World Transactions on Engineering and Technology Education
Vol.4, No.2, 2005

What is courseware? A comparative analysis

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ABSTRACT: In this article, the authors present research that provides an analysis of various *courseware* features that are available on the Internet, in order to develop a new model that is based on some of the technologies, such as computers and telecommunications, within a constructivist context. Also, learning skills models and the main components of such courseware, so as to improve the resources available to the information society and enhance knowledge, are presented and discussed in this article.

INTRODUCTION

The initial objective of this article is to enhance educating and learning skills with the support of the Internet, and is focused on a comparison of the characteristics of samples of courseware models, such as *courseware* or *online* courses. The authors also compare course features and propose potential directions for future developments, while concentrating on courseware that is focused on the student within a constructive context.

WHAT IS TEACHING/LEARNING?

Learning Skills Models and Components of Courses

In this article, the authors provide a presentation of some of the notions of education, models, support technologies and educating environment that should be adapted to the concept of educating and distance learning. This is even though some theories related to those models of education and learning are uncharacteristic, such as the method/manner of the concept of the course [1][2].

In this context, technologies, such as computers and telecommunications, when adapted using educational methodology (apprenticeship and pedagogy), have led to different objectives, namely a bigger availability of information. This is an essential factor for society, which strives for, and spreads, this knowledge.

Distance learning (DL), especially e-learning, supports this new drive for knowledge [3]. This is a learning method from the ample area of information and knowledge, and was once only aligned to information and communication technologies (ICT). It has since become part of the programme format of classes and their utilisation. Various teaching institutions use them with various types of support: multimedia CD, Internet or another web type.

Other definitions may be found on the Web [4-6]. But such definitions are similar where a teacher and student are remotely separated in terms of space and time [7].

Taking into account the concepts stated above, some base aspects of the conception of a course on the Web can be expressed, such as five fundamental features, namely:

- Description of the course (interfaces);
- Type of connection (security);
- Communications (synchronous);
- Educational foundation (characterisation);
- Organisation (contents) [8].

However, in the learning environment context, a number of characteristic elements emerge that should be considered [9]. The contents and structure of the course itself need to be managed carefully in order to have an outstanding influence on the type and manner of learning.

COURSEWARE MODELS

Concept of Courseware

Key organisations, such as the National Education Delivery System (http://www.needs.org/), promote operations for the quality, growth, plan and conception of methodologies within an educational context and for projects of educational materials (educating/training) for use with computers, denominated as courses – courseware. With regard to the particular case of educational materials, these are also called educative programmes.

Specifically, the area of engineering known as *courseware engineering* serves as support material for students of this area in the process of learning. Courseware may be utilised as in a

virtual class, lecture, self-learning, such as reference materials, and in the accomplishment of tests to evaluate the performance of a student individually or in a group. In the context of engineering education, courseware has a typical feature of existing in a multimedia environment, such as graphics, photographs, images, video and animation, in order to illustrate engineering concepts, theories or experiments. It can also include links to other sites that allow the user to investigate information related to the contents.

The quality of courseware is considered to be trustworthy when it is incorporated into a learning environment and duly tested, which can then provide effective results for students. Courseware should be considered to be an advantageous average resource, especially when compared to traditional models (texts and classroom).

The objects of courseware may be altered if the context for which it was created is different to that where it is used. Quality *courseware* should incorporate educational recommendations for its correct utilisation [10].

Courseware Classification

Basically, courseware is divided into two types, namely:

- An individual learning environment that is standalone by means of CDs, videos, etc;
- Learning in the Web environment (WWW or other), online by means of sites, with images, animation, etc [11].

This characterisation emphasises that there exists an intensive use of the term *courseware* or *online course*, which has been designated to other courses that have a less frequent utilisation of the Internet or is only accessible via the Web. This results in the existence of a large range of models of *courseware*.

Mason presents three classifiable categories for *online courses*, as follows:

- *Context + support models*: This model was one of the first to be created and is the most used; it consists of two pieces of information: course contents and educational support;
- *Wrap-around model*: This category attempts to define courses that are a group of diversified materials (eg texts from books, CDs, educators, etc);
- *Integrated model*: This course consists of collaborative activities, learning resources and tasks given.

Of the models presented above, the first, the *contents + support model*, is the most popular and up-to-date for users due to the fact that it is the one most similar to the traditional teacher and for being the most expositive regarding its contents. It may also complement the subject. The *integrated model* is adapted to this type of learning; there exists a role for the teacher and manager of these activities of interaction and collaboration between students. The *wrap-round model* serves personalised training situations, but there a few applications available.

