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Improve learning achievement in Engineering Metallurgy Course by Online Asynchronous learning

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Abstract: - In this paper, the authors describe the construction of Web-based instruction (WBI) for online asynchronous learning on engineering metallurgy course, the evaluation and learning effectiveness. The research tools comprised WBI on engineering metallurgy, learning achievement tests and learning effectiveness tests. The research was used an Interactive Multimedia Computer Instruction Package (IMMCIP) model. The WBI included introduction to engineering metallurgy, crystal structure, deformation mechanism, phase diagram, Fe_3C-diagram, heat treatment process, ferrous metals, non-ferrous metals, corrosion in metals and powder metallurgy. The sample covered 45 undergraduate students in engineering metallurgy course in Department of Production Technology Education, Faculty of Industrial Education and technology, King Mongkut's University of Technology Thonburi.

The results revealed that the efficiency of WBI was higher that the criteria set. Analysis results of the pre-test and post-test was efficient. Therefore, the WBI could improve the learning effectiveness. This, online asynchronous learning could be to increase efficiency and effectiveness of learning.

Key-Words: - Learning achievement, E-learning, Web Based, Asynchronous learning, Engineering Metallurgy

1 Introduction

Online learning is in its infancy. As pioneers struggle with new technologies and new practices, the discipline evolves almost daily [1]. Yet despite the rapid change, trends may be identified, trends which point to the future of online learning. What will be is not as radically different from current models as may be conceived, however, some significant shifts in the nature of online learning, and learning in general, may be identified.

By 2002, people will be breaking free of the obsolete, inefficient model of learning imprinted on them by the school system. Real learning starts with the learner, not the teacher. People learn by solving problems, by making mistakes and correcting them, by hearing stories, by engaging multiple senses, and by following the call of their innate curiosity. Learning can take place outside of classrooms, classes need not last an hour, and the strongest motivation comes from within. Pages, documents, classes, and files are anachronisms, vestiges of a bygone era of factories and smokestacks. The Internet revolution enriches learning with mass customization, collaborative filtering, object-orientation, production on the fly, easy-to-use authoring software, cheap video, rapid application development, plug-and-play modularity, wireless connectivity, abundant bandwidth, and more. [2]

Engineering Metallurgy is subject in undergraduate of Bachelor degree of Industrial Education in Production Technology Education. In order to succeed in this subject, it is important to increase the knowledge of metallurgy theory and practices, eg. Principle of atomic, heat treatment process or phase transforms mechanism. However online asynchronous learning is alternate of learning for help student to understanding in metallurgy. Because it was combination between Internet technology and learning design process in order to increase learning efficiency and improve limitations, such as learning site or time. It uses Internet resource and properties to encourage and facilitate education. [3]

1.1 Objectives

- To construction of Web-based instruction (WBI) for Online Asynchronous Learning (OAL) in Engineering Metallurgy;
- To evaluate the efficiency and effectiveness of Web-based instruction for Online Asynchronous Learning for distant learning in Engineering Metallurgy.

1.2 Expected Benefits

- To obtain knowledge of principle and application in engineering metallurgy;
- To obtain Web-based instruction for Online Asynchronous Learning for engineering metallurgy;
- To learn how to produce Web-based instruction for Online Asynchronous Learning and develop other subjects;
- To promote knowledge of engineering metallurgy and community.

2 Research methodology

2.1 Scope of research

The contents of this WBI consisted of ten topics were followed : introduction to engineering metallurgy, crystal structure, deformation mechanism, phase diagram, Fe_3C-diagram, heat treatment process, ferrous metals, non-ferrous metals, corrosion in metals and powder metallurgy

2.2 Population and Samples

The population of this research comprised student enrolled in the Bachelor degree in field of Production Engineering at King Mongkut's University of Technology Thonburi (KMUTT), Bangkok, Thailand, as well as related persons who are interested.

The samples of this research were 45 students in the Bachelor degree in Department of Production Technology Education at KMUTT, who were selected by random sampling.

