
Learning Elements Affecting Practical Competencies

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Abstract

The research objectives are: to study the learning factors affected to the lack of practical competencies, to develop and assess the achievement of the classroom activities that consists of the teaching methods, instructional media, and implements. The questionnaires were divided into two sets. First set was used to query and assess the satisfaction of the instructors and trainers about the practical competency shortage in the electrical installation works of students. Second set was used to quiz the opinion of students about the learning activities in the electrical installation course. The investigate results revealed two important problems were the pedagogy method did not support to create the practical skills competencies, and the training materials insufficiency that affecting to experiences. The investigation results were used to analyze practical skills learning, learning problems, and classroom environment. The e-learning were used to enhance and replace the traditional pedagogy in learning process. The practical training was designed in the face plate simulator aspect by using replicas materials to compensate the lack of training materials. The sixty-four undergraduate students in third year were assigned to the experiment and a control groups. The simulation training method was compared to the traditional training method by pre-test and post-test to find the achievements of the learning. The standard testing model of the department of skill development was adapted to decide the achievement of practical competencies in the real working testing. The training satisfaction of students was evaluated by using the questionnaire after finished the experiment process.

Keywords: Practical competencies; Competency; Replicas material; Learning and training environments

1. Introduction

Nowadays, the employers need the students who can work already after finishing from the education institutes. Actually, most of the graduates must be training by their employers before starting in new work places [1]. The practical skills insufficient in the students are the essential thing which must be improve and develop to

the suitable capability of students. The characteristics of the 21st century skills of people competency include the self-learning, creativity, responsibility, collaboration and problem solving [2, 3] that are essential to works. In western societies, employers expect that new employees will have more knowledge, more skills, and will be more intrinsically

motivated than employees were two decades ago [4]. The answer may be that the worlds of employment and the education are different [5] caused by technologies in the institutes are outdated compared to technologies in factories are complex and difficult to study. Therefore, the worker's learning ability and problem solving in working by themselves are required by employers.

The laborers' practical skills ability shortage is an interesting problem and it is a barrier to the development of industrial technology growth. The obstructions occurred were the training costs, training materials, training places, training media that limited and insufficient to trainees, who need to refine and improve their practical skills ability, and the vocational education of the institute was involved. These problems are repetition occurred in developing countries. Therefore, the development of the training of the vocational learning is an essential thing, to improve and solve these shortage problems.

2. Materials and Methods

2.1 Analysis Training Approach

- **Defining Skill Level of Students**

The practical competencies shortage situation of students indicated to practical skills ability that occurred within the institutes affecting toward the enterprises. According to the education enterprise linkages: developing occupation standard and qualification told about the qualification system that was divided by level of performances were consisted of five levels: semi-skilled, skilled, technician, technician expertise and professional level, on the other hand, it also provides definition about meaning for each level [6]. For the practical competencies shortage study, regarded to expectancy and requirement of the enterprises, education institutes, government, and participants towards vocational students. The interesting things of them were student occupation competencies which contained academic knowledge, working knowledge, skills ability,

responsibility, and team collaborative. Many factors have been mentioned that indicated to the skilled level of the qualification system and matching for the meaning of the skilled level workers that contained the responsibility toward tasks assigned, complex working, and team working [6]. Therefore, the appropriate study level of the research is skilled level. The skilled level that is suitable to age, learning environment, live experiences, learning cultural, and intellectual level which relative to seniority and qualification of the novice vocational students.

