A DEVELOPMENT OF ONLINE INSTRUCTIONAL PACKAGE ON AUTOMOTIVE TRANSMISSION SYSTEMS SUBJECT FOR MECHANICAL TECHNOLOGY EDUCATION PROGRAM

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ABSTRACT

The objectives of this research were to 1) construct the online instructional package on automotive transmission systems subject for Mechanical Technology Education (MTE) program at King Mongkut's University of Technology Thonburi; 2) measure the efficiency of online instructional package; 3) evaluate the effectiveness of learning on online instructional package; and 4) investigate the learner satisfactions. Sampling group was the third year student of MTE program in the 2006 academic year, selected by purposive sampling that have not studied the course of automotive transmission systems. The research design was one group pre-test and post-test design. The instruments used were the online instructional package, the achievement and the questionnaire for the students' opinions towards the package. The data was analyzed by means, standard deviation, t-test dependent and content analysis. The research results reveal as follows:

1. The efficiency of the online instructional package on automotive transmission systems subject was 82.6/84.4 that had the value higher than 80/80.

2. The effectiveness of the students could be analyzed by comparing with the critical value by using statistical formula (t-test). The calculated t value was at 35.19 higher than the t critical value, 1.6853, at .05 of significant level.

3. Students satisfaction showed an average value of 4.39, which mean good level.

Keyword: Automotive Transmission Systems Subject, Learning Strategy, Learning with Technology, Online Instructional Package

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INTRODUCTION

The main purpose of the mechanical technology education program (MTE) at King Mongkut's University of Technology Thonburi focuses on development of various knowledge skills and attitudes among the students. At present they can construct more effectively and intelligently in the educational and technological demand. The traditional teaching method has emphasized the transmission of knowledge only. The importance of teaching strategically is that the instruction material has to be articulated effectively to the students to make them understand the fundamental knowledge. Innovative and dedicated automotive instructors should be selected to exploit the classroom environment in terms of successfully being offered as resource for learning.

Basically, learning is a process whereby an individual or a firm "acquires, creates, and disseminates new knowledge" (Kim, 1999) by combining and recombining different pieces of knowledge into something new (Gregersen & Johnson, 1997). Strictly speaking, only individuals can learn, organizations – made up of individuals – can foster this individual learning and try to integrate it into their routines, organizational processes and finally products. In industrial education system, the technological progress will cause the maladjustment of the manpower supply and demand. As a result, the industrial education should head for the directions of high-qualitative life, technology progress, productivity upgrade, manpower requirement, economical development, and modernization to greet the epoch-making approach of the high-tech age (Chang, 1998).

At present, modern automotive technology changes very fast and appears as new technology on a car, which instructors must be change follow as technology. The efficiency of learning need to propose in material package and the efficiency tools for self-study is computer. Because the learner can study every time, everywhere, and everyone. It is easy to access through the learner by networking. The online instructional package on automotive transmission systems subject was provided to four units of learning as follows: clutch; driven system; manual transmission system; and automatic transmission system. There was the interactive multimedia learning with an online instructional package on assembly with pictures, characters, animation, sound effects with narration for presentation and integrated knowledge of all topics with correspondence evaluation. The learner can be solving problems and have discussions showing results of learning using just in time approach.

RESEARCH OBJECTIVES

1. Construct the online instructional package on automotive transmission systems subject for Mechanical Technology Education (MTE) program at King Mongkut's University of Technology Thonburi.
2. Measure the efficiency of the online instructional package.
3. Evaluate the effectiveness of learning with an online instructional package.
4. Investigate learner satisfaction.

RESEARCH HYPOTHESIS

1. The efficiency of the online instructional package on automotive transmission systems subject is higher than the selected efficient standard criterion 80/80.

2. The students' learning achievement scores of the post-test are required to be higher than the prêt-test significantly different at .05 level.

3. The student's satisfaction of online instructional package on automotive transmission systems subject is at a good level.

RESEARCH METHODS

In design process, the researchers applied IMMCI theory (Interactive Multimedia Computer Instruction) to undertake the project. It is an online instructional package development approach of Faculty of Industrial Education and Technology at King Mongkut's University of Technology Thonburi, which details of an online instructional package are explained as follows: (Boonchom Srisa-ard, 2000)

1. Content Analysis. It is a methodology to analyze content that will be a guideline for developing the computer instructional package for the course which aimed for learners who want to learn autonomously. Analysis methodology is to construct a Brain Strom Chart. This process was carried out by tree that they out-lined main titles and related sub-titles. Determining titles was based on content coherent approach. After that, a Concept Chart was constructed. In this step, we considered content accuracy and logic in order to delete or add-on titles. This leads to further step – Content Network Chart. We brought titles that were written in the previous step to write

content network. Then, we analyzed content interrelationship by using Network Analysis method until its completion.