2.3 Experimental Tools

The Web-based instruction for Online Asynchronous Learning for engineering metallurgy was designed and developed utilizing an Interactive Multimedia Computer Instruction Package (IMMCIP) (Fig. 1) [4]. The WBI for OAL was constructed in order of modules and present in website form (Fig. 2) and the flow chart of this course was present in Fig. 3

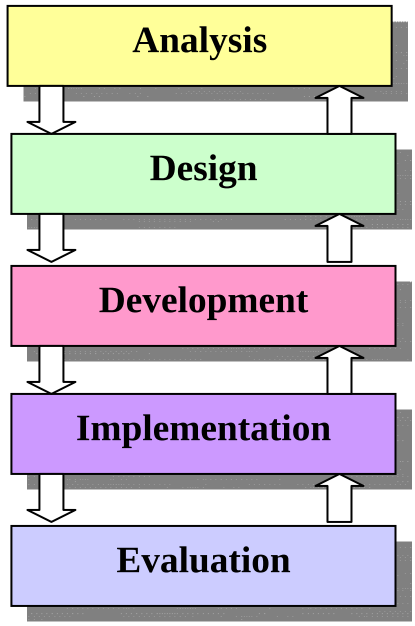

Figure 1 Structure of the Interactive Multimedia Computer Instruction Package (IMMCIP)

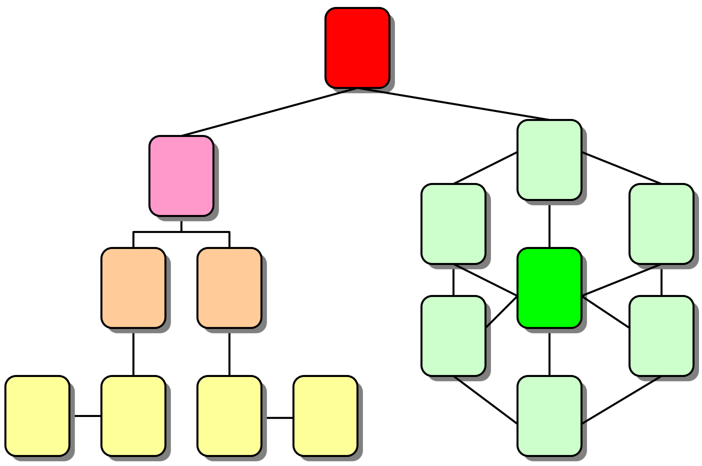

Figure 2 Example of lessons modules

The procedure of this research was organized in IMMCIP concept in five steps as Fig.1. This process was starting with analysis, the followed:

