

The Construction and the Evaluation of Efficiency of the Instruction on the Topic Heat Treatment of Steels

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Abstract- the research aimed to construct and evaluate the efficiency of the heat treatment of steel lesson, undergrad learners. Firstly, the lesson had been divided into five contents; they were the principle of heat treatment, the time-temperature-transformation phase diagram and the continuous cooling transformation diagram, the method of heat treatment, the heat treatment of steel practices and the hardness testing practices. Secondly, the lesson had been evaluated by three specialists, $\bar{x} = 4.67$, S.D.=0.58 and the efficiency of the lesson were 80.83/82.23, by 61 learners enrolled the Metallurgy and Heat Treatment of Steels, semester 2, 2016. Lastly, The evaluated teaching of undergraduate learners had the average levels in all contents, $\bar{x} = 4.54$, S.D.=0.05.

I. INTRODUCTION

The National Economic Development Plan of Thailand has focused on ability, performance and competitions leads to increase dramatically industries. Heat treatment of steels sector is one of the industries that has been supported and promoted by the Government [1]. One of the most obviously is that the automotive parts as academic information, expert assistances have been supported the establishments by the Government. Not only information and assistance but also support money has been assisted significantly on industry research papers [2]. Training staffs, heat treatment of steel, have knowledge, ability and skills not only increase productivity of business but also competitiveness of the country.

The intensive curriculum for the special industry staffs or engineering students has importance as it can be prepared experience, knowledge, skills and characteristics to the learners by evaluating [3]. The curriculum is important as it can be transferred conventional patterns of experience to the learners, knowledge, ability, performance so that the research, emphasis on heat treatment staffs and engineering students, constructed the heat treatment of steel lesson with was similar the heat treatment of steel practice in industries.

II. RESERCH OBJECTIVES

1. To construct the heat treatment of steel lesson for undergraduate with has quality.

2. To find the performance of heat treatment of steel lesson for undergraduate.

3. To evaluate the teaching method of heat treatment of steel lesson with has good level.

III. RELATED LITERATURE

Yuth Kaiyawan [4] conducted Development and Training Curriculum Effectiveness for Quality Inspection and Control in OEM Automotive Parts Production. In this research, he constructed the training course for 3 sections: 1) statistical methods for quality control 2) the use of MIL-SRD-105E standard tables and 3) creating control charts. The course was experimented by 29 staff samples, purchasing department, production department and transport department, in order to evaluate the effective indexes in each sections and the efficiency of training. The results, the effective indexes section 1, 2 and 3, were 68.50, 72.76 and 63.55 percent, respectively which were higher than 60%. Moreover, the efficiency of training, 80.29/81.43 was higher than criterion in this research, 80/80.

Sarun Jaruchitsophon et. al. [5] conducted research, Effect of using Cognitive Tools in Web Based Instruction upon Creative Problem Solving Skill of Undergraduate Students, which 30 students enrolled Art of Speaking and Presentation subject, North Bangkok University, semester 1st, 2011. The research tools were the cognitive tools in web based instruction, a document of evaluation lesson quality about content and technical, a study achievement document, a document of ability in writing and questionnaire of satisfaction. The research resulted the specialists evaluated, the cognitive tools in web based instruction, the content and technical was highest, $\bar{x} = 5.00$, S.D. = 0.00. What is more, the score of the achievement after study, $\bar{x} = 21.19$, S.D. = 2.23, was higher than the score of the achievement before study, $\bar{x} = 15.24$, S.D. = 2.64, the statistical significance at .05 level. Lastly, the students evaluated a student's satisfaction on web based instruction, high level.

Lapus Poolperm and Manit Sittichai [6] conducted a Construction and Efficiency Validation of Web-Based Instruction for the topic AC Circuits, Vocational

Certificate Level, Lopburi Technical College for the 1st year students, 30, year 2011. In this research, they constructed a Computer Assisted Instruction, the AC Circuits lesson, on internet with had efficiency for the students, various learning skills. The efficiency of training, 81/80.06, was higher than 80/80, in addition, the various learning skill students had similar Academic progress, the statistical significance at .01 level.

IV. METHODOLOGY

The research methodology has these steps.