2. Design. It is to decide presentation method and content objective. After that Presentation Chart of each unit of subject matter was constructed.

3. Development. This step is to detail content frames whether each frame consists of what particular content. After that, content ordering arrangement was done according to frames that we previously designed. Though all of the contents were still in printed materials, we presented the prepared materials to experts for examination.

4. Implementation. It is to develop the instructional package. We integrated multimedia technologies into development such as letter, still picture, sound effect with narration for presentation.

5. Evaluation. After its completion, the instructional package was presented to information technology experts and sample group as to evaluate its multimedia technology quality and users' satisfaction toward the package and to measure learning effectiveness and efficiency respectively. Sub-unit test and post test to measure E1/E2 effectiveness. Pre-test and Post-test to measure learning effectiveness $E_{pos} - E_{pre} = 60$.

6. Data Collection Method. In testing to measure effectiveness, learning effectiveness and learners' satisfaction, the process had steps as follows:

- Conducting testing to measure effectiveness using sub-unit test and post-test;

- Conducting testing to evaluate learning effectiveness and

efficiency in learners using pre-test and post-test;

- Collecting learners' satisfaction information using satisfaction questionnaire to gather data.

7. Data Analysis. In doing data analysis, we adopted statistic method as tool to analyze data as details follow:

- In analyzing the test quality, statistical methods that used to analyze the tests are difficulty index {P}, Discrimination power {D}, and Reliability.

- Analysis computer instructional package effectiveness, statistical method used for computation is E1/E2 formula. It is to measure effectiveness of learning retention in learner which criterion was set at 80/80.

Sampling group was the second year student of MTE program in the 2006 academic year, selected by purposive sampling who were have not been studied the course of automotive transmission systems. The research design was one group pre-test and post-test design. The instruments were the online instructional package, the achievement and the questionnaire for the students' opinions towards the package. The data were analyzed by means, standard deviation, t-test dependent and content analysis.

METHODOLOGY

The methodology used for the studies which are: (1) the research design was one group pre-test and post-test that the sample of the study were ninety five students studying in MTE program in 3ʳᵈ year semester 2/2005 academic year. There were selected 40 samples student's used in this study selected by purposive sampling technique; and (2) tools for the study were entry competency-based instruction test and pre/post-test common the instruction material package.

The content and items of the above tools were validated. While the automotive suspension system experts established the content validity, item validity was done using discriminative and difficult indices. The pre-test and post-test examinations consists of 30 multiple choice by evaluating from experts in relate fields consist of content expert, instructional design expert, and language expert among 5 persons. Then finding Index of Conjugate (IOC) is effective in terms of the content validity: (IOC> 0.5), the level of difficulty (p) = 0.2 – 0.8. And then try out with automotive technicians 30 persons to find reliability of test that tested by alpha coefficient = 0.6 -1.00. Discrimination of test = 0.2 – 1.0.

PROCEDURE

1. Students were matched by giving a pre-test.
2. Academic content in automotive suspension system was identified and sequenced.
3. A pre-test for each the online instructional unit was structured and administered before instruction.
4. Each unit was taught through the online instructional package.
5. A post-test for each module was structured and administered after instruction.
6. A criterion test for the whole content was administered after instruction.
7. Suitable statistical techniques were employed to analyze the data collected.