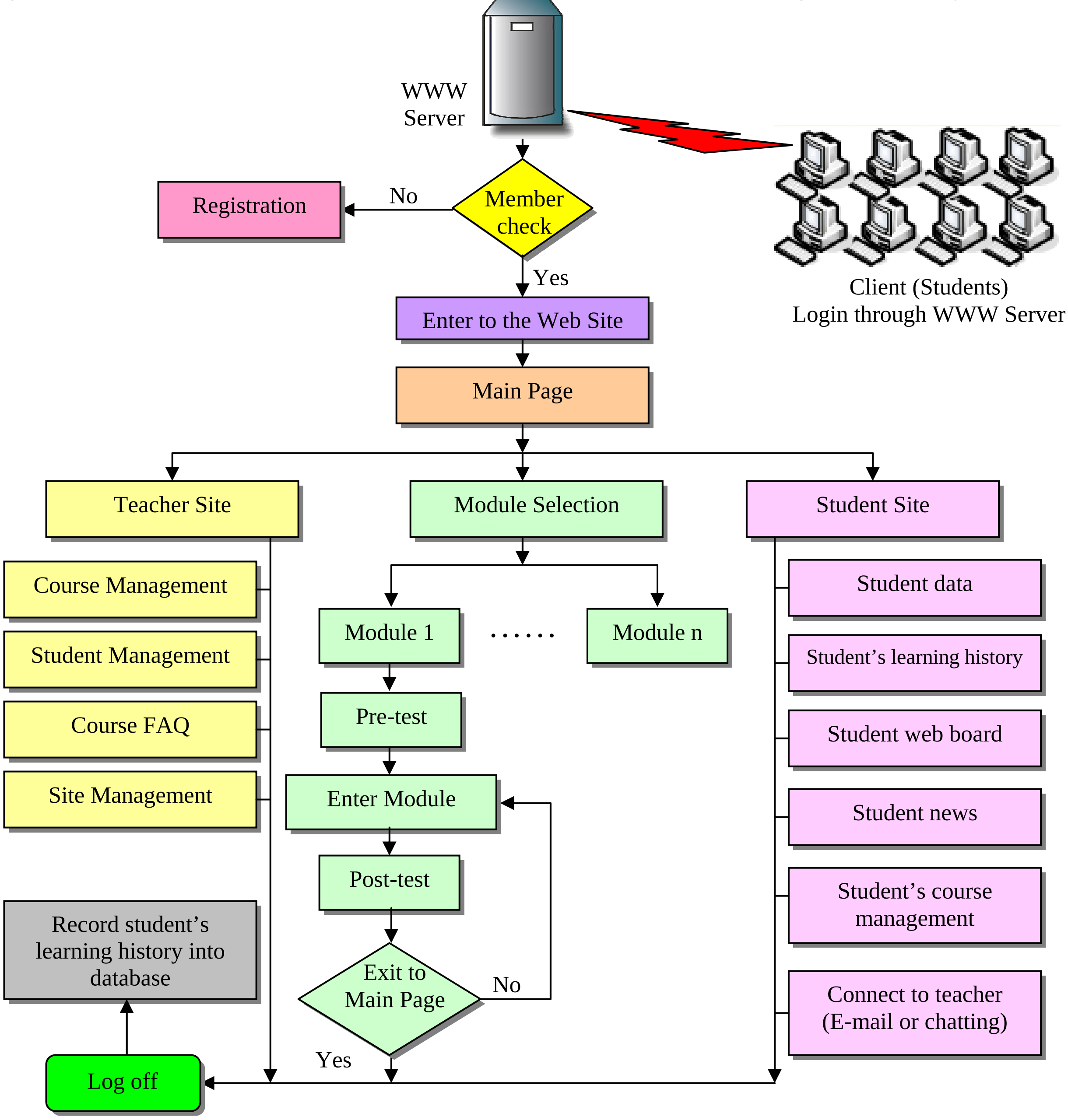

Figure 3 Web-based instruction for Online Asynchronous Learning Structure

Analysis
1) Brainstorm Chart Drafting;
2) Concept Chart Drafting;
3) Contents Network Analysis Chart Drafting;

Design
4) Strategic Presentation Plan with Behavior Objectives and Course Flow Chart Drafting;
5) Module Presentation Chart Drafting;

Development (Course Forming)
6) Script Development (Interactive Subject Frames);
7) Story Development by Storyboard Technique;
8) Contents Correctness, Contents Validity and Reliability Check-Up;
9) Test Item Check-Up (Difficulties, Discrimination, Validity and Reliability);

Implementation
10) Authoring Software Selection (This research is meaning in order of Web Based Programming and Database, eg. PHP, ASP, SQL, MySQL);
11) Acquisition of Readymade or Tailor-made Video, Animation, Audio, Picture and other Clip Art;
12) Completion of Creating IMMIP(This research created in WBI from);

Evaluation
13) Quality evaluation (Multimedia and Instruction Design Check-Up);

14) Small Group Rehearsal Testing;
15) Efficiency Evaluation (E_1/E_2) Effectiveness Evaluation ($E_{post-test}/E_{pre-test}$);
16) Preparation of User's Manual for Publication

A contents evaluation specialist reviewed the test's content validity. The test item were analyzed for the P-value (how easy/difficult), which was in the range of 0.20-0.80; the D-value was more than 0.20. The acceptable reliability value, which was based on Kuder-Richardson 20's formula, should not is lower than 0.60.

Table 1 Topics and contents of the homepage.

Unit	Topics	Contents
1	Introduction to engineering metallurgy	Text Picture
2	Crystal structure	Text Picture Animation
3	Deformation mechanism	Text Picture Animation
4	Phase diagram	Text Picture Animation
5	Fe_3C-diagram	Text Picture Animation
6	Heat treatment process	Text Picture Animation
7	Ferrous metals	Text Picture Animation
8	Non-ferrous metals	Text Picture Animation
9	Corrosion in metals	Text Picture Animation
10	Powder metallurgy	Text Picture Animation

3 Research results

The construction of the Web-based instruction for Online Asynchronous Learning for engineering metallurgy can be summarized as follows:

1) The contents of WBI for OAL have ten topics and each topic can explain the contents of the unit topics as table 1 and Fig.4

2) Results of the WBI for OAL efficiency: The results show that during learning process the percentage of total average score of efficiency is 85.46 (module test) but the total average score after learning process is 82.00 (post test). Therefore, the efficiency of the WBI for OAL is 85.46/82.00 (Table 2), which is higher than the criteria set (80/80).

