The Development of High Quality E-Learning Courseware For Students in Higher Education[1]: Empirical Findings from Chiang Mai University

Dr. Thanomporn Laohajaratsang[2]

Abstract

In order to make the best use of e-Learning's power for learning, we need to address the barriers that frustrate learning in this new environment. One of the key areas identified in the report of the Web-Based Education Commission, (December 2000), as the basis for a set of actions was the development of high quality online educational content that meets the standards of educational excellence.

Chiang Mai University's Systematic Approach Model (CMU-SAM) was used in the development of e-Learning courseware. Prior to the development of CMU-SAM model, several methods for developing e-Learning courseware were analyzed. The findings of this study led to the conclusion that the CMU-SAM development model is an efficient model for developing educationally stimulating, high quality, online content.

Keywords: e-Learning, courseware, Online content, Higher Education

The Definition of e-Learning

A great deal of attention has been focused recently on the use of Information and Communications Technology (ICT) in learning. In the last three years, the term e-Learning has really emerged and is being used to cover almost any technology-supported, learning initiative ranging from a text-based facilitated discussion to an interactive simulation exercise. This term is also used to refer to the delivery of content via electronic media including the Internet, intranet, extranets, sattelite broadcast, interactive TV, and CD-ROM. In this paper, the scope of e-Learning will be limited to Internet-enabled learning in which information or content is designed using multimedia and interactive technology and delivered electronically over the Web through a university's intranet, or via CD-ROM.

---

[1] This research project was funded by Computer Service Center, Chiang Mai University, Thailand

[2] Deputy Director of Computer Service Center, and Assistant Professor from Faculty of Education, Chiang Mai University, Thailand

Rationale for this Study

Currently in Thailand the higher education system is a driving force demanding the development of more diverse, efficient teaching methods. In most classrooms, the lessons and activities focus around the instructor's desk or blackboard. This "chalk and talk" relies solely on lectures and rote memorization. The development of creativity and individuality is therefore, discouraged by this learning approach. With high quality online content, e-Learning can play an important role as a knowledge-based source in which provides students with the opportunity to convert information to knowledge at their own pace, anytime, anyplace and on a just-in-time basis. On the other hand, instructors can spend class time focussed on more learner-centered teaching (i.e. promoting in-class interaction between peers and between students and the faculty, or questioning approaches to students' learning). Instructors can also spend the time they saved by using e-Learning courseware to update the course materials, complete research, mentor students, or pursue other critical scholarly activities.

Many Thai universities have tried a variety of approaches in the process of developing content for e-Learning. Some have also provided workshops and technical consultation to faculty members as a means of encouraging faculty members to reengineer their own courses incorporating the use of e-Learning. For most of the projects developed at many Thai universities, e-Learning is regarded as merely a conversion of teaching material to an on-line form. Other projects have been driven as a technology project, with learning coming secondary. However, these approaches developed without a correct understanding of the e-Learning concept will have limited success since expecting faculty to convert their own teaching materials into a high quality e-Learning courseware is unrealistic. As suggested by Brahler, Peterson, and Johnson (1999), there are four reasons that account for the shortcomings:

1. Typically, the institution cannot provide faculty release time from other responsibilities to the extent required to develop educationally stimulating online content.
2. Faculty generally lack the comprehensive technical skill base required to develop educationally stimulating, digital learning materials that involve students actively in the learning process, and accommodate diverse learner needs.
3. Faculty may have many learner-centered, innovative teaching ideas, but in many cases, attempts to convert these to electronic learning materials results in a significant proportion digressing to

linear representations of didactic materials, due to insufficient technical abilities.

4. The individual-developer approach does not spread capitalization costs out over a large number of projects, therefore making the development cost per project much higher than necessary.

Therefore, it is necessary for a university to develop a systematic approach model in the development of educationally stimulating, high quality, e-Learning courseware. In other words, a more effective approach for developing high quality e-Learning courseware must be determined and institutionalized.

A Case Study : Development of High Quality e-Learning Courseware for the Students at Chiang Mai University

Realizing the importance of developing high quality online educational content, Chiang Mai University has committed itself to developing high quality e-Learning courseware for its students. Supported by the University's administrators, Computer Service Center, Chiang Mai University launched the e-Learning project early in the year 2001.