- **Appropriate Direction to Develop Learning and Training Process**

The practical skills ability shortage and the uneven quality of students become relatively serious to the institutes, enterprises, and participants [7] because "Designing electric installation project, demands not only academic knowledge, but also other types of knowledge not easily acquired through traditional instructional methodology" [8]. A lot of missing knowledge that could be fulfilled with addition of the empirical knowledge, therefore pedagogies must be supplemented with possible different categories of knowledge, such as real-life practical, virtual reality, and other simulations [8]. According to the multi-level practice training model which has achieved good results was used in the western region local university of China by using second classroom training to provide differential activities. Moreover, they presented the improvement of the experimental equipment and contents were reformed to train practical capability of the electrical engineering students [7]. Presently, the number of study periods have limited and packed tightly in normal study times. Therefore, the appropriate and possible aspects of the additional learning should be the private course learning. The private course must support self-learning and training aspect to students.

2.2 Individual Difference in Learning

"Many observe that these cultural differences among students have a significant impact on the learning process. For instance, workers from different cultures appear to exhibit different styles of work and problem solving [10]. The appropriate learning is support the learner to success [11]. The differences of individual relate to learning aptitude, gender, culture, age, and other demographic variables. They gave opinion about interesting and learning difference that should have appropriate with the learning strategies. The learning strategies make such a difference to learning success [12]. Experiential learning theory is used to describe the learning process and Kolb Learning Style Inventory is used to assess differences in how individuals learn [10].

- **Learning Modality and Training Execution**

"Researchers and practitioners use learning style research with personality and cognitive styles to determine ability, predict performance, and improve classroom teaching and learning" [12]. The learning forms are consisted of the thinking style and the learning strategy which are the learning modalities of the learners, who used to respond in the suitable learning activities with the situations and the works [13]. The individual difference relate with the humans thinking. The individual difference consisted of the belief, the attitudes, the cognitive style and learning style. The learning styles are the physical aspects and thinking features which the peoples knew, responding and related with the learning environment [14]. As the results of researched focus the thinking style and the learning style of the learner that have affect to the learning achievement. The learning achievement could be increasing when the teaching method, the instruction media and the learning environment relation and matching with the learning style and thinking style of the learner. The learning

style identified the importance of distinguishing between the two terms. The cognitive style represents a stable characteristic representing an individual's typical manner of receiving and processing information [15]. For the cognitive styles and the learning style studies, the teachers and the trainer necessary to understanding the cognitive levels and the cognitive styles of the learners or the trainees for helping the students to successful in the learning by relation with the cognitive level of the learners. The intelligence is the important thing for the learning successful. An intelligence which consisted of the problem solving ability, the communication dialoged, language, the social ability and the interpersonal skills [16]. A triarchic theory of the intelligence contained the componential aspect, the experiential aspect and the contextual aspect. The componential aspect focused on the thinking factors, that relation with the data analysis in the problem solving of the mental process or skill while an individual indicated the behavioral from any causes. The experiential aspect highlighted the experiences which constructive the cognitive of the peoples. The tacit experience, it could help to solve the new problem, for example is an adaption to a new work place and the conflict between the partners. The contextual aspect is the cognitive flexibility to solve the instantaneous problems that are varied all time [17].

2.3 Research Assumption

The first assumption for the lack of practical competency in the students consisted of the quantity of the inappropriate training practice and the insufficiency of the training material. These problems could use the simulation training model consisting of the web based learning contents and the replicas training material to compensate the lack of practicing skills in the students? Second, according to the instructors, trainers and coaches, who believed the suitable practical skills training

methods that consist of the demonstration, coaching, and formal training course. Therefore, the new learning method designed would have capability better than the traditional learning and training method? Lastly, the training media and tools are important to extend the practical skills in working of students. The real situation of practical skills training in the workshop, students are limited the training materials. They cannot improve their incorrect practices and create practical competencies to raise capability. Therefore, the simulation training model consisting of the web base learning in e-learning media and the replicas material, they could support and remunerate insufficient tools in the students?