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158

RESEARCH RESULTS

1. Designing and creating an online instructional package have procedure as follows:

Figure 1
Program Main Menu

Figure 2

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159
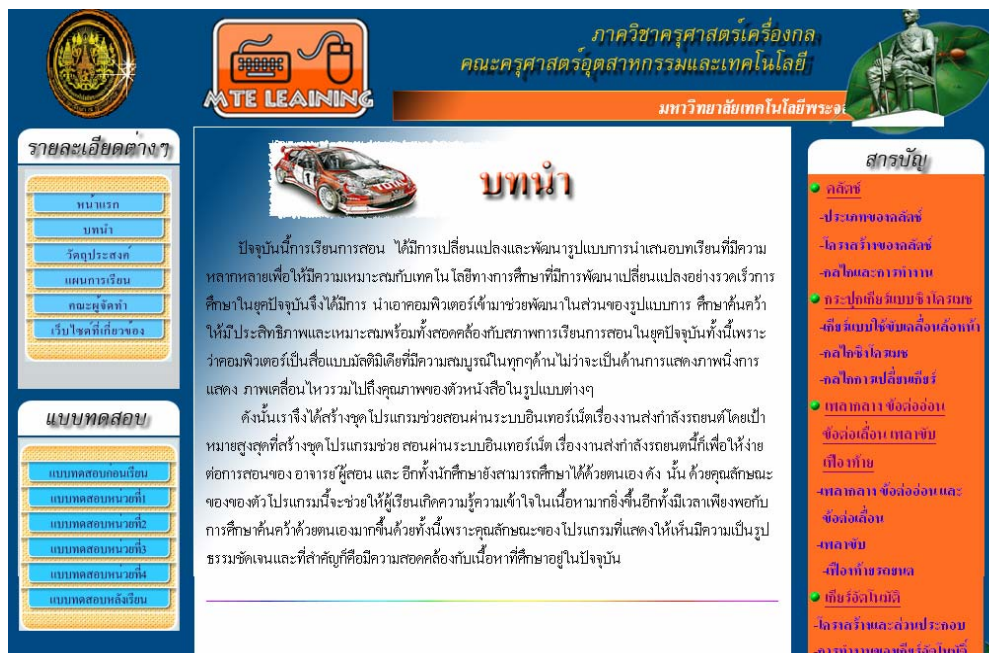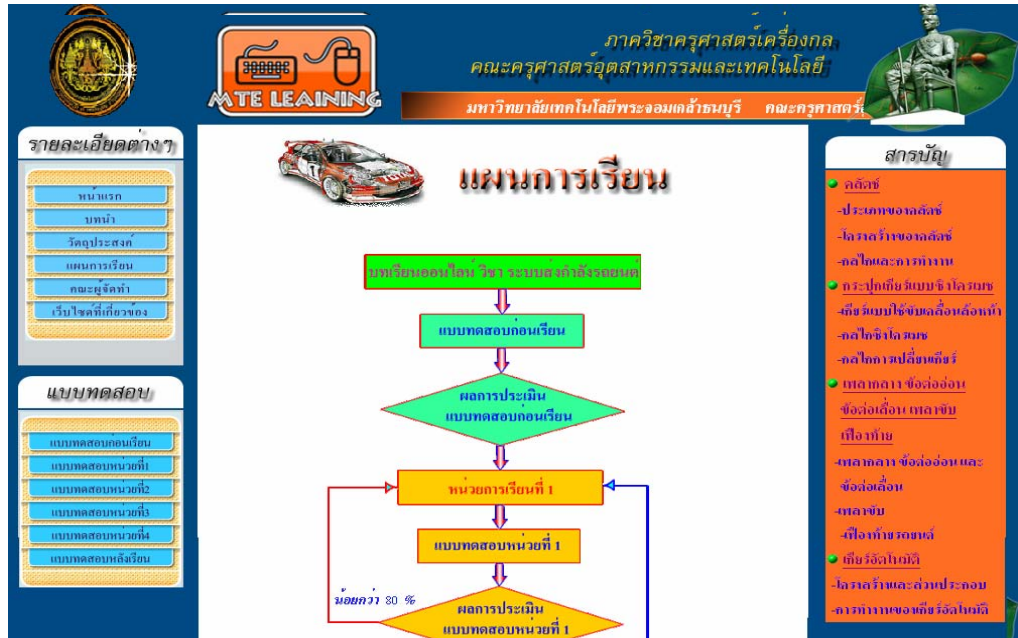
Program Content