3.1 To study the course of Metallurgy and Heat Treatment in curriculum of Bachelor of Engineering Program in Tools and Dies Engineering Technology, The College of Industrial Technology, King Mongkut's University of Technology North Bangkok 2011 [7] in order to prepare the research. In this curriculum had the objectives to increase knowledge, analysis and realization in Metallurgy and Heat Treatment for industries.

3.2 To plan the experiment, this research was experimental research with has one group pre-test, post-test design, to sample with only one group to getter with pre-test and post-test.

3.3 Define population and sample

3.3.1 In this research, the population of students was Tools and Dies Engineering Technology undergraduate students, The College of Industrial Technology, King Mongkut's University of Technology North Bangkok, enrolled semester 2nd, 2016 for 2 classes with were plastic tools and dies 33 and metal tools and dies 28.

3.3.2 The research sample had been selected the specific collection by Tools and Dies Engineering Technology undergraduate students with enrolled Metallurgy and Heat Treatment Methods course in semester 2nd, 2016. Every Monday, the learning and teaching had been processed at 9.00-12.00 a.m. for plastic tools and dies undergraduate students and 13.00-16.00 p.m. for metal tools and dies undergraduate students. The sample was able to representative population as in all respects; the collection used the similar criteria with population.

3.4 Creating research tools.

3.4.1 To study and analysis Metallurgy and Heat Treatment curriculum with has the objectives to increase knowledge, analysis and realization in Metallurgy and Heat Treatment for industries.



Figure 3-1 the heat treatment furnace



Figure 3-2 some heat treatment apparatuses

3.4.2 To analyze topics and contents in order to compiled the suitable lessons and according behavioral objectives. The lesson of Heat Treatment had been analyzed the materials with were compact, obvious quality and multiple media to getter with heat treatment and hardness testing practices. There were 5 contents 1) the principle of heat treatment 2) the time-temperature-transformation phase diagram and the continuous cooling transformation diagram 3) the method of heat treatment 4) the heat treatment of steel practices and 5) the hardness testing practices. The heat treatment furnace provide in figure 3.1, some heat treatment apparatuses show in figure 3.1 and the hardness test machine provide in figure 3.3

3.4.3 To evaluate the priority contents and analyze the behavioral objectives, the five contents had been analyzed in the analytical table for grading contents. The specialists inspected and evaluated the contents and the behavioral objectives, after that the adjusted materials had been constructed to the heat treatment of steel lesson.



Figure 3-3 the hardness testing machine

3.4.4 To construct the questions in Achievement Test related to the behavioral objectives. The test, one hundred items were the multiple choice exams 4 options with had one of the absolutely correct answers. Consistency index, the test and behavioral objectives, had been inspected and considered the suitability by the three specialists.

3.4.5 The sample test had been proved by the Tools and Dies Engineering Technology (plastic tools and dies) undergraduate students, The College of Industrial Technology, King Mongkut's University of Technology North Bangkok, enrolled semester 1st, 2016 for 35. The score of the test had been analyzed to the quality of the test with was the Level of Difficulty, the Discrimination Power. The number of tests with had the Level of Difficulty, 0.20-0.80, and the Discrimination Power, more than 0.20, passed the criteria for 85 items.

3.4.6 The reliability test scores, 0.90, had been analyzed by KR-20 formula this means heat treatment of steels test has suitable reliability and can exam with the learners. Then, the test had been constructed to the Final Test and the Achievement Test.

3.5 Data Collection

3.5.1 To prepare the experimental rooms, the researcher selected the Rooms number 207, Building 63 as it has the lecture room and practice area. The timetable, every Monday, semester 2nd, 2016, plastic tools and dies undergraduate students learned between 9.00 and 12.00 a.m. and metal tools and dies undergraduate students from 13.00 to 16.00 p.m.

3.5.2 To prepare the equipment for the heat treatment and the hardness testing practice such as, furnace, S45C steel, pliers, quenching media and Rockwell hardness testing machine.