CMU-SAM is a systematic approach model designed for use in the development of e-Learning courseware and constructed at Chiang Mai University. Prior to the development of CMU-SAM model, several methods for developing e-Learning courseware were analyzed (National Special Media Institute, 1971; Knirk and Gufstafson, 1986; Gagne et al., 1992; Smith and Ragan, 1993; Gentry, 1994; Kemp & Morrison, 1994; Dick & Carey 1996; Heinich et al., 1996; Diamond, 1997, Richards, 2001). Our studies found considerable overlap amongst the design models reviewed.
The overlapping elements were pulled together to create a new model which includes 7 development stages together with 4 nested phases of Instructional System Design (ISD). The nested phases are curriculum analysis, curriculum design, instructional development, and evaluation (Figure 1: the CMU-SAM Model).

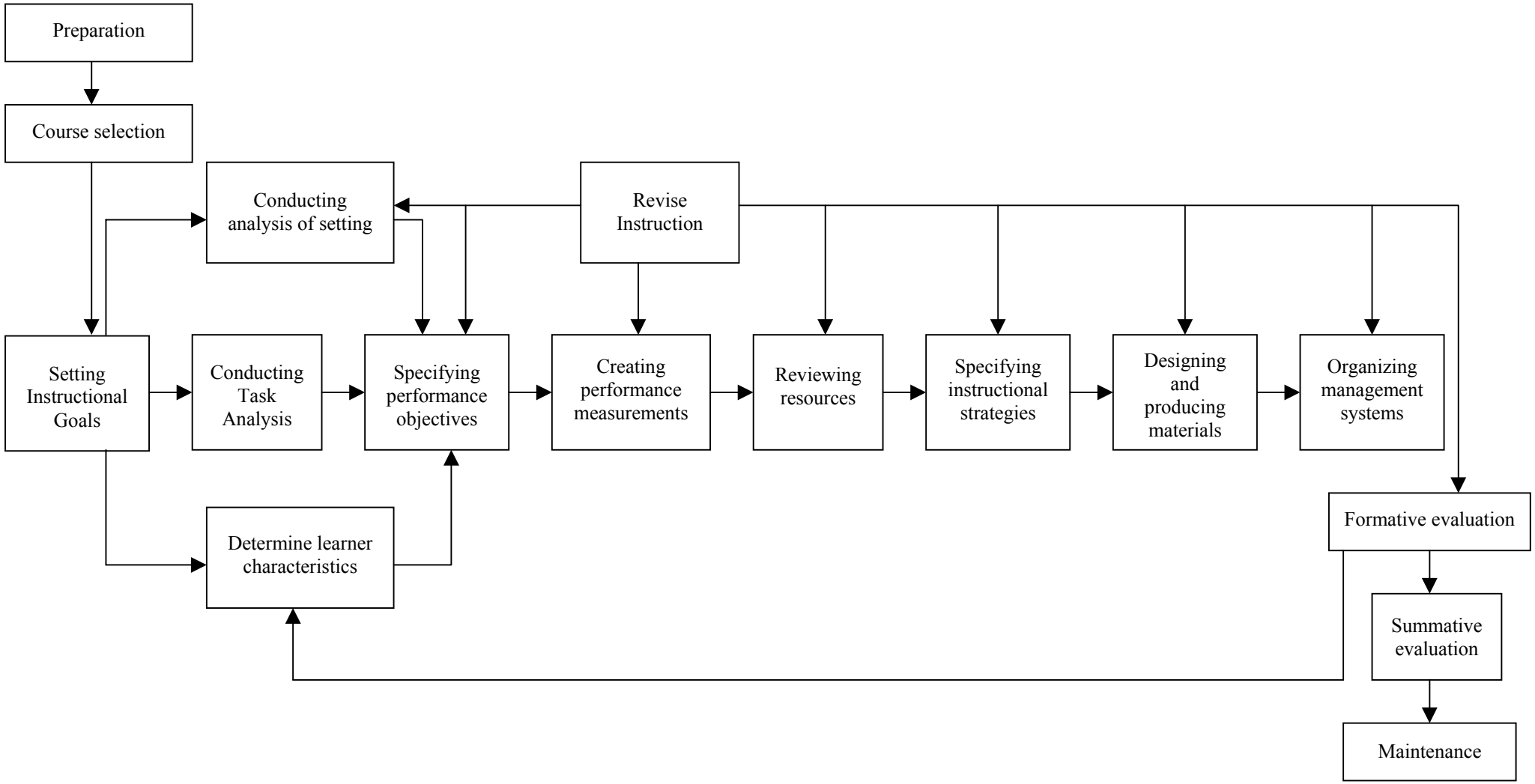

Figure 1: The CMU-SAM Model

Stage 1: Preparation Stage

As mentioned earlier, although instructors are the most logical individuals to design the content for developing high quality e-Learning courseware, instructors should not be expected to complete the technical tasks associated with the development. Therefore, it is necessary to form a development team. At CMU, this meant the hiring of new personnel (full-time personnel and student employees) who possess the comprehensive technical skill required to develop on-line learning materials. In addition, our current employees were asked to attend all related workshops and training sessions in order to acquire a better understanding of the e-Learning concept and to prepare them for future developments. (Figure 2 , The model for e-Learning team members).

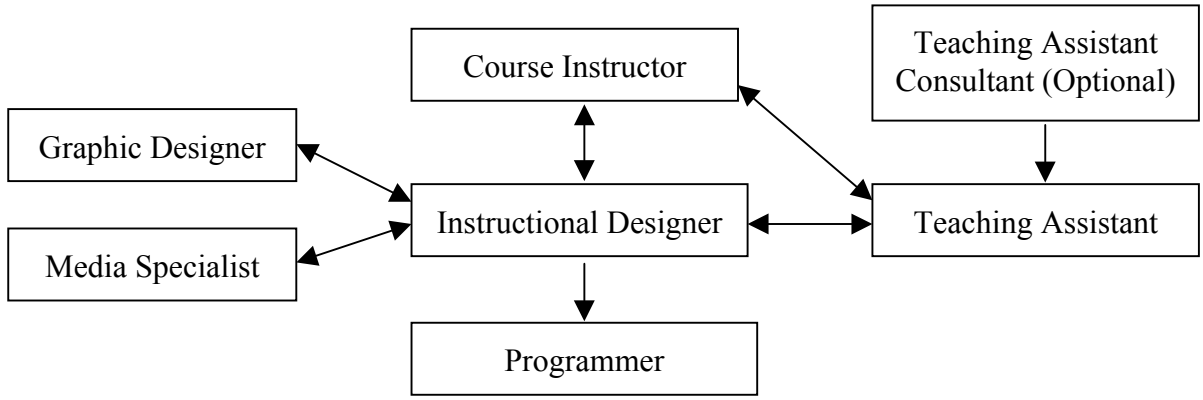

Figure 2: Members of the e-Learning Team

Stage 2: Course Selection

