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**Perspectives for Improvement of Distance Learning Environments (SCORM)**

*The main purpose of this paper is to describe and study the synchronous character of education, which is the asynchronous web-based learning. More specifically an investigation is carried out concerning the new possibilities that are offered by Web–Based Learning Environments, conducting by this way the positive steps and the changes that took place in synchronous education. Furthermore, the paper points out the main problems that have been created and seem to play a vital role to the future development of web–based learning education. Finally the paper refers to future possibilities and efforts in order to offer more quality in education. Thus, there is a description of the main features of SCORM standard.*

**Introduction**

In the last few years remarkable efforts have been observed in the design and development of Web-Based Educational Environments (WEE) that exploit the possibilities of new technologies and adapt the processes of teaching and learning to modern educational reality.

Education has seen important developments in the last decades and continues, at a regular and careful pace, to incorporate new methods and techniques in the educational process. New possibilities, such as asynchronous education, are cultivated and developed at very quick rates. New terms, such as virtual classrooms, distance-learning, and adaptive education, most of which derived mainly from technological developments, have been added to educational terminology. There is no doubt that the field of education is one of the most rapidly developing sectors of modern society. Today, more often than ever we hear about distance learning, asynchronous education via the internet, continuous education and individualised learning.

Despite the positive progress and the innovations that have contributed to distance learning, there have been a lot of problems. These problems arise mainly from the lack of satisfactory standards and specific rules that would not only ensure the rendering of quality education, but also its future development. The main notable effort in the standardisation of certain processes associated with distance learning was realised in the last few years with the creation of the model SCORM (Sharable Content Object Reference Model). This model can constitute the foundation and the beginning for the development of distance learning via the internet, as it determines specific rules for many subjects, while at the same time being flexible enough and susceptible to a lot of improvements.

**Asynchronous Web–based Learning Environments**

The rapid growth of distance learning in the last decade has resulted in the continuously greater increase in the number of people, from various sciences, interested

in the design and creation of suitable internet environments where knowledge can be transferred. Thus today an abundance of available educational tools exists, as well as completed educational internet environments (WEE) that can be used to support distance learning via the internet.

Web-Based Educational Environments incorporate various operations, such as asynchronous and modern communication, discussion forums, user management and training material. In fact, the growth of open source communities has resulted in further development of web-based educational environments, the possibility of their use, free of charge, the appreciation of their environments by more users as well as the most rapid increase of available web-based educational environments (WEE). Efforts in the growth of web-based educational environments are realised either by companies whose main objective is their commercial exploitation, from universities and other non-profit organisations or by individuals (mainly professors).

Surely we could split the wealth of web-based educational environments that have been created in many different categories, based on the objective for which they have been created, the pedagogical approaches that follow, the services that they offer and other criteria. Nevertheless, in the particular proposal, a segregation of web-based educational environments is conducted based on the benefit potential, adapted capabilities and individualised learning.

Therefore, on the one hand, we can distinguish WEE that offer advanced services in distance learning with the incorporation of many tools and aids so much for the professor as for the student[1]. Professors can not only manage, check and evaluate students (student management) easily and within a friendly interface, but they can also manage the instructive material (content management). Various means of communication are offered to students, such as discussion channels (chat rooms), discussion forums (newsgroups-forums), electronic correspondence (e-mail), video-discussion (videoconference), etc. Also, many times the possibility of writing instructive material exists through tools offered by the platform (authoring tools), as well as the creation of student evaluation sheets. However, the main characteristic of the above mentioned WEE is the relatively static nature of the potential for individualized services.