2.4 Research Methodology

The research conceptual framework was used to consider the factors. Beginning, the investigation into two sets, the first set is used to query and assess the satisfaction of the instructors and trainers about the practical competencies shortage in students, second set is used to quiz the opinion of students about the electrical installation course. The investigation results lead to analysis the crucial elements of practical competency shortage. The elements consist of the teaching method inappropriate, training material privation, training time insufficient, lack of repeat practice opportunity, learning aspect inconsistency, teaching media inappropriate. These factors are did not support and create the working skills, self-learning, self-working, problem solving, making decision, and necessary knowledge in the career working. Kolb's experiential learning theory used to design the appropriate learning and training aspect for individual difference, and possible to learning in the students. The short term training course used to develop the practical competencies and problem solving skills from the results of the problems analysis by the using of experiential learning theory. The e-learning contents on web-based learning and the practical implements

(replicas training material) were used in the examination process for self-learning aspect. The participant students are assign to learn two hours in six weeks after normal classroom. Seventh week, the students were examined in the real working aspect underly the real situations. The standard training testing model of the department of skill development of Thailand was applied and adapted to test the final practical competencies in the real working of the students for evaluating the student competencies.

- **Participants**

The investigation participants are consist of thirteen instructors in the electrical field in the university, nine auditors who acquired the licence for inspection the electrical installation standard examination in first level form the skill development, sixty-four electrical technology students in two classrooms which study the electrical installation course in third year. The students were assigned to participants in study for the experiment and control groups

- **Practical Skills Learning Investigation**

The instructors, trainers, and auditors in the electrical field answered the questionnaire and gave their opinions to the working knowledge and competencies in the investigation as showed in table 1. Moreover, the instructors who teach an electrical technology courses answered the questionnaire and explained about the obstacle of the practical skills learning and activities in classroom and work shop. The obstacle that includes the training material insufficient and unbalance to students, the learning and training contents which difficult to immediately understanding because it must be learning by doing and understanding via the training activities, and learning time period limited that could not teach with carefully to each student on face-to-face demonstrate aspect. The electrical technology students answered the

questionnaire about their opinions to learning feeling in the classroom learning and training process of electrical system installation in the piping bending topic in the interviews as showed in table 2. Furthermore, they are the sampling groups in an observation for keeping the facts in learning process. The participant students were randomly assigned to examine competency by using skills test to consider the practical competencies shortage.

Table 1. Working skills satisfaction level of participants.

Working Skills shortage	Satisfaction (%)
Career basic knowledge	39
Working skills abilities	31
Problem solving decision	16
Working precision	41
Accuracy as model	34
Self-working	45
Self-learning	48
Working adaptive	37
Using tools appropriately	53

Table 2. The practice learning opinion of students toward learning process.

The cause of skills lack Opinions	Opinion (%)
Teaching method	40.1
Training material privation	22.3
Training time insufficient	40.1
Repeat practice opportunity	24.3
Learning aspect inconsistency	37.7
Teaching media inappropriate	42.7

• **Theory and Learning Model Analyze Practical Competency Shortage in Learning Process**

The practical skills instruction configurations in the learning model as showed in figure 1 were indicated to important parts which are mainly factors of the practical skills learning that are teaching method, and training material. Both main factors were used to create the learning aspect through observe, think, feel, and act of the practical skills learning. The teaching method is the demonstration practices that would be provide the concrete experiences

(observe) and the reflection observation (think) to students. The training materials are equipment to the students using for training in self- performing the sub-skills steps and the total skills step. The practical skills shortage is analyzed by using the experiential learning model and the practical skills instruction models.

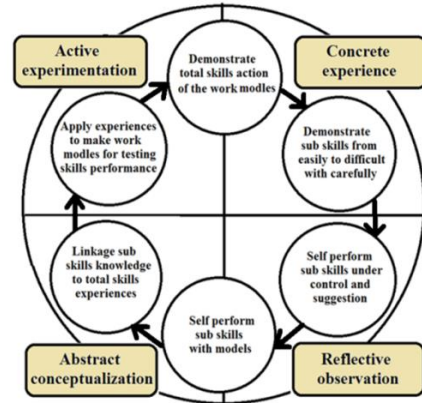


Figure 1. Learning model to analyze learning activities.