Table 2 Average score of Module and Post test.

Module test score	Post test score
85.46	82.00

3) Results of learning achievement: The study that efficiency of students before the learning process ($E_{pre-test}$) was 26.25 and after the learning process ($E_{post-test}$) was 82.00. When the comparison of two values to consider the learning achievement of samples was 55.75 (Table 3). This indicates that the WBI for OAL can increase learning achievement of samples.

Table 3 Test score of achievement

Test	Efficiency	Learning Achievement
Pre-test ($E_{pre-test}$)	26.25	55.75
Post-test ($E_{post-test}$)	82.00	

4 Conclusion

Researchers constructed a Web-based instruction for Online Asynchronous Learning for engineering metallurgy. The contents of the WBI for OAL consisted of 10 modules. Each module has 4 sections including pretest, module contents, exercise and posttest. Moreover, the package was composed of learning management system such as registration, student's database, and achievement evaluation for each module. For pretest and posttest, module test, questions were selected randomly according to the objective of each module and evaluation was done according to the objective. The evaluation result of each module was also to be informed. The result of the experimental showed that the efficiency of the package was 85.46/82.00. It clouded that the efficiency of the package was higher than the standard set criteria of 80/80. The effectiveness of the sample before learning process ($E_{pre-test}$) was 26.25 and after the learning process ($E_{post-test}$) was 82.00. They differed by 55.75. It could be concluded that the package increased learning achievement of the sample by 55.75 and the package could be used in learning and teaching process.

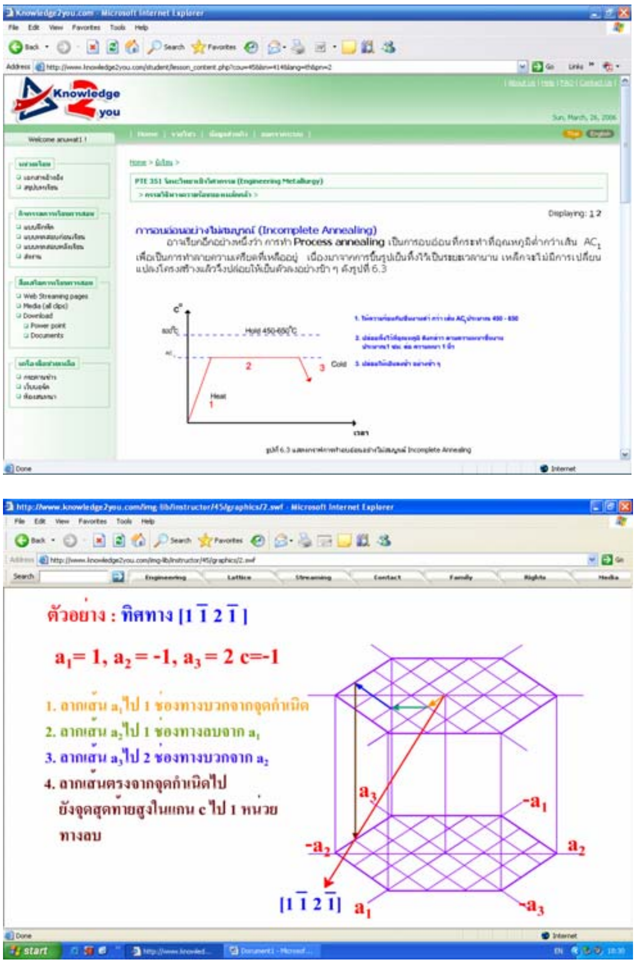

Figure 4. Sample of WBI for OAL

References:

[1] Stephen Downes, *The Future of Online Learning*, 1998, http://www.downes.ca/future/

[2] Jay Cross, *Looking back from the future*, Internet Time Group, 1999

[3] Tritanakung, P., *Design of IMM Computer Instruction*, *Bangkok*,KMUTT, 1999

[4] Tritanakung, P., *Design and Producing a Computer Instruction Package for E-Learning*, Bangkok, KMUTT, 2003