Appropriate courses are selected in this stage. Choices include courses that have high enrollments as well as required courses for many different subject areas. The needs for the e-Learning courseware are also determined during this stage. Prior to stage 3, faculty orientation has to be organized in order for course instructors to acquire an understanding of their roles in the project. Also, course instructors need to be informed that their lectures will be videotaped. Permission from the instructors is required.

Stage 3: Curriculum Analysis

After selecting a course, course instructors undertake curriculum analysis. This involves setting instructional goals, determining learner characteristics, conducting an analysis of the environment, and conducting task analysis.

1. Setting Instructional Goals

During the initial state of developing high quality online content for e-Learning, the general outcomes of the overall instruction are stated by the course instructors. They do not have to be described in behavioral terms at this point. Needs assessment will not be performed again providing the need for e-Learning has been determined during the course selection phase.

2. Determining Learner Characteristics

It is very crucial to get a clear picture of the learner. Course instructors are to share with the e-Learning team their students' data on personal demographic profile. This profile might include information on student motivation, computer literacy, academic abilities, and learning style preferences. High quality online content for e-Learning has to be carefully designed to meet the needs of the students before significant funds are committed to the development of such courseware.

3. Conducting an Analysis of Setting

Similar to determining learner characteristics, course instructors are to analyze the learning context in which the instructional content will be used (Figure 3).