Figure 3
Program Lesson Plan

Figure 4
Program Learning
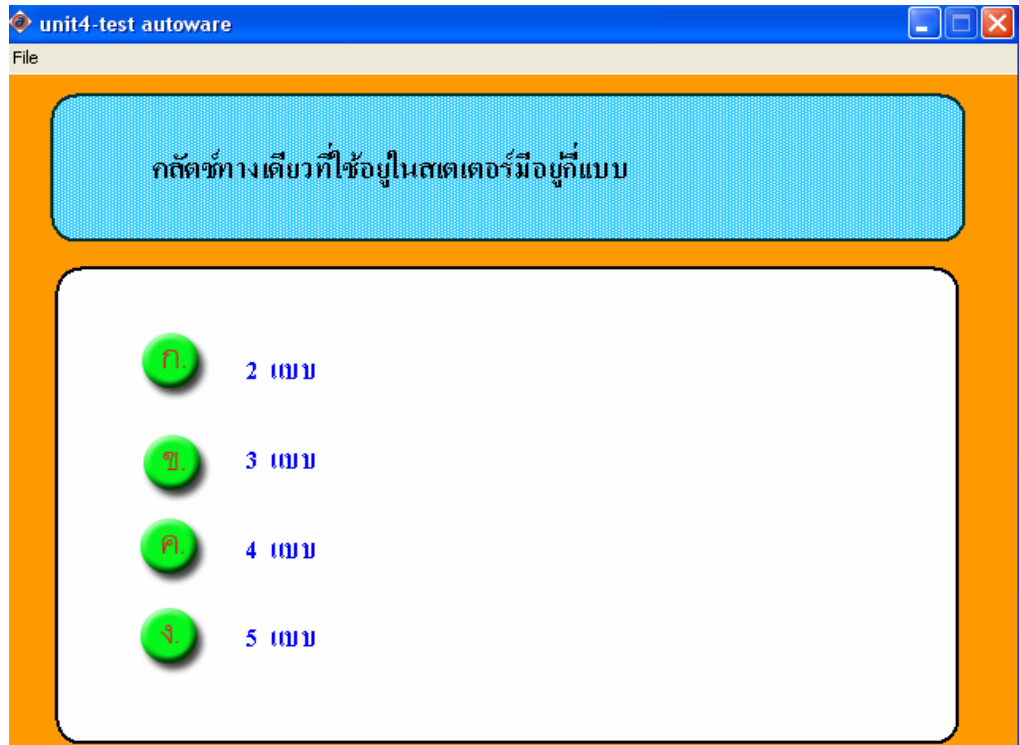
Figure 5
Program Pre/Post-test

2. Data Analysis

Table 1
Mean Score from Lessons Evaluation by Exporters' in Content Analysis

Topic	Mean	Score Level
1. Content Analysis		
1.1 Lesson presentation (clearness, logical)	4.00	Good
1.2 Lesson presenting continuously	4.00	Good
1.3 Lesson presentation (easiness to understand)	4.33	Very Good
1.4 The right lessons for target group	4.66	Very Good
1.5 The numbers of lessons support to target group	4.66	Very Good
1.6 Lesson priority	4.66	Very Good
1.7 Lesson corrections	4.00	Good
1.8 Lesson completeness	4.00	Good
	4.28	**Good**

Table 1 (Cont.)
Mean Score from Lessons Evaluation by Exporters' in Content Analysis

Topic	Mean	Score Level
2. Items		
2.1 Items discrimination	4.33	Good
2.2 Items clearness	4.33	Good
2.3 Items (easiness to understand)	4.33	Good
2.4 Items right and support to the objectives	4.33	Good
2.5 Amount of items	4.66	Very Good
	4.39	**Good**
3. Program		
3.1 Program color	4	Good
3.2 Figure clear	4.33	Good
3.3 Easy to access	4.33	Good
3.4 Program Complete	4.33	Good
	4.24	Good
Total	**4.30**	**Good**

Table 2
Mean Score from Lessons Evaluation by Exporters' in Online Instructional Package

Topic	Mean	Score Level
1. Program Design		
1.1 Program menu	4.33	Good
1.2 Program discrimination	4.33	Good
1.3 Program efficiency	4.33	Good
1.4 Program speed	4.33	Good
1.5 Program clearness	4.66	Very Good
1.6 Program complete	4	Good
Mean	**4.33**	**Good**
2. Program Figure		
2.1 Color of figure	4.66	Very Good
2.2 Figure clearness	4.66	Very Good
2.3 Ability to communicate	4	Good

2.4 Linkage between figure and content	4	Good
2.5 Size and balance	4	Good
Mean	**4.26**	**Good**
3. Program alphabet		
3.1 Program alphabet support to monitor	4.33	Good
3.2 Program alphabet is clearness	4.66	Very Good
3.3 Position of program alphabet	4	Good
3.4 Program alphabet is pretty	4.33	Good
3.5 Program alphabet is right	4	Good
Mean	**4.26**	**Good**
Total	**4.28**	**Good**

Table 3
The efficiency of the online instructional package

Item no.	Unit 1 (15 marks)	Unit 2 (15 marks)	Unit 3 (15 marks)	Unit 4 (15 marks)
1	12	13	11	12
2	14	12	13	11
3	13	13	13	12
4	11	14	13	13
5	11	13	12	11
6	12	13	11	11
7	12	11	13	12
8	14	13	13	14
9	13	12	12	14
10	14	11	13	13
11	13	13	12	12
12	13	14	11	12
13	12	11	12	13
14	12	13	12	14
15	11	13	13	11

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November 9-11, 2007 Mahasarakham University, THAILAND

