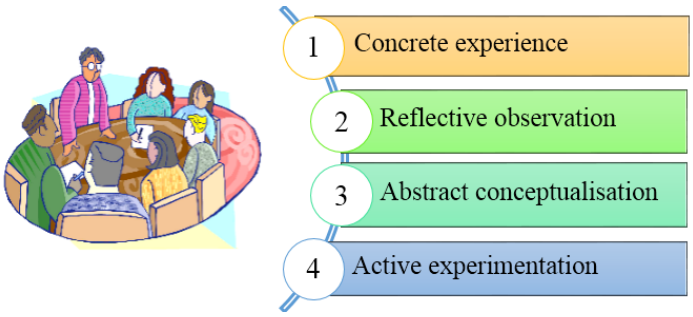

Figure 2: Experiential learning cycles.

Concrete experience: learners will gain experience from practicing the instructor's activities. It may be an experiment, reading, watching a video, listening to a story, discussing conversation, group work, games, role-playing, simulation and performance presentations. The important part of this step is that learners play a major role in the activity.

Reflective observation and discussion: learners express their opinions, feelings, and share experiences from activities with their group members. Learners will learn the idea and feelings from other people that help to learn more widely. The effect of reflection, the discussion, will give the concept or conclusion more weight. In addition, learners will feel themselves involved as a member. This step will help the learner develop both knowledge and attitude in the discussion.

Abstract conceptualisation: learners summarise information, comment from the reflections and discussions in step 2. At this step, the instructor may use questions to stimulate the learner. If the activity is new information, the instructor may supplement the information and facts on that point further by explaining, giving notice, reading documents, watching videos, etc. to complement the new experience. Learners can summarise principles, ideas or new knowledge by writing a summary of learning outcomes, drawing conceptual diagrams, charts or conceptual frameworks.

Active experimentation/application: learners must bring the concept, knowledge or conclusions of step 3 to experiment or application. Most teaching activities are lacking in experimental/applied concepts. This is an important step that the instructor will have the opportunity to learn and apply the knowledge. Activities related to application of knowledge, such as project work, knowledge dissemination activities and campaign activities.

CONCEPTUAL FRAMEWORK FOR PRERARATION

In fact, as an in-company trainer, students must have a basic knowledge, skills and attitudes towards the roles and responsibilities of the in-company trainer. The main basis of the above will include the following subjects (Figure 3): teaching profession, education psychology, innovation and instructional media, educational measurement and evaluation, teaching methods in vocational and technical education.

After the students pass through these courses, the students will practice microteaching, and this practice will be carried out within the group with the teacher supervising. In this practice, the topic and content framework will be defined for use in training for a staff development course in the following semester. The final stage of preparation is an in-company trainer who relies on the four steps discussed at the beginning by using experiential learning.

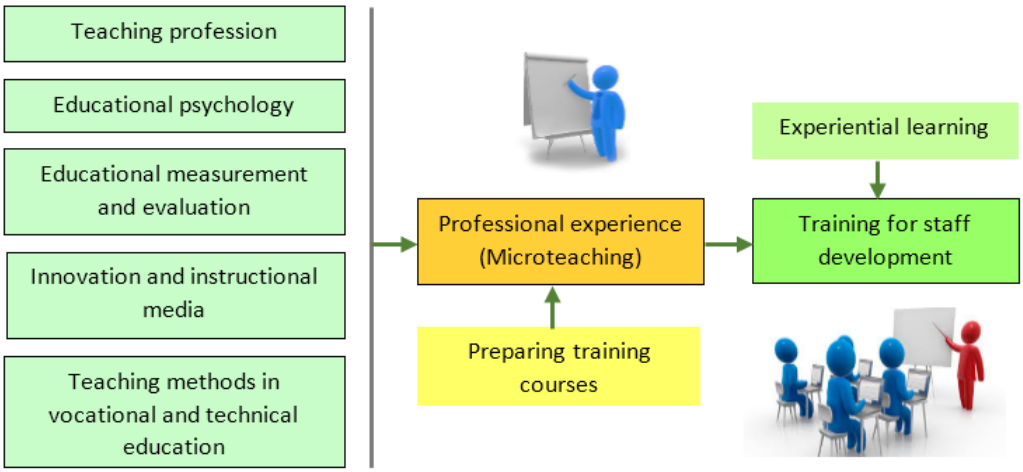

Figure 3: Conceptual framework for preparation of in-company trainers.

IMPLEMENTATIONS

The procedures will be applied in the staff training and development course (there are 16 registered students), it lasts 16 weeks, four hours per week. The process assumes the four main categories of the in-company trainer as mentioned above. These areas were arranged into four steps. The steps and competencies are related to each other and follow a logical order. The steps are: analysing work tasks and defining learning requirements, planning and preparing training, conducting training, and evaluation and further development of training. Each step will use the experiential learning.

Analysing work tasks and defining learning requirements: at this stage, the following experiential learning methods are used. Concrete experience: students will gain experience from practicing the instructor's activities. This study is to analyse and define learning requirements of applications of programmable logic controller (PLC).

Reflective observation and discussion: students express their opinions and feelings through experience in the activities and exchanges with members in the classroom. Abstract conceptualisation: students share a summary of the comments received from the reflection. Active experimentation/application: students have a series of training courses on the application of basic PLC that are available. All the above will take place within six weeks.