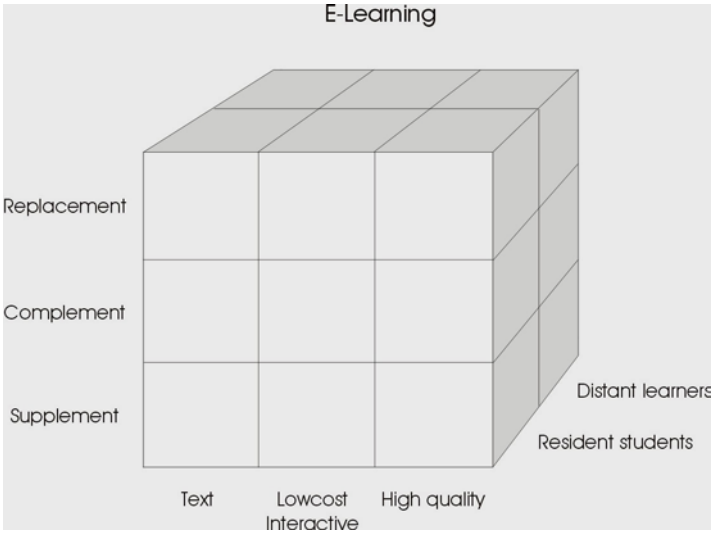

Figure 3 : Learning contexts which relate e-Learning

This is because different learning context can affect the way high quality e-Learning courseware should be developed. For example, e-Learning courseware which aims to be used as a replacement for classroom teaching must be self-contained while e-Learning courseware which aims to be used as supplementary may not have to.

Integrating e-Learning into institutions can be viewed and understood by reflecting on the three dimensions cube presented in Figure 3. The first dimension requires that e-Learning be categorized by committing to one of these media presentation selection: the text-based, the low cost version with interactive online content, or the high quality online content. The second dimension requires that e-Learning be divided by its functionality by selecting ond of three categories -supplementary, complementary, or a replacement for classroom instruction. The third dimension requires that e-Learning be grouped by its audience into one of 2 classifications – resident students, and distant learning students.

4. Conducting Task Analysis

Task analysis is considered a must for developing high quality online material. Course instructors are to determine the content to be taught and to analyze the skills they wish to teach. By breaking complex skills into component skills, they can determine an effective teaching sequence. We observed that a number of course instructors had already completed this task previously. For others, this may be something new. This task can be completed by course instructors with/without the help of the instructional designers.

Stage 4: Curriculum Design

The fourth stage involves specifying performance objectives, constructing performance measurements, reviewing resources for the design and delivery of instruction, and specifying instructional strategies.

4.1 Specifying Performance Objectives

Performance objectives should be specified in terms of what the students should be able to do as a result of having learned this unit of online content. Course instructors must write the desired outcomes in specific, measurable terms so that e-Learning teams can use them to efficiently design the required courseware.

4.2 Constructing Performance Measurements

It is necessary to develop assessment instruments that measure attainment of the performance objectives set initially. If course instructors do not use the performance measurements, they will never know whether their students have achieved the knowledge, skills and/or attitudes that they want their students to achieve. In addition, the e-Learning team can make use of this data in designing activities, exercises, or tests in the way that customize each individual course.

4.3 Reviewing Resources for Design and the Delivery of Instruction

The development team needs to be aware of the adequacy of the existing materials for their possible inclusion in the system. Course instructors

or teaching assistants are to provide the team with information on available resources for the design and delivery of all instruction at this stage.

4.4 Specifying Instructional Strategies

Stating instructional strategies is considered another crucial step in instructional design. It is a step that recommends ways that each learner can master the objectives. Instructional strategies and tactics are to be planned by course instructors and the e-Learning team. Decisions should be made about the type of materials to be developed and how much individualization will be needed.

Stage 5: Instructional Development

The fifth stage involves designing and producing materials, and organizing and managing support system.

5.1 Designing and Producing Materials

This stage involves videotaping all lectures that course instructors offer. In addition, it includes designing templates into which content will be fit and designing course content into pencil and paper storyboard templates or simple electronic storyboards using a uni-dimensional software program such as Word, FrontPage, or Excel. For high quality e-Learning courseware development, this stage is crucial. Whether the content will be interesting and educational stimulating or not, depends heavily on how the content is effectively designed. Interactive message designs have to be performed efficiently. The instructional designers are urged to consult the videotaped lectures every time they are unclear of the course content.

