eLearning Courseware Production System: 
Underlying Principles, Major Components, and Evaluation Criteria

Chaiyong Brahmawong, Ph.D.
Senior Professor/Chief Technology Officer
College of Internet Distance Education, Assumption University of Thailand
E-mail: chaiyong@ksc.au.edu  Website: www.chaiyongvision.com

Abstract
For producing effective eLearning courseware, an eLearning courseware production system needs to be developed using relevant psychological and technical principles.

This paper offers a set of underlying principles, and major components for an eLearning courseware production system to be applied to any production of similar eLearning packages.

The underlining principles are based on the nature of students, psychological and technological characteristics to ensure effective planning, preparation, delivery, and evaluation of the Intern-based distance education.

The components of an eLearning courseware should meet both psychological principle and on-screen presentation. Consequently, a set of seven criteria for evaluation of an eLearning courseware is also presented.

1. Background Information
In developing an eLearning courseware production system, an eLearning institution must have a full understanding of E-Education and its major components.

E-Education comprises three components: E-management, E-Learning, and E-services.

E-Management: - An educational management system via electronics based on an effective management model available such as POSDCARE Model developed at Sukhothai Thammathirat Open University in Thailand (Brahmawong, 2003)

E-Services: --E-Service is a service system whereas rendering and receiving services are processed via electronic means.

eLearning: -eLearning is a system of learning in which ICT is used to support interactive two-way communication among learners and instructors. The combination of on-screen interactive (OSI) and web-based instruction is developed for effective teaching and learning in the form of digital and analog, synchronous and asynchronous, and on-line and off-line, and narrowcast or broadcast delivery systems.

eLearning may employ, as a major approach, digital, asynchronous, on-line, and broadcast or a combination of analog, synchronous, off-line, and narrowcast electronic media.

![E-LEARNING](image)

**Fig. 1** In views of delivery channels. i.e. among class-based, web-based, and on-screen based instruction, web-based instruction plays the central role. Class-based and OSI-based instruction are employed as supplementary channels.
In views of delivery systems, digital, asynchronous and on-line are combined to offer the main stream for imparting knowledge and experiences to the students. Face-to-face and more traditional eLearning forms such as analog, synchronous, offline and narrowcast are blended to offer supplementary role to the eLearning process.

2. Underlying Principles in Producing eLearning Courseware

The underlining principles are based on the nature of students, psychological and technological characteristics to ensure effective planning, preparation, delivery, and evaluation of the Intern-based distance education.

2.1 Student Learning Nature-

By nature, student learning varies according to their interest, aptitude, styles, convenience in place and time, accessibility and ability to know the progress of their learning. In developing eLearning courseware, the following principles in learning nature are considered:

2.1.1 Learning according to their interest.

Students are motivated to learn topics of their interest and they are keen to learn. eLearning institutions need to develop adequate sources of knowledge in the form of knowledge bases or knowledge centers to serve the needs for on-demand learning;

2.1.2 Students and their learning styles.

Students prefer their own learning methods and styles appropriate to their habits and character traits. Hence, eLearning institution should provide alternatives for students to select their learning style from instructor directed learning (IDL), peer directed learning (PDL) to enhance self-directed learning (SDL);

2.2.3 Convenient study times. Students prefer to study at the time they feel convenient. eLearning institutions should therefore allow the students to study any time they are ready;

2.2.4 Appropriate study places. Students find their home the most convenient place to learn. However, some students may need to gather at a certain place to do some practical work. eLearning institutions, consequently, need to provide the kind of home-based learning on line as well as center-based learning at the study center provided. In short, students should be able to study at any place convenient for them;

2.2.5 Wider access to learning resources. Students’ learning will be more effective if the students have better access to wider sources of information. The Internet provides search engines leading students to numbers of knowledge-based websites from where students can access the information they want to learn. eLearning institutions must develop adequate knowledge centers for students.

2.2.6 Awareness of learning progress. Students’ learning will be better motivated if they are aware of their learning progress. eLearning institutions should therefore provide systematic feedback to the students so that they can check the learning results, improve and progress with better self-confidence along their program of study.