First, the concrete experience was used to analyze the practical skills lack situation by comparison between Kolb's experiential learning cycle model and the results of the investigation. The concrete experience identified the important causes of practical skills shortage situation. The important problem was the inadequate of the skills practice materials which had affected the practical skills training process in the students. Therefore, the students did not receive the concrete experience from the practical skills training process adequately.

Second, the reflective observation stage described the practical skills shortage effects by considering the correlation between Kolb's experiential learning model cycle and results of the investigation. The reflective observation indicated the important causes of the practical skills shortage situation. The practice unsuitability and practice periods inadequacy had affected the students understanding, applying, and skills of the decision making

to problem solving in training process. Thus, the students could not receive reflective observation from the skills practice training, they could not reflect the skills practice and problem solving for the observation because of the lack of the practical and problem solving skills.

Third, the abstract conceptualization stage was used to analyze the practical skills shortage effects by a comparison between Kolb's experiential learning model cycle and results of the experiment. The abstract conceptualization revealed the important causes of practical skills lack situation. The important problems are the incomplete practice in the each skills practical training and the continuous skills practice training involve the limited skills practice which affected the integrated skills knowledge in the students training process. Thus, the students received less or never got the abstract conceptualization from the skill practice learning

Lastly, the active experimentation was used to analyze the practical skills shortage effects by a comparison between Kolb's experiential learning model cycle and results of the investigation. The active experimentation showed the important causes of skills lack situation. The important problems are the privation of tools for practicing, training material and training media. The important causes affected the repeat skills practice in the training process. Therefore, the students did not receive the active experimentation from the practical skills training process.

Summary, the comparison processes of Kolb's experiential learning model with skills practice lack situation in the electrical system installation training revealed the main training problems, which consist of skills practice training materials inadequacy, the skills practice training was not run continuously, limited and insufficient skills practice training resources. The initial causes leading to unsuccessful of the practical skills training and the solving

problem skills in the students. Therefore, the results of the analysis that identified importance factors consist of teaching method and training material.

2.5 Learning Method and Training Equipment Analysis and Design

The practical skills shortage and the problem solving skills lack results were analyzed by Kolb's experiential learning model which used to define a private practical skills training course. A private practical skills training course was used to improve the skills lack in the students.

- **Modeling Strategy for Skills Learning Course**

The skills shortage situation consist of the elements of the practical skills and the problem solving skills lack which were used to define the electrical system piping installation training course. The short term training course was analyzed to describe the training course objectives need that use to portray the main skills of the training course. The training loop was consisted of the learning method and main skills which had six sub skills and Kolb's experiential learning model were used to check capabilities level in practical skills training and knowledge occurred. The modeling design skills training course as showed in figure 2.

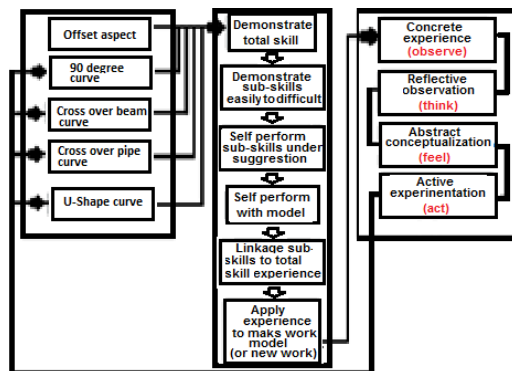


Figure 2. Designing the practical skills learning methodology.

- **Training Method in Online Learning Contents**

The learning media could find on the website in the online contents. The e-learning is the most essential progress in recent education movement and it rid the distance, place, and time obstacles. The e-learning materials were expected to be available and to the characteristics of publics occupation training. The already e-learning media from WWW.TEMCA.COM were used via web based learning to enhance and replace the pedagogy of the learning process and the websites which provides a multi-sensory learning approach to the learners by using words, pictures, sounds, animations, and images to achieve learning objectives.