Apart from the removal of restriction in the time and the space between the instructor and the student, asynchronous education via the internet has much deeper changes to offer to the educational process. Henceforth the student can be regarded as a separate entity, with distinct characteristics and capabilities. In this way, dealing with each student differently is feasible and so is adapting teaching techniques to each student's particular traits and peculiarities[2]. In other words, the possibility of individualized education is provided with the use of internet and special educational

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[1] WebCT - www.webct.com, Blackborad - www.blackboard.com, TopClass - www.wbtsystems.com, BSCW – http://pc53371.uni-regensburg.de/bscw, Claroline - www.claroline.net, Compus – http://compus.uom.gr, lrn - http://dotlrn.org, Campus K12 - www.campusk12.com, Moodle - www.moodle.org, E-tutor – http://etutor.sourceforge.net/, etc

[2] T. Miskelly, *Interactive student modeling*, *ACM southeast Regional Conference*, pp. 88-94, 1998

environments that have been designed precisely for this purpose (Hypadapter[3], ELM-ART[4], Arthur[5], CAMELEON[6], Kbs-Hyperbook[7], AHA![8].

The Adaptive Hypermedia constitute a relatively new sector of research that can help students' education via the internet, adapting the instructive material and its presentation style to students' particular characteristics and preferences[9]. Recently, the standardisation of certain processes began and all the new adaptive educational platforms began to follow a specific building framework, while others include even tools for writing training material. One of the main characteristics of these systems consists of the various ways of providing help and guidance to students in the educational process.

Adaptive learning systems (ALS) surely constitute living proof of the continuous improvement and development of modern education, materialising theories and practices that would be practically impossible with traditional teaching methods or the static systems for distance learning. Nevertheless, many times problems are created in the design and application of such systems, with unfavourable impact on the quality of education being offered. It is therefore important that these problems be identified and resolved.

**Weaknesses of Web-Based Educational Environments**

Undoubtedly the positive progress that has been achieved in the field of distance learning is very important. However, very often, so much in the design as in the application stages of WEE, certain problems arise and their weaknesses surface.

One of the more important disadvantages of the majority of WEE is their weakness to communicate with other systems and exchange information such as educational material. In the design stage of all systems mentioned above, the possibility of professors accessing other systems and exchanging educational material that could be reusable was not taken into account. Undoubtedly, the work of professors would become much easier if they could use educational material which has already been prepared by someone else from another part of the planet. Furthermore, there is no possibility of communication between WEE for data collection purposes for the students, who most likely had taken certain courses in other educational platforms, with the main objective

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[3] H. Hohl, H. Böcker, P. Gunzenhäuser, *Hypadapter: An Adaptive Hypertext System for Exploratory Learning and Programming. User Model. User-Adapt. Interact. 6*(2-3): 131-156, 1996

[4] G. Weber, M. Specht, *User modeling and adaptive navigation support in WWW-based tutoring systems.* In: A. Jameson, C. Paris, C. Tasso (eds.) *User Modeling* (Proceedings of *6th International Conference on User Modeling*, Chia Laguna, Sardinia, Italy, 1997) Wien: Springer-Verlag, pp. 289-300, 1997

[5] J. E. Gilbert, C. Y. Han, *Arthur: Adapting Instruction to Accommodate Learning Style.* In Proceedings of *WebNet 99: World Conference on the WWW and Internet*, Honolulu, *Association for the Advancement of Computing in Education*, pp.433-439, 1999

[6] M. Laroussi, M. Benahmed, *Providing an adaptive learning through the Web case of CAMELEON: Computer Aided MEdium for LEarning on Networks.* In C. Alvegård (Eds.), Proceedings of CALISCE'98, *4th International conference on Computer Aided Learning and Instruction in Science and Engineering*, pp. 411-416, Göteborg, Sweden, 1998

[7] Henze N. and Nejdl W. (1999): *Adaptivity in the KBS Hyperbook System, 2nd Workshop on Adaptive Systems and User Modeling on the WWW*, May 11th Toronto, and June 24th, Banff, 1999. Held in confunction with the WorldWideWeb (WWW8) and the *International Conference on User Modeling*.

[8] P. De Bra, L. Calvi, *AHA! An open Adaptive Hypermedia Architecture. The New Review of Hypermedia and Multimedia*, vol. 4, pp. 115-139, Taylor Graham Publishers, 1998

[9] P. Brusilovsky, *Methods and techniques of adaptive hypermedia*, *User modeling and user adapted interaction*, V. 6, N. 2-3, pp. 87-129, 1996

being the adaptation of the educational environment to the particular needs of each student.