2.2 Psychological Principles

There are two groups of learning principles applied to distance learning: S-R Theories and Field Theories.
According to S-R Theories, learning occurs when an appropriate stimulus (S) is given, the student responds (R) appropriately to the stimulus, and the student receives appropriate reinforcement (Re). The students, consequently, must be taught a topic of content in well-thought logical orders, steps by steps, with appropriate, well-designed content presentation through an effective multi-media package. Each student gets involved in the learning process through active learning, and complete the works assigned by the instructor who, in turn, checks the outcomes (assignments, reports, activities) and provides comments as feedback to help him/her improve his/her learning and assignments.

Field theories, on the other hand, assert that learning takes place when the students have the need to learn and engage in active learning. Most important of all, learning must take place in an appropriate environment, physical, psychological and social.

eLearning institutions should make use of the integrated applications of the two sets of learning psychologies for the production of its courseware by providing the four conditions to facilitate learning and make sure that appropriate organizers are applied in the courseware.

2.2.1 Four Conditions Facilitating Effective Learning. The four conditions needed for facilitating effective learning are active participation, immediate feedback, success experiences, and gradual approximation.

Active participation. Students should be programmed to have active participations in the learning process by, not just mere reading, performing and completing all activities and assignments provided in the course.

Immediate feedback. After completing the activities or assignments, the results of their performance need to be recorded for feedback, either immediate or delayed. However, immediate feedback was proven to be more effective to let the students know the outcome and progress of their learning. In distance learning, self-feedback is more preferable to the external feedback given by the instructors or other external sources.

Success experiences. The feedback given to the students gives the student the feeling of success. It becomes reinforcement to encourage the students to further their studies. Comments help students correct their mistakes and improve their work while praises or admiration drive them further to more success in learning.

Gradual approximation. In the process of self-directed learning, the students are gradually directed to progress along bits of knowledge and experience, well analyzed in advance, through the process of approximation or thorough thinking. Consequently, content analysis is the most important steps to be conducted by courseware production team in order to make sure that the students are programmed to progress along in the logical step-by-step approach.

2.2.2 Applications of Learning Organizers. An organizer is instrumental to get the student involved in an effective learning process. It helps the students to be aware of what knowledge or experience they are expected to encounter, in what manner, through what means and process, for what outcomes, and in what situation the learning outcome should be transferred.

There are three learning organizers to be integrated in the courseware production process: advance organizers, concurrent organizers, and post organizers.

Advance organizers. An advance organizer (OA) provides the learning plan to the students at the beginning of a lesson to let them know the topics, concepts or main ideas, objectives, learning activities, instruction media, learning resources, and evaluation process.
An AO may be formal or informal. Formal AO is usually presented in the form of a lesson plan. Informal AO is presented in the form of an introduction or a preamble given at the beginning of the course, the unit, or module.

*Concurrent organizers-* A concurrent organizer (CO) is a tool to help the students acquire the knowledge, read the required subject matter or know-how, get hand-on experiences, perform the assigned tasks, and check the results of their work.

In distance learning, a COs are in the form of instructional media, i.e. self-learning texts, audiotape/CD, videotape/CD, radio/TV programs, CAI, real objects, laboratory equipment, and activities and assignments to be performed by the students during the course of their learning process;

*Post organizers-* A post organizer (PO) provides generalization or conclusion of what the students learn and how they should apply what they have learned in different situations.

In distance learning, POs are given in two occasions: (1) as the conclusion at the end of each learning topic, and (2) as separated units or modules at the end of the course.

From the above-mentioned learning theories, eLearning institutions make use of both sets in designing learning management system (LMS), content management system (CMS), and student management system (SMS) to ensure the most effective Internet-based learning achievement of CIDE students.

### 2.3 Technological Characteristics

Major technological characteristics applied to the Internet-based distance education are its accessibilities. The Internet technology embraces various characteristics beneficial to distance learning: file transfers and data exchanges, high speeds and wider links, two-way communication and interactivity, and massive storage and retrieval capacity.

*File transfer and Data exchanges-* The Internet allows users to transfer files and exchange data and information. This is beneficial for eLearning institutions to create a CMS allowing students to get access to the database and knowledge base by logging in to eLearning institution’s Knowledge Center to learn the subject matter, engage in practical works, and submit the assignments to the instructor.