Figure 3. The students learned via the online e-learning content.

- **Training Materials Design**

The training materials are the metal conduits which insufficient to each student. Therefore, the researcher produced the replicas training material in the replicas pipe aspect for the face plate simulator training. The replicas pipes avoids and reduce expenses of the materials damage and it could repeat used unlimitedly to compensate the real metal conduits that could not reuse and repeat for using in the practical training process.

- **Experiment Procedure**

Two groups of the technology students consisted of the sixty-four members are defined to participate in this study. First group (C-group) was defined to a control group learn by the traditional learning method. Secondly group (Ex-

group) was defined to an experiment group learn by the face plate simulator method (replicas material). An experiment is determined the schedule is two hours per week in six weeks. The students would be learning the electrical system installation in the conduit bending topic via online media as full time learning in two groups as showed in figure 3. Both groups were tested by pre-test before begin the experiment process. After the classroom learning, instructor that was used the working tests, an interview dialogs, and an observation to evaluate knowledge, experience and skills of students about the learning contents of the electrical system piping installation topic. After finishes an experiment process in six weeks, the instructors used the post-test include the real works test and the standard criteria gain of the labor skilled development department to decide practical competencies of the control group and the experiment group. The standard criteria gain was adapted in some part. The new criteria was used for decision about the piping installation works, to pay the scores in the consider process of the final testing.

3. Results and Discussion

Two groups of the electrical technology students which consist of 64 members are defined to participate in this study. Both groups of the participants reduced the group size into half of the original groups while the training process. Table 3 was presented the results of the student practical skills learning. The comparison results revealed the practical competencies of the control group in five important tasks did extend significantly. The results of experiment group have values more than the control group significantly at confident level 0.95.

Table 3. The comparison results of training between control group and experiment group.

Practicing	Mean	S.D.	t	Sig. (2-tail)
Offset	-0.6875	1.1482	-3.387	0.002
90° Curve	-0.5312	1.0155	-2.959	0.006
Cross over beam	-0.250	0.4399	-3.215	0.003
Cross over pipe	-0.5937	0.8747	-3.840	0.001
U-shape curve	-0.1562	0.3689	-2.396	0.023
Total test	-3.2812	5.2685	-3.523	0.001

* $p > 0.05$

Table 4 is presented the comparison results among the training material, teaching method, repeat opportunity, practical skill, and problem solving skills. The results indicated any variables below that affected to increase the practical competency in the students. The teaching method, material quantity affected to increase the problem solving ability but repeat practices quantity and opportunity did not affect to promote the problem solving ability.

Table 4. The comparison results of skills abilities and training factors in control group and experiment group.

Practicing	Mean	S.D.	t	Sig. (2-tail)
Teaching method - practical skills	0.21918	0.9942	3.262	0.001
Training material privation - practical skills	0.36530	0.9833	5.498	0.000
Training time insufficient - practical skills	0.37443	0.9465	5.854	0.000
Repeat opportunities - practical skills	0.31507	1.2364	3.771	0.000
Learning inconsistency - practical skills	0.32420	1.1731	4.090	0.000
Teaching media unsuitable - practical skills	0.22831	1.1223	3.010	0.003

* $p > 0.05$

4. Conclusion

As the results of the table 4, the practical skills could be produced by the repeated practices continuously. After training by using the replicas training

material, in the final week, the students could use the metal conduit and got the rather high score in the real works test. Therefore, the replicas training material could be used to compensate the real metal conduits in training process. The problem solving skills did not produce by the repeated practices continuously. The practical skills learning by using the e-learning via web based could be support and create practical learning in the knowledge aspect. Moreover, in the experiment process, the researcher did not assist the students, they learned by using the e-learning media only. Lastly, the learning media, tools and practice materials were effective for increasing the practical skills and problem solving skills.

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