The fundamental problem that comes up in adaptive educational environments is that the modelling of students is not always completely reliable. Errors may result so much during the process of building a model for the student, as in the application efforts for the technical individualisation in the model of the student. Moreover, certain elements that are required to build the model of a student, such as experiences and preferences, must be entered in the system directly by the student, a procedure which carries the risk of erroneous data provision/entry.

Various elements, which theoretically could be used for drawing useful conclusions, such as the web pages that a student has visited and the period of time of the visit, cannot constitute reliable sources for building and updating the model of a student[10]. Certain adaptive learning systems (Hyperflex, Isis-Tutor) use the above variables to update the model of a student; however, no one can guarantee that the user that visited a particular web page or opened a file actually read it as well. Similarly, the period of time that the user remained in a web page can be fictitious because the user may not have necessarily dedicated all this time working out the content of the page, as it is possible that he was working on something else at the same time.

Problems can also be created while the student is navigating through the material via all the links and pages that he is provided with. If effective navigation techniques have not been applied, and in parallel the student has not been provided with additional and appropriate help with respect to the route that must be followed so that he achieves his objectives, there is a chance that the student will disorient himself from the teaching process and will follow alternative teaching methods which are not recommended. Something like this can happen, leading the user to select links that are not very relevant to the subject that is being taught at that particular moment[11].

The most important problem that the designer of adaptive learning systems can face is the fact that there are no fixed rules, techniques and methods for the provision of individualised education that would be acceptable by all. In other words, there is not one single design, or a common framework for the design and application of adaptive learning systems. As a result, the growth of Adaptive Educational Systems experiences long delays because precious time is spent in the programming of their application, and not enough weight is given to the development of training strategies and suitable educational material that might, for example, be reusable by other platforms.

All of the above mentioned problems arise mainly from the lack of a common acceptable design framework, a set of conditions and rules, and a lack of standards. Consequently there is an imperative need for the determination of a common framework for the design of WEE that will exploit the technological capabilities with the benefit of distance learning being the final objective.

**Perspectives for Improvement**

The fact that the internet is liable to become the basic channel of communication between organisations and people constitutes a reality. At the same time, the continuous

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[10] P. Brusilovsky, *Methods and techniques of adaptive hypermedia*, *User modeling and user adapted interaction*, V. 6, N. 2-3, pp. 87-129, 1996

[11] T. Miskelly, *Interactive student modeling*, *ACM southeast Regional Conference*, pp. 88-94, 1998

growth of technology in combination with the continuously increasing requirement for qualitative services in the field of distance learning via the internet makes the need for the determination of certain standards crucial.

The most essential effort in the creation of certain standards that will solve many of the problems related to Web-Based Educational Environments as previously mentioned, but that will also give a new boost in the growth of distance learning via the internet, were completed recently with the creation of the model SCORM 2004 (Sharable Content Object Reference Model www.adl.org).

The main objective of this model is the creation of suitable rules and standards that aim towards providing various and functional capabilities for easier access to and re-use of educational material from various Educational Environments[12]. At the moment SCORM 2004 provides an environment of contact with the user, a defined model of data for the presentation of a variety of information, and a set of rules for the writing of educational material that activates the possibility of re-use and easy access, and a set of rules that can be applied to the presentation style of educational material.

The first publication of SCORM was presented in 1999 and in its current form was presented in 2004. SCORM describes a model for designing training material and an environment for its utilisation that can support individualised learning based on the particularities and the preferences of users, their records, but also other factors. It allows the designer of the material to apply specific rules and to evaluate the behaviour of the student in the area of navigation, while at the same time providing the possibility of re-use of the instructive material for other courses and by other users[13].

The fundamental objective of this model is to structure the material in such a way so as to be accessible and reusable by many. The model SCORM consists of a set of rules that describes the method of designing school material for the internet, so that it can be transferred to any educational platform and be used by different professors and students[14].