COMPARATIVE ANALYSIS OF COURSES

A comparative analysis of courses is accomplished by a contextual type of product, and is characterised by an analysis of a sample of various courses, including course details and contents.

Context

After conducting a survey of various institutions (universities, associations, institutions and firms) that dedicate themselves to this activity of distance learning (DL) in Portugal, it was found that many of these institutions have an indirect relation with DL, and only produce courses and material (videos, CDs, etc) when requested by others. However, only about $^1/_3$ support such learning. This is a residual percentage compared to institutions of the USA, where according to some facts in 2001, approximately 75% of the universities there engage in DL via the WWW in multiple areas and attribute various academic degrees. Portugal is still at the beginning of a wide scope of possibilities through its institutions.

Sample Characterisation

The present research takes into consideration the projects already accomplished by Hooper concerning a comparison of the available courses on the WWW [12]. The present sample of *courseware* resulted from a multi-featured research namely of the Internet, associations, universities and various publications by various conferences authors, including ED-MEDIA and WebNEt [13]. After starting with many samples of courseware, the first 15 samples were kept, after viewing the various contents of courses originally from the USA and two from Europe.

The objective of this analysis is to visualise, experience and select, starting with a course's contents, plus its most relevant and useful facets for a characterisation of courses on the *Web*, hence resulting in the comparative table shown in Table 1.

The characteristics of most of these online courses originate from *NetLearning*, since there are no criteria for the evaluation of the characteristics [14]. This institution exists on the edge of the influence of the University of Vanderbilt, USA [15]. Most of the authors analysed their courseware projects as they were needed and not following classic designs. These systems have been formulated by various investigators verified elsewhere [16]. There is also no constructive approximation of the course created [17].

These models of courseware sometimes originate architectonic structures that are relatively distinct and complex. According to Draves, a long distance course is an educative programme accessed by the Internet for a certain type of audience because of three principal elements, namely: contents, interaction and evaluation [18].

Characteristics Analysed

The list of characteristics that were analysed is as follows:

1. Seeing and feeling:
    a. A first impression;
    b. Use of graphics;
    c. Disposition of the material presented.
2. Navigability;
3. Programme/contents;
4. Task/designation;
5. Interaction with students;
6. Student support;

Table 1: A comparison of courseware features.

	Features (1 … 14 Items)															
	Classification: (NS=Not Sufficient , S=Sufficient, G=Good, VG= Very Good)															
Courseware (Origins)	1a	1b	1c	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Eng. Inf. (Vanderbilt Univ.)	G	S	S	S	G	S	S	S	S	NS	S	NS	G	NS	NS	USA
2 Ciê. Mat. (Vanderbilt Univ.)	G	S	G	G	G	G	G	G	S	G	G	G	G	NS	NS	USA
3 Pre. Inf. (AVSC Org.)	G	S	G	G	G	G	S	G	NS	G	S	G	G	NS	S	USA
4 Pri. Fra. (Texas Univ.)	G	G	G	S	G	G	S	G	G	G	G	G	G	S	G	USA
5 Int. Bio. (Iowa Univ.)	S	S	S	S	G	S	S	S	NS	NS	S	G	G	NS	NS	USA
6 Enf. Ped. (L. Tech. College)	S	S	S	S	NS	S	S	S	NS	NS	S	NS	G	NS	NS	USA
7 Ling. Prog. (MIT)	S	S	S	G	VG	S	S	VG	NS	G	S	G	G	NS	G	USA
8 Learning S. (Capella Univ.)	G	G	G	G	S	G	G	G	G	VG	G	G	G	G	G	USA
9 Wor. ALN (Vanderbilt Univ.)	S	S	S	G	S	G	S	S	S	G	S	NS	G	NS	S	USA
10 WebTycho (Maryland Univ.)	G	G	G	G	S	G	G	G	G	G	G	G	G	G	G	USA
11 Geo. Sta. (Texas Univ.)	S	S	S	S	G	G	S	NS	S	NS	S	NS	S	NS	S	USA
12 Biolog. (Illnois Univ.)	NS	NS	NS	S	G	S	G	NS	S	S	G	G	S	NS	S	USA
13 Elec. C. Che (Maryland Univ.)	S	S	S	NS	G	G	NS	G	NS	NS	NS	G	G	G	G	USA
14 TrainingCL (European group)	G	G	G	G	VG	VG	G	VG	G	G	G	VG	VG	G	G	*
15 Bus. Int. (Sofia Univ.)	G	S	S	S	G	G	G	VG	NS	G	G	G	G	NS	G	**

* Group of six European countries (UK, Italy, Greece, the Netherlands, Hungary, Bulgaria).
** Bulgaria/UK

7. Multimedia;
8. Fluency of the tools;
9. Interfaces/types of display units;
10. Evaluation;
11. Moulding of the problem;
12. Animated/movement images;
13. Actualisation of methodology;
14. Others/country of origin.