In addition, a media type is selected according to the nature of each piece of content during this stage. With the use of Multimedia technology, e-Learning can display the content in a variety of formats (i.e. still pictures, animated pictures, graphics, video, text or sound). In addition, instructional designers are to prepare the scripts for all narrative text and describe the details they want to display on presentation screens. At this point the draft lesson on paper is carefully evaluated and revised until course instructors agree on its quality.

After instructional designers have completed their works, they hand the storyboards to the graphic designers and media specialists. The graphic designers and media specialists now develop media according to what has been specified on the storyboards. Finally, instructional designers check the media quality before sending it to the programmers who will bring the various media elements together into one platform.

5.2 Organizing and Management Support Systems

All e-Learning projects require excellent organization and managing support systems. During this stage, the e-Learning team selects resources to support instruction and learning activities (i.e. textbooks, worksheet, etc.).

Stage 6: Formative and Summative Evaluation

This stage is the same as the one entitled "**Evaluation phase"** in the ISD. Formative evaluation is a required step to evaluate the effectiveness of the instructional development. Students are asked to use the e-Learning courseware and complete questionnaires constructed by the e-Learning team. In addition, the students' problems and difficulties are recorded. The e-Learning team analyzes the recorded data and makes revisions accordingly. Further, a summative evaluation has to be conducted because it offers information on the effectiveness of the instructional development after implementation.

Stage 7 : Maintenance

Refinement of the modules is a continuous and ongoing process to update content information and respond to suggestions for improvements. In addition, we recommend addressing user support issues each semester. In order to avoid redundant responses, it is wise to create a FAQs file for each course.

Results of the Study

"**High Quality**" in high quality e-Learning courseware refers to a category or level of e-Learning which put emphasis on making the best use of interactive and multimedia technology in the courseware development (Figure 3). However, in this paper, "**High Quality**" in high quality e-Learning courseware development also refers to the courseware's positive impact upon student learning behaviors, attitudes, and achievements.

The subjects of the study were 133 first year undergraduate Chiang Mai University students who enrolled in Fundamental English course during the first semester of 2001 academic year. The subjects selected for the study were from 8 sections taught by 4 instructors. (One instructor generally took care of 2 sections each semester.) From each pair of sections taught by the same instructor, one section was selected as an experimental group, another section as a control group. After their midterm examination, the subjects in the experimental groups learned the content from the e-Learning courseware developed by using the SAM model while the subjects in the control groups learned from the traditional instruction. After the instruction ended, they were required to take the final examination.

This research study used a two-group (e-Learning courseware vs. traditional instruction) posttest design to determine achievement differences.

The dependent variable was English achievement as assessed by achievement posttest scores. In addition, this study also investigated the effects of using e-Learning courseware upon students' attitudes.

Concerning student achievement, both positive and neutral results were noted. (See Table 1-4 for the details of statistical data.) Among 4 pairs of experimental and control groups, data collected from the first experimental group and control group showed that the students learning with the e-Learning courseware performed better than students learning with traditional instruction when the final tests of the students were compared. In addition, for comparing a second and third experimental groups with its paired control groups, students learning with e-Learning and students learning with traditional instruction performed equally well on their final tests. However, when looking thoroughly into their midterm scores of these 2 pairs, it was found that the midterm scores of students learning with traditional instruction were significantly different than those of students learning with e-Learning courseware. That is, the students learning with traditional instruction had higher midterm scores than students learning with the e-Learning courseware. Therefore, it could be summarized that learning with the e-Learning courseware has helped to improve the performance on their final tests of the students in the experimental groups. Nevertheless, for the fourth (the last) pair of the experimental group and control group, data showed that students learning with the e-Learning courseware performed equally well with students learning with traditional instruction. No statistically differences were found regarding the midterm scores of the students from both groups.