The main advantages of SCORM are centred on the continuous updating of students' progress in the course, the benefit of more freedom in students' activities and choices, the dynamic creation of adaptation of courses, as well as the existence of specific tools for the development of instructive material (www.adl.org).

The model SCORM consists of four components (Picture 1). The first component (Book1: The Overview) covers the history and the objectives of SCORM, the general logic of its conception and a concise description of the advantages, operations and applications that it finds in education via the internet. Moreover it includes rules and models from various teams that have dealt with subjects of standardization in education[15], from which the model SCORM has borrowed many elements and experimental results following many years of research[16].

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[12] "SCORM Overview", *Advanced Distributed Learning, 2nd edition*, http://www.adl.org

[13] E. Mor, J. Minguilla, *E-learning personalization based on itineraries and long-term navigational behavior*, *Thirteenth World Conference*, N. York, 2004

[14] A. Rockley, S. Manning, *E-learning, single sourcing and SCORM*, *Society for Technical Communication Conference*, http://www.stc.org/confproceed/2002/ PDFs/STC49-00018.pdf, 2002

[15] IMS - www.imsglobal.org, AICC - www.aicc.org, ARIADNE - www.ariadne-eu.org, IEEE LTSC - http://ltsc.ieee.org

[16] "SCORM Overview", *Advanced Distributed Learning, 2nd edition*, http://www.adl.org
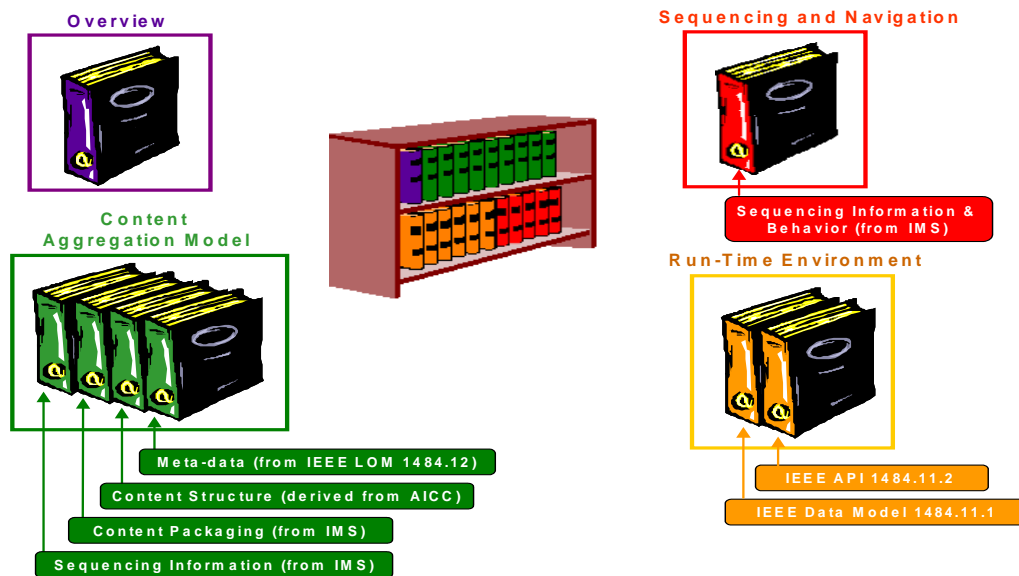
**Picture 1: Content of SCORM (www.adlnet.org)**

The second component (Book 2: Content Aggregation Model) describes the various elements (types of files with educational material) that can be used in the educational process, as well as the methods for organising, storing and compressing these elements so that they can be transferred easily from one educational environment to another. Information is also included on the technique one can use to search the internet for various file containing educational material that is included in a package (content package) SCORM[17].
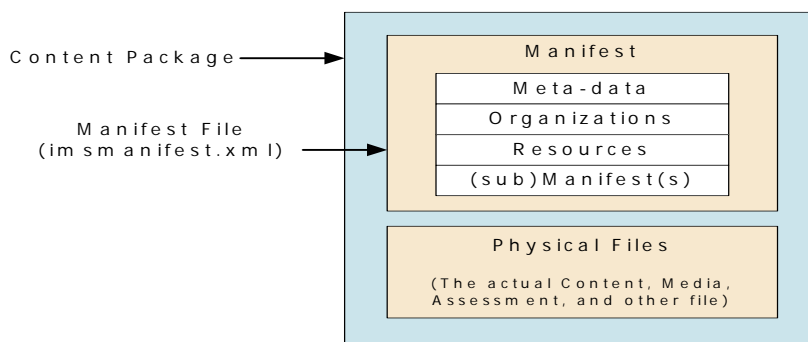