Each of the items characterised have been classified as follows:

- *Not sufficient*: no item exists;
- *Sufficient*: an item exists in a much summarised form;
- *Good*: there is a lot of information on the item;
- *Very good*: there is a lot of information that leads to other points of diversified information.

Details, Contents and Contexts: Synthesis

- The 1st course analysed covered computer programming language, with the course information and contents given by means of a set of pages [19];
- The 2nd course related to materials science and was found at the same site as the 1st course;
- The 3rd course targeted medical students and had an easily navigable table structure with good graphics and many suggestions of publications of interest [20];
- The 4th site was a university programme detailing a French language course [21];
- The 5th site was a university course introducing the subject of biology [22];
- The 6th course came from a reputed organisation in the area and addressed the training of nursing staff from the perspective of continuous education, and contained questionnaires and its contents were certified [23];
- The 7th course was from Massachusetts Institute of Technology (MIT) on programming language, and yielded a menu for general information pages [24];
- The 8th site covered a university's courses that had the same structure based on space of learning (type of schoolroom), and contained pages where the contents and contexts developed were connected [25];
- The 9th site came from a satellite organisation of a university and had a similar structure to a previous course [14];
- The 10th site was from a university course that was based on teaching/learning, where all its courses possessed similar contents [26];
- The 11th site was for a university course on geo-statistics; the contents of the lectures were presented along with videos and text slides from each lecture [27];
- The 12th site was for a university biology course with lecture plans and accompanying summaries [28];
- The 13th site covered a chemistry course, with basic concepts and a great variety of exercises [29];
- The 14th site covered a group of five courses that were conceived by six European associations from the UK, Italy, the Netherlands, Hungry, Greece and Bulgaria); this group of courses was found to be complete and had multiple possibilities of interaction with various pages between students and teachers [30];
- The 15th site described a university course for training people in Web commerce; the initial page presented two screens, one with icons linked to various areas (principal, introduction, planning, beginning of the course, glossary and project) [31].

Analysis of Comparisons

An analysis has been undertaken in order to interpret the classifications given to each item characterised in each course from a quality perspective. Comparisons have been made. However, an analysis of certain global aspects also needs to be made. Another element to be considered is the type of authoring system utilised in order to generate a virtual learning environment/area (ASVLE), such as: LearningS, Wor_ALN, WebTycho, etc; these systems present the course in a more accessible way. Further, they may be completed with functionalities that are in proportion to the environment, already discussed above, and the author/designer may also be incorporated.

These factors are reflected in the 8th (LearningS) and the 10th course (WebTycho), which obtained a classification of (Good) B=13 and B=14, which should be considered successful when compared to the other courses. However, the scores of the 4th course (Pri_Fra) and the 2nd course (Cie_Mat), which were classified as B=12 and B=11, respectively, demonstrate a willingness to create functionalities that are available to students by choosing good support technologies.

In the 14th course, the courseware presented had the highest number of VG (Very Good) and G (Good) rankings. TrainingCL was classified with a VG = 5 and still B = 10, but it should also be noted that this course was very well financed in comparison with the other courseware studied.

It is recognised that the classification attributed to each item has a certain level of subjectivity attributed to it. However, if a certain functionality does not exist, then the course is assigned an NS (Not Sufficient) ranking for that area.

A common factor between these courses' results in that they are all oriented towards a methodology of teaching-learning following a model where the triangle (student-teacher-knowledge) is a set to which the teacher is the preponderant element.

CONCLUSIONS

This research conducted and presented in this article covered a comparative sample of courseware. The various courseware features were presented from the perspective of knowing what exists, while also proposing new solutions. A platform of a new courseware was chosen to integrate the support technologies for courseware taking into consideration the costs involved.

However, the aim is to develop learning competences. From this aspect, the conceptions of methodology of courseware presented do not seem to encourage students to this paradigm. This forces the project to develop a totally new design of courseware (contents, interaction, evaluation and simulations) with mechanisms that construct a cooperative learning environment. In this case, the teacher would be the tutor/manager of the information. This still requires the development phase to include the personalisation of courseware, where its structure and contents are dependent on the knowledge, experience and motivation of the individual.

The area of adapted hypermedia systems that reflect some characteristics of the user may be utilised to develop this personalisation, whereby the system is adapted to the user. Another future perspective is to develop a fast way to get to the various models of interactive multimedia, collaborating with intelligent functionalities that are centralised on the student, as one method to develop constructivist courseware.

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