*High speed and Links-* The speed of the Internet, if maximized, can transmit data and information at a high speed, thus allowing teachers to update, upgrade and deliver the subject matter to the students timely. Where high speed facilities are not available, the combination of off-line technology such as CD and other conventional, and analog media, can be used to reduce download time. eLearning institutions must design the Internet learning system to allow integration of on-line and off-line components in its Internet distance learning system.

The Internet permits quick and simultaneous links to various servers, in side and outside the country. This is very useful for the instructor to direct the students to learn from more than one source, i.e. university libraries, public libraries, museums, community resources within or outside the university, in or outside Thailand.

Consequently, instructors may be recruited from all over the world to teach a wide range of students from all over the world through the existing linkages between eLearning institution’s server and other eLearning sources.

*Two-way communication and Interactivity-* The most critical attributes of the Internet distance education are two-way communication and interactivity.

Two-way communication does not confine itself to mere face-to-face situation but mostly through various communication
media such as the Internet, telephone, and facsimile.

The interactivity is the provision of synchronous or asynchronous two-way communications allowing the instructor to interact with his students and the students to interact with other students not only via face-to-face but also via interactive media. The provision of interactive media such as web boards, chat rooms, email, and mobile phones is an indispensable component of eLearning in providing a wider range of interactions among various parties involved in the Internet distance learning process.

3. Components of eLearning Courseware

The components of an eLearning courseware should meet both psychological principle and on-screen presentation:

3.1 Psychological Component- An eLearning courseware, as a form of eLearning packages, should comprise six parts, namely pre-test, advance organizer, body of content, assignments/activities, feedback, and posttest.

3.2 Component by On-Screen Presentation- Based on the appearances of the eLearning on the monitor screen or on-screen appearances, an eLearning courseware should compose of 12 components: homepage, learning center, knowledge center, external learning resources, laboratories, audio-visual center, evaluation center, web-board, chat room, electronic communication, frequently-ask questions (FAQ), and personal profile.

3.2.1 Home Page- the first page of the section comprising course homepage, unit homepage, and topic homepage.

Course Homepage is the first page of the course. It displays the name of the institution, school/faculty, and departments, objectives and course description, list of units, course synopsis, instructor and student profiles, bulletin board or web-board, news, and announcement.

The unit homepage is the first page of the unit that follows the link from the course homepage. It comprises the 12 components listed as a navigation menu, namely unit objectives, unit concepts, Content, Activities, AV Media, Chat room, FAQ, External Resources and Web Board.

3.2.2 Learning Center/Virtual Classroom- Learning Center is the actual platform where learning takes place. It is the center of learning activities of the course and represented by the course homepage.

There are various components such as navigation menu, lists of teaching units, instructor’s photograph, and a synopsis of the course.

The standing menu to appear every unit and topic webpage comprises objectives, concepts, content, assignments/activities, AV Media Center, Chat Room/Web board, Pretest/Posttest, FAQ, and External links.

3.2.3 Knowledge Base-KB - The KB contains knowledge and experiences of all courses of the curriculum. The KB usually contains separate content for each course to be used both for class-based and for home-based.

The KB contains three types of knowledge and information: (1) Hard core for permanent or unchanged knowledge, facts, or information; (2) Interactive for the knowledge or information to be used in the interactive mode allowing students to have partial interaction to posted knowledge or information; and (3) Add-on for new unfiltered or verified knowledge, information, opinion, research findings posted by students or instructors for comments or reactions by others. The posted articles, after being verified by the faculty

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members, may be selected and deposited to the interactive and hard-core sections of the KB.

3.2.4 External/Supplemental Resources-
The external resources are sources of knowledge or information (libraries, databases, knowledge bases etc.) provided by external organizations to be used as supplementary sources of knowledge or information both in the same or different network. External links are made possible both at the course level or at the unit level.

In eLearning, the external resources can only be accessible on-line via the Internet or the intranet or off-line via CDs. Books and texts are usually converted into e-books for better access.