**Picture 2: Content Package (www.adlnet.org)**

In essence, the Content Aggregation Model organises all the educational material in a package, according to certain rules. A SCORM Content Package (Picture 2) can include either a completed course, a chapter of a course, or even a single unit of a lecture. All the information related to the content of a SCORM package is found in a file named

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[17] "SCORM Content Aggregation Model (CAM)", *Advanced Distributed Learning, version 1.3.1*, http://www.adl.org

"imsmanifest.xml". This file can contain information on the sequence in which the package content will be presented to the student and useful directives on the appropriate procedures to operate a Learning Management System.

The third component (Book 3: Runtime Environment) includes the application environment of the logic and rules of SCORM. It describes the attributes and the characteristics that are required by a Learning Management System in order that the system can manage the instructive material according to the rules of SCORM. It also determines the process by which two LMS will communicate and exchange information relative to the instructive material as well as students' progress on various evaluation sheets[18].

The last component (Book 4: Sequencing and Navigation) which was presented recently, contains information related to the sequence in which the educational material will be presented to the students (in the form of a tree - Picture 3). It also describes the navigation rules that an instructor must impose on the educational process. More specifically, it describes the sequence in which various educational activities will be realised, depending on the interaction that the student has with the instructive material that is provided to him each time by the instructor[19].
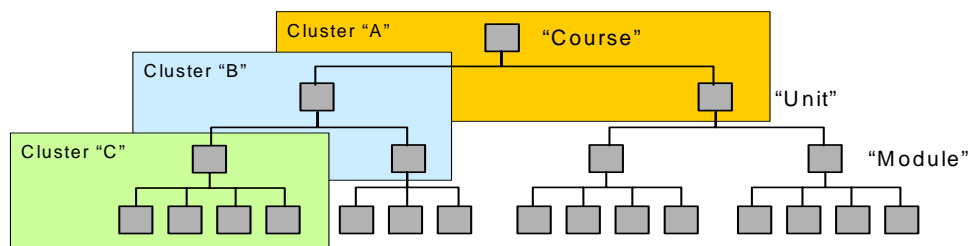


**Picture 3: Presentation of instructive material in the form of a tree (www.adlnet.org)**

Although it is still premature to draw solid conclusions on the functionality of the model SCORM, there is no doubt that its conception constitutes very important progress in the improvement of WEE, the advancement of distance learning, and the quality education provided in general. This model sets the foundation and determines the course as well as the general framework that the new WEE should follow, through the determination of specific yet flexible rules and conditions.


**Conclusion**

Undeniably, the progress of technology and information science has played the most important role in the development of education and the transition from traditional teaching methods to learning via the internet. However, in order to maximally exploit the possibilities that technology and the field of information technology provide us, certain rules must be set and standards developed, with the main goal of providing qualitative services in the field of education.

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[18] "SCORM Run Time Enviroment (RTE)", *Advanced Distributed Learning, version 1.3.1*, http://www.adl.org
[19] "SCORM Sequencing and Navigation (SN)", *Advanced Distributed Learning, version 1.3.1*, http://www.adl.org

The various educational environments that have been created over time have surely offered a lot to the educational process and have facilitated the work of teachers quite a bit. However, they never had a common set of design rules and as a result have presented a lack of uniformity and weaknesses for future improvement. The time is now right for specific standards and rules to be implemented with regards to distance learning, through the adoption and application of the model SCORM 2004.

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