3.5.3 The students had been examined the test with was similar to the Achievement Test.

3.5.4 The five contents had been taught to the learners.

3.5.4.1 The principle of heat treatment.

3.5.4.2 The time-temperature-transformation phase diagram and the continuous cooling transformation diagram.

3.5.4.3 The method of heat treatment.

3.5.4.4 The heat treatment of steel practices.

3.5.4.5 The hardness testing practices.

After finish each lessons, the learners had been examined the Final test.

3.5.5 After completed five contents, the learners examined the Achievement Test.

V. RESULT

The result research had been divided to 3 sections.

4.1 The analysis of lesson by three specialists, the evaluated results, was good level.

4.2 The evaluated results of the lesson had been provided in table 4-1

The table 4-2 provided the average score of Pre-Test in each contents, summary average scores $\bar{x} = 29.44$, S.D.=2.66 and the finished Heat Treatment of Steels lesson, five contents, Post-Test scores were $\bar{x} = 80.83$, S.D.=3.56.

The table 4-3 provided the efficiency of Heat Treatment of Steels lesson. By finished lesson, the average scores, Final-Test, were $\bar{x} = 80.83$, S.D.=3.56 similarly in Achievement Test, they were $\bar{x} = 82.23$, S.D.=3.22. The two results were higher 80/80 criteria, this mean was the lesson has efficiency.

4.3 The evaluated teaching of graduate learners in the Metallurgy and Heat Treatment of Steels, enrolled semester 2, 2016, illustrated in the table 4-4.

The evaluated teaching of graduate learners in all contents, they were the average scores $\bar{x} = 4.54$, S.D.=0.05. The highest scores were the completely lesson plan and concordance in curriculum $\bar{x} = 4.63$, S.D.=0.59, the clear language and easy to understand $\bar{x} = 4.55$, S.D.=0.59, the teaching contents cover the materials in curriculum $\bar{x} = 4.55$, S.D.=0.62 and the numerical, communication and information skills $\bar{x} = 4.66$, S.D.=0.56, respectively.

Table 4-1 the evaluative contents by specialists.

Evaluation items	$\bar{x}$	S.D.	Level of quality
1. The lesson suitable for the industries	4.67	0.58	Very Good
2. The apparatus and tools availability for learning	4.33	0.58	Good
3. The objective learning completeness	4.00	1.00	Good
4. The sequence transferring to learners	4.33	0.58	Good
5. The learning suitable for applied working	4.33	0.58	Good
6. The sequence learning suitability	4.67	0.58	Very Good
7. The period for learning	4.33	0.58	Good
8. The test for evaluation	4.67	0.58	Very Good
9. The evaluative criterion for learning	4.33	0.58	Good
10. The instructor in lesson	4.33	0.58	Good
Overall	4.40	0.21	Good

Table 4-2
the Pre-Test scores and The Post-Test scores in five contents.

		Contents				
		1	2	3	4	5
Marks		15	15	15	15	15
Pre-test	$\bar{x}$	28.63	29.29	28.31	29.95	31.04
	S.D.	1.24	1.32	1.39	1.01	0.89
Post-test	$\bar{x}$	80.11	80.33	80.77	81.75	81.20
	S.D.	1.41	1.47	1.64	1.74	1.61

Table 4-3
the efficiency of Heat Treatment of Steels lesson.

items	N	A	$\bar{x}$ (S.D.)	%	E1/E2
Final-Test	61	75	60.62 (3.56)	80.83	80.83/ 82.23
Achievement Test	61	75	61.67 (3.22)	82.23	

VI. CONCLUSION

By finished and evaluated the efficiency of Heat Treatment of Steels lesson, it had been concluded the results that 1) The Heat Treatment of Steels lesson had five contents, the principle of heat treatment, the time-temperature-transformation phase diagram and the continuous cooling transformation diagram, the method of heat treatment, the heat treatment of steels practices and the hardness testing practices.

Table 4-4 the evaluated teaching of graduate learners in the Metallurgy and Heat Treatment of Steels, enrolled semester 2, 2016, [8].