External resources must be well selected and made available only when needed. Provision of external links to unspecified sources may unleash the student’s attention to browse through the more attractive websites, which may not necessarily be related to the lesson. Students may be disconnected resulting in the waste of time and money.

3.2.5 Practical Experiences Center/Laboratories - This section allows the students to get involved in doing assignments or practical work in the operation center or the laboratories in virtual labs, simulated labs, or real laboratories.

The students may be assigned to undertake project works and summit them via the Internet or e-mail.

Audio-Visual Media Center- AV Media Center provides links to the knowledge or information provided in still and moving images, audio, video, and full feature multimedia such as video on demand, audio on demand, audio and video via the Internet using streaming technology.

All AV media must be carefully selected by both the content specialists and the instructional designer before they are deposited in the AV Media Center.

3.2.7 Evaluation and Monitoring Center - This section provides self evaluation (self-pretest and posttest), formative and summative evaluation. Scores of the tests are kept confidential and made known to individual students who want to know their learning progress.

3.2.8 Web Board/Bulletin Board- This is the platform for the students to exchange their ideas and opinions with their friends and instructors concerning academic, social, and personal activities.

3.2.9 Chat Room- The chat room allows real time dialogues between students and students, students and faculty members on the subject matters and personal matters in text mode, sound, and web cam. This is provided for the instructors and their students in the assigned collaborative group.

3.2.10 Personal Information Center- This section keeps the information of the students and the instructors. Only non-confidential information is provided here. The personal information may consist of curriculum vitae, photographs, e-mail address, telephone number, and other information to be made public by permission of the student or the instructor.

3.2.11 Electronic Communication- This is to provide personal communication between students and students in the form of electronic mail or E-mail, facsimile (FAX), voice-mail, or other electronic communication.

3.2.12 Frequently Asked Question-FAQ. This section compiles the most frequently asked questions and their answers related to the subject matter of the whole course or the unit to help the student move smoothly along
his study without having to wait for the answer to any questions he wants to ask. This prevents the instructor from repeatedly answering the same or similar questions and helps the student to get the answer to the question without having to ask the instructor.

4. Criteria for Evaluation of eLearning Courseware

Criteria for evaluating eLearning comprises seven aspects:

4.1 Look and Feel- Look and feel is what appears on the monitor screen. It displays the images to the eyes and lures the feelings to the mind affecting the desire to enter the web pages. Design of a good-look-feel page is carried out at the design for learning management system (LMS) and the content management system (CMS) for well analyzed and treated content.

An eLearning lesson should contain good composition of the web pages, clean and simple, not too colorful, and not too much information jammed in one web page.

4.2 Course Development Process- Course development is a major element content presentation. It must comprise course syllabus, lesson plans, details of course content, list of units, and concept mapping logically arranged according to the CMS.

4.3 Learning Interactivity- An eLearning courseware must provide learning interactivities to allow immediate responses between students and students or students and the instructors or between students and interactive media. This is evidenced from content presentation, tutorial sessions, assignments and feedback, and the provision of practical work.

Good eLearning courseware must ensure continuous interactions both personal and media interactions.

4.4 Evaluation of Learning Achievement-

Students should know the progress of their learning achievement through self-evaluation. Correct answers or keys to the questions or activities should be made available.

eLearning modules must provide self-pretests, self-posttests, and samples of the final examinations to let them check the understanding of the lesson before they actually sit for the final examination.

4.5 Communication Tools-

eLearning courseware must make available the communication tools to allow the students to communicate among themselves through texts, sounds, or video.

Chat rooms, web board, and list of e-mail address must be made available.

4.6 Virtual Classroom or Environment-

In order to simulate real or physical learning experiences, eLearning courseware should provide virtual class room or virtual environment to give the students a feeling of real class room situation by providing live broadcast, video and audio on-demand, real time presentations, and seminars via teleconferences.

An eLearning courseware should provide some levels of simulated or virtual situations to the students.

4.7 External Accessibility: Links and Search-

To make full use of the Internet potentialities, eLearning courseware must provide the links to other websites, e-libraries, knowledge bases, or other resources outside the university to enable the students to search for additional knowledge or information.