163

Table 3 (Cont.)
The efficiency of the online instructional package

Item no.	Unit 1 (15 marks)	Unit 2 (15 marks)	Unit 3 (15 marks)	Unit 4 (15 marks)
16	12	13	11	13
17	14	12	13	13
18	13	13	13	12
19	13	14	13	12
20	12	13	12	11
21	11	13	11	11
22	11	11	13	14
23	12	13	13	13
24	12	12	12	12
25	12	11	13	13
26	11	13	12	14
27	11	14	11	12
28	14	11	12	12
29	13	13	12	11
30	12	13	13	11
31	13	12	11	11
32	11	11	13	13
33	11	11	13	14
34	13	13	12	14
35	14	12	12	13
36	11	13	11	13
37	12	12	13	14
38	13	13	13	12
39	13	14	13	12
40	14	13	12	11
Total	**495**	**502**	**491**	**496**
Mean	**12.37**	**12.55**	**12.27**	**12.4**

The efficiency of the online instructional package on automotive transmission systems subject was 82.6/84.4 that had the value higher than 80/80.

Table 4 Items of sampling group for pre-test and post-test

Item no.	Test		(D)	(D²)
	Pre-test	**Post-test**		
1	18	25	7	49
2	15	26	11	121
3	15	27	12	144
4	16	27	11	121
5	14	29	15	225
6	14	28	14	196
7	15	28	13	169
8	12	26	14	196
9	10	25	16	225
10	12	24	12	144
11	12	26	14	196
12	12	26	14	196
13	10	27	17	289
14	15	23	8	64
15	10	24	14	196
16	10	24	14	196
17	11	25	14	196
18	12	23	11	121
19	15	26	11	121
20	14	26	12	144
21	16	28	12	144
22	14	25	11	121
23	11	26	15	225
24	12	27	15	225
25	14	24	10	100
26	14	22	8	64

Table 4 (Cont.)

Items of sampling group for pre-test and post-test

Item no.	Test		(D)	(D²)
	Pre-test	**Post-test**		
27	13	26	13	169
28	12	24	12	144
29	11	25	14	196
30	12	22	10	100
31	13	22	9	81
32	13	26	13	169
33	13	25	12	144
34	10	25	15	225
35	11	27	16	256
36	14	24	10	100
37	16	28	12	144
38	14	27	13	169
39	10	22	12	144
40	15	23	8	64
Total	520	967	494	6293
Mean	13	25.32	12.35	157.325
Percentage	43.33 %	84.4 %	-	-

$$t = \frac{\sum D}{\sqrt{\dfrac{N\sum D^2 - \left(\sum D\right)^2}{N-1}}}$$

$$\sum D = 494$$
$$\sum D^2 = 6293$$

$$t = \frac{494}{\sqrt{\dfrac{\left(40 \times 6293\right) - \left(494^2\right)}{40-1}}}$$

$$t = 35.19$$

The t test (t – distribution) degree of freedom at 39 (d_f 40-1 = 39). The effectiveness of the students could be analyzed by comparing with the critical value by using statistical formula (t-test). The calculate t value was at 35.19 higher than t critical value, 1.6853, at .05 of significant level.

Learner satisfaction was showed to evaluate on program had average valued of 4.27, to evaluate on program figure had average valued of 4.28, to evaluate on program alphabet had average valued of 4.33, to evaluate on program presentation had average valued of 4.32 and total of average value of 4.39, which mean good level.

CONCLUSION

Results of a development of online instructional package on automotive transmission systems subject for Mechanical Technology Education (MTE) program at King Mongkut's University of Technology Thonburi, which is consisted of online content, manual and information of sample group. The subject matter contains of four learning units. Each unit contains: introduction to content, main menu and supplement presentation, learning activities, exercises, summary and pre-test and post-test. Moreover, the online instructional package as follow as learning systematic arrangement: registration, learning verification,

measurement and evaluation learning achievement record of each unit. In achievement testing, which is consisted of pre-test and post-test of each unit before and after learning, there was a sampling test which done according to objective of each learning unit and evaluate learning according to each test item objective. Test score will be notified immediately.

LIMITATIONS

1. This research was limited to students studying in mechanical technology education program at King Mongkut's University of Technology Thonburi.
2. The experiment is limited to only automotive transmission systems subject.

SUGGESTIONS FOR FUTURE RESEARCH

1. The research should be extended to other Technology Universities, Vocational and Technical education institutes.
2. The research should be conducted in other branches of academic subjects also.
3. The research should be conducted to study competencies profiles of students toward this method.

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November 9-11, 2007 Mahasarakham University, THAILAND

167

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