Our research also concluded that the implementation of the CMU-SAM model yielded positive results where on student attitudes and behaviors were concerned. It was found that most of the students (80 %) who used high quality e-Learning courseware expressed their positive attitudes toward the courseware that they used. The main reason was that they could learn at their own pace. Further, the students reported that the courseware developed was interactive, fun, and quite easy to use. Several students reported that the courseware visually captivated their interest through its intense use of animated graphics and visual effects. Most found that the graphics and audio were integrated in a way which motivated them to work and effectively meet the instructional goals. Some also reported that they liked the courseware developed because it was a more flexible method of learning in which they could consult the lessons and also undertake a self-test anytime (depending on computer availability). However, 20% of the students expressed their negative attitudes. The main reason was that learning with the courseware made them unable to get an immediate help that they needed from the instructors. In addition, the students reported that they disliked this method of learning because the facilities were not enough. To find available computers to access the

courseware was not such an easy task for them. Lastly, some also found that they did not like this way of learning because the computers they used tended to have problems and since they did not own enough skills to fix the technical problems, the felt frustrated.

Summary

Some difficulties were noted when we evaluated the success of implementing the CMU-SAM model. One was the time required to complete each module. According to the CMU-SAM model, in order to produce high quality e-Learning courseware, it is necessary to progress through each of the numerous stages. Each stage can be time-consuming and costly. High quality products require trained individuals as well as the necessary technology. Therefore, it is necessary to select appropriate courses to produce high quality courseware. As stated earlier, choices should include courses that have high enrollments as well as required courses for many different subject areas.

Table 1: Final Scores of first control group VS experimental group

SECTION	MEAN	Std. Deviation	N
e-Learning	16.629*	3.640	31
traditional	10.924	3.192	33

***p<=.01**

Table 2: Final Scores of secon control group VS experimental group

SECTION	MEAN	Std. Deviation	N
e-Learning	12.73	3.57	30
traditional	13.65	3.69	34

***p<=.01**

Table 3: Final Scores of third control group VS experimental group

SECTION	MEAN	Std. Deviation	N
e-Learning	12.73	3.57	30
traditional	13.65	3.69	34

***p<=.01**

Table 4: Final Scores of fourth control group VS experimental group

SECTION	MEAN	Std. Deviation	N
e-Learning	12.73	3.57	30
traditional	13.65	3.69	34

***p<=.01**

Summary

Most of the online educational content available today is mediocre or rather poor. This is due to the misconception amongst many educators that e-Learning is simply a straight replacement for classroom learning. Hence, educators tend to develop online content for e-Learning that involves selecting a tool and planning to implement existing material with a minimal amount of technical expertise from highly trained individuals. Often, these approaches fail to achieve the expected benefits. By developing s systematic approach for use in the development of high quality e-Learning courseware, like CMU-SAM, high quality standards should be attainable.

References

Brahler, C.J., Perterson, N.S., & Johnson, E.C. (1999). **Developing on-line learning materials for higher education: an overview of current isssues.** retrieved March, 2000: from http://ifets.gmd.de/periodical/vol_2_99/jayne_brahler.html

Diamond, R. M. (1997). **Designing and assessing courses and curricula: a practical guide.** San Francisco, CA: Jossey-Bass. In press.

Dick, W., & Carey, L. (1996). **The systematic design of instruction (4 th ed.).** New York: Harper Collins College Publishers.

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). **Principles of instructional design (4 th Ed.).** New York: Holt, Rinehart and Winston.

Gentry, C. G. (1994). **Introduction to instructional development: Process and technique.** Belmont, CA: Wadsworth Publishing Company.

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1996). **Instructional media and technologies for learning (5 th ed.).** New York: Macmillan.

Kemp, I. B., Morrison, G. R., & Ross, S. M. (1994). **Designing effective instruction.** New York: Merrill.

Knirk, F.G. & Gustafson, K.L. (1986). **Instructional Technology: A systematic approach to education.** New York: CBS College Publishing.

National Special Media Institute. (1971). **What is an IDI?** East Lansing, MI: Michigan State University.

Richards, L. (2001). **Step-by step Developing Online Learning.** *Document presented at the seminar on E-Learning and Online Course for Distance Education*, STOU, Bangkok.

Smith, P. L., & Ragan, T. J. (1993). **Instructional design.** New York: Macmillan.