Planning and preparing training: the process in this step is the same as in the past which took six weeks. The students will divide the responsibilities, such as the group is responsible for finding the participants, group that serves as a trainer and assistant, group responsible for documenting, group is welcome and facilitated, group responsible for meal and snacks. Part of the active experimentation/application of experiential learning cycle is the result of the public relations through the social networks and others, to find the target group for the training course shown in Table 1.

Table 1: Number and details of participants.

Description	Number	Percent (%)
Sex		
Male	41	95.35
Female	2	4.65
Position		
Engineer	22	51.16
Maintenance technician	7	16.28
Teacher	6	13.95
Student	5	11.63
Sale representative	3	6.98

Conducting training: after developing the PLC course, people are interested in applying for training, and preparation of various aspects which are in accordance with the plan. Before the actual training, which is the active experimentation/application**,** it is essential to practice beforehand using the experiential learning process. In this process, it takes two weeks, but the actual course will take two days. Figure 4 shows the PLC training course provided by the students to the participants.

Figure 4: Show the environment while training.

Evaluation and further development of training: when the training ends, the next step would be to survey participants' satisfaction and comments on the course. The average score of 43 participants using Likert's 5-level scale is shown in Table 2. After the evaluation, the students used the same experiential learning process as before. Concrete experience: students analyse the results obtained after completing the training. Reflective observation and discussion: students express their opinions and feelings through experience in the activities and exchanges with members in the classroom. Abstract conceptualisation: students share a summary of the comments received from the reflection. Active experimentation/application: students report the summary of the training course with the problems, solutions and suggestions for the next training. All of the above will occur within two weeks.

Table 2: Evaluation results from the participants.

Description	Evaluation results	
	Mean	SD
1. Trainer		
1.1 The trainer was knowledgeable about the training topics	4.79	0.41
1.2 The content was organised and easy to follow	4.50	0.50
1.3 Participation and interaction were encouraged	4.63	0.48
1.4 The trainer was well prepared	3.99	0.98
2. Participant comments on the course		
2.1 The objectives of the training were clearly defined	4.68	0.57
2.2 This training experience will be useful in my work	4.54	0.50
2.3 The training objectives were met	4.84	0.36
2.4 The time allotted for the training was sufficient	3.63	1.04
2.5 The integrity of the documents used for the training	4.47	0.50
2.6 The experimental set was available and adequate for training	4.32	0.73
3. Other		
3.1 Reception and registration procedures	4.05	0.76
3.2 The training room and facilities were adequate and comfortable	3.84	0.87
3.3 The quality and hygiene of meals and snacks	4.11	0.85

DISCUSSION

From the conceptual framework, the implementation and results of the evaluation reflect the well-prepared students as in-company trainers, as discussed in the following order. The main purpose is to prepare students to learn, understand, and be aware of the role and responsibility of being an in-company trainer. In this case, the application of experiential learning is applied to all stages of the training course development. The results of the four steps of the training course development were as follows.

In the first step (analysing work tasks and defining learning requirements), the instructor assigned the students to develop the PLC training course. The measure of the success of this procedure was the result of a questionnaire from 43 participants in the following topics (Table 2): the objectives of the training were clearly defined (the average score was 4.68), this training experience will be useful in my work (4.54), the training objectives were met (4.84), and the integrity of the documents used for the training (4.47). The average score on each of these topics reflects the success of the first step.

In the second step (planning and preparing training), the success indicator of this stage was 43 participants. In addition, the results of the average score received from participants on the topics of the trainer was that he/she was well prepared (3.99), the experimental set was available and adequate for training (4.32), and the training room and facilities were adequate and comfortable (3.84).

In the third step (conducting training), the average scores from participants were obtained in the following topics: reception and registration procedures (4.05), the trainer was knowledgeable about the training (4.79), the content was organised and easy to follow (4.5), participation and interaction were encouraged (4.63). The average score of the topics mentioned shows the satisfaction of participants, reflecting the competence of the students as a trainer.

In the final step (evaluation and further development of training), at this stage, the student evaluates the participants' satisfaction, then analyses and summarises the results of the training project, and then presents the instructor in the next order.

As a result of the presentation, students can clearly project the strengths, weakness and suggestions for improvement in future training. The process of developing a training project will be based on an experiential learning. The results of the development are reflected in the participants' feedback as discussed previously. This process allows students to learn through real-world experience in a systematic way. Thus, it is the preparation of the engineering students into a career as well.

CONCLUSIONS

Due to the rapid technological change, organisations need continuous human development, and the trainer is an essential requirement in such circumstances. In this article, the author describes the preparation of students to be in-company trainers through experiential learning. The key concept in preparation was to assign students to develop technical training course to technicians and engineers.

All steps in the development of the training courses of the students to understand and realise the roles and responsibilities of the in-company trainer are based on experiential learning. The results of the evaluation of the participants from the developed PLC course showed that the average level was very good. Therefore, it was concluded that the experiential learning as one of the strategies for preparing engineering students to become in-company trainers.

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BIOGRAPHY

Pornjit Pratumsuwan received his BS, MS and PhD degrees, all in electrical engineering and education, from King Mongkut's University of Technology North Bangkok (KMUTNB), Bangkok, Thailand, in 1989, 2003 and 2011, respectively. He is currently an assistant professor in the Department of Teacher Training in Mechanical Engineering at KMUTNB. His current research interests include fluid power and controls, mechatronics and engineering education.