The lesson plan and learning apparatus	Mean	S.D.
The completely lesson plan and concordance in curriculum	4.63	0.59
The material and teaching Textbooks are appropriate	4.51	0.70
The apparatus and teaching medias are appropriate	4.47	0.72
The instructor	Mean	S.D.
The instructor's expertise and ability	4.54	0.62
The timeliness and always teaching	4.53	0.64
The clear language and easy to understand	4.55	0.59
The appropriate demeanor	4.49	0.63
The multiple counseling channels to learners	4.53	0.66
The teaching method	Mean	S.D.
The teaching contents cover the materials in curriculum	4.55	0.62
The learners can be cerebation, analysis and solving problems by special teaching method	4.46	0.69
The instructor give opportunity for cross-examine and clearly explanation	4.48	0.62
The appropriately measurement and criterion	4.51	0.66
The instructor's suggestion to the learners to find the additional information	4.51	0.60
The curriculum learning results	Mean	S.D.
The morality and ethics	4.49	0.68
The knowledge, contents in curriculum	4.59	0.63
The intelligence skills, bring knowledge to use	4.55	0.62
The interpersonal relationship and responsibility skills	4.51	0.66
The numerical, communication and information skills	4.66	0.56
Summary	4.54	0.05

The specialists evaluated the lesson suitable for the industries, the sequence learning suitability and the test for evaluation were highest, $\bar{x} = 4.67$, S.D.=0.58. 2) The Heat Treatment of Steels lesson had the efficiency 80.83/82.23 were higher than 80/80 criteria. This mean, the lesson had efficiency. 3) The evaluated teaching of graduate learners in the Metallurgy and Heat Treatment of Steels, enrolled semester 2, 2016 had good level in all contents, average scores $\bar{x} = 4.54$, S.D.=0.05.

This research accorded the Kaiyawan's research [4] conducted Development and Training Curriculum

Effectiveness for Quality Inspection and Control in OEM Automotive Parts Production. In his research, the efficiency of the curriculum were 80.29/81.43, similarly in Poolperm's research [6] conducted a Construction and Efficiency Validation of Web-Based Instruction for the topic AC Circuits. In his research, the efficiency of training, 81/80.06. The two researches had criteria more than 80/80, based on the hypothesis set.

VII. ACKNOWLEDGMENT

This research, I must thank Associate Professor Sathaporn Chatakorn, Head of Department Mechanical Engineering Technology, College of Industrial Technology, King Mongkut's University of Technology North Bangkok. He supported me, giving academic advisor, examine the curriculum etc.

VIII. REFERENCES

- [1] Industrial Sector Codes of Practice for Pollution Prevention (Cleaner Technology) Electroplating Industrial, Department of Industrial Works, 2005.
- [2] Research report "Heat Treatment Process; pin production in Diesel oil injection", Iron and Steel Institute of Thailand, 2010.
- [3] Khak Boonmatun, "Evaluation and Measurement Potentiality Development to Enhance Students' s Learning in Education Reformation of the Teachers in Teaching Experience Training Network Schools of Faculty of Education", Research and Development Education, Faculty of Education Phetchabun Rajabhat University, 2013.
- [4] Yuth Kaiyawan, "Development and Training Curriculum Effectiveness for Quality Inspection and Control in OEM Automotive Parts Production", Technical Education Journal King Mongkut's University of Technology North Bangkok Vol. 5, No. 2, pp. 140-148, 2014.
- [5] Sarun Jaruchitsophon, Panita Wannapiroon2 and Pallop Piriyasurawong, "Effect of using Cognitive Tools in Web Based Instruction upon Creative Problem Solving Skill of Undergraduate Students", Technical Education Journal King Mongkut's University of Technology North Bangkok Vol. 6, No. 2, pp. 220-227, 2015.
- [6] Lapus Poolperm and Mani Sittichai, "A Construction and Efficiency Validation of Web-Based Instruction for the topic AC Circuits, Vocational Certificate Level, Lopburi Technical College", Technical Education Journal King Mongkut's University of Technology North Bangkok Vol. 7, No. 1, pp. 56-64, 2016.
- [7] Bachelor of Engineering Program in Tools and Dies Engineering Technology, (Curriculum Improvement 2011), Mechanical Engineering Technology Department, College of Industrial Technology, King Mongkut's University of Technology North Bangkok.
- [8] Teaching Assessment Model University Level, <https://grade.icit.kmutnb.ac.th/PollReportByCourse.aspx>.