

3 E-learning Standards and Pedagogical Approaches



E-learning standards have always been associated with the technical aspect of e-learning. The early AICC (Aviation Industry Computer-Based Training Committee) standards on computer managed instruction essentially deal with how e-learning should be packaged and how assessment results from online quizzes should be captured and recorded. Tracking the performance of online learners is another important issue. However, what are the pedagogical approaches inherent in the various e-learning standards like those on metadata, content package, and sequencing and navigation?

This article intends to highlight the relevant pedagogical approaches that are used in the various e-learning standards like those from the IMS Global Learning Consortium, the AICC and ADL's (Advanced Distributed Learning) SCORM (Sharable Content Object Reference Model). These include pedagogical approaches like constructivism, active learning, inquiry-based learning, learning by doing, learning by discovery, collaborative learning and associative learning. The article will also present situations in which knowledge of the e-Learning standards and its associated pedagogies will improve learning by the student.

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1 Introduction

There is no doubt that e-learning, as in the use of technology in learning, is now an accepted part of the student's life in school. However, many people who have undertaken some e-learning lessons would have their own opinions and feelings about e-learning. Some would argue that e-learning is nothing but the delivery of Web-based lessons. Others would praise e-learning for making it easy and convenient to learn some things quickly and also without the need to travel.

Whatever it is, e-learning is now widely seen as a tool for enhancing teaching quality. Consequently, there is a growing need for well-designed e-learning materials. With the production of more e-learning materials, researchers and e-learning practitioners begin to introduce e-learning standards for different purposes. Since 1988, when the first e-learning standards organisation is formed (i.e. AICC), we now have several e-learning standards that cover areas like metadata for learning objects, content packages, assessments, e-books, learner's information profile, learning design and lately in the area of sequencing and navigation of content objects. But with the proliferation of many e-learning standards, what and where are the pedagogical principles found in these e-learning standards?

2 E-learning & Pedagogical Approaches

ICT (Information and Communication Technology) is now widely used in many different pedagogic contexts such as blended learning and virtual online courses. It is also increasingly being used as the main vehicle to propagate new approaches in pedagogy. Burrhus Frederic Skinner was perhaps one of the first persons to suggest the use of machines in education. He was regarded as the father of mastery learning which subsequently led to the development of methods like instructional design. Essentially, the ideas of these models are as follows:

- 1) Present content in small and logically subsequent 'chunks'; and
- 2) Test regularly for learning progress and also to get immediate feedback.

Such ideas lead to many 'drill and practice' type of programmes being coded and deployed. However, in terms of pedagogy, these programmes are normally regarded as receptive or passive learning.

Nowadays, more people are going into exploratory and other 'active learning' approaches. In the 1990s, the constructivistic approach gained much popularity. The others are pedagogies like learning by discovery, inquiry learning and experiential learning.

The most recent development in this field is the socio-constructivistic approach (due to the works of Piaget and Vygotsky). The main point in this approach is the significance of **social interaction** and **collaborative solving of problems** as a learning method. What these mean is that people learn better if they are in a group and they learn to connect, cooperate and collaborate as they go about finding solutions to the problems.

Whatever the methods and approaches used, they should support active learning strategies such as games, cooperative group work, simulations and case studies. After all, learning is a human activity, not a robotic activity. By utilising new and better technology such as virtual reality and multimedia effects, today's high-quality online teaching materials can come close to the real world.



3 Learning Objects and Pedagogy

The first item we want to examine is the concept and the pedagogy beneath learning objects. Learning objects, or small chunks of learning content, seem to be the preferred aggregation for e-learning specifications like the AICC [1], the IMS [2], IEEE LTSC (Learning Technology Standards Committee) [3], ADL's SCORM [4] and ADRIANE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe) [5]. Unfortunately, the concept of learning object is seen differently in different organisations. Table 1 summarises the different definitions for learning objects in the different e-learning specification organisations.

Organisation	Definition of Learning Object
IEEE-LTSC	Any entity, digital or non-digital, that can be used, reused or referenced during technology supported learning (LTSC 2000)
ARIADNE	Pedagogical documents
LON Inc	Learning objects are small stand-alone ' <u>chunks</u> ' of information designed to be easily reused and repackaged to meet the needs of different audiences. They typically are designed to achieve a certain narrow <u>learning objective</u> and may contain an <u>assessment</u> to determine success against that objective. Learning objects may reflect varying degrees of granularity ranging from as large as a <u>chapter in a book</u> , a <u>case study</u> , or an <u>interactive courseware topic</u> , to smaller items such as a <u>single pedagogical concept</u> (teaching the boiling point of water, for example).
MERLOT	Online learning materials
Netg	Topic, consisting of a single learning objective, a learning activity and an assessment
SCORM	Content Object, normally known as content package. It can be a Web page with JavaScript or it can be a zip file with the necessary SCORM system files
IMS	Object (text, tool, test-item) needed to perform an activity

(LON, Inc - formerly known as LearningObjectsNetwork, Inc. Website has also been changed to: <http://s102098605.onlinehome.us/main.php>)

Table 1: Learning Object Definitions

By itself, the learning object is just the content aspect of learning. The ADL SCORM specification treats it to be pedagogically neutral. On the other hand, in the LOM (Learning Object Metadata) specification of IEEE, there is an 'educational' element which is a container for many pedagogical metadata as shown in Table 2.

S/No.	Element Name	Description
1	interactivity Type (IEEE 1484.12.1-2002)	active: Active learning (e.g., learning by doing) is supported by content that directly induces productive action by the learner. expositive: Expositive learning (e.g., passive learning) occurs when the learner's job mainly consists of absorbing the content exposed to them. mixed: A blend of active and expositive interactivity types.
2	learning Resource Type (IEEE best practice)	exercise, simulation, questionnaire, diagram, figure, graph, index, slide, table, narrative text, exam, experiment, problem statement, self assessment, lecture
3	interactivity Level (IEEE 1484.12.1-2002 but meaningful only in community practice)	very low, low, medium, high, very high
4	semantic Density (IEEE 1484.12.1-2002 but meaningful only in community practice)	very low, low, medium, high, very high
5	intended End User Role (IEEE 1484.12.1-2002)	teacher, author, learner, manager
6	context (IEEE 1484.12.1-2002)	school, higher education, training, others
7	typical Age Range	
8	difficulty (IEEE 1484.12.1-2002 but meaningful only in a context of a community)	very easy, easy, medium, difficult, very difficult
9	typical Learning Time	open text element
10	description	open text element
11	language	standardised def.

Table 2: The 'educational' element in LOM Specification [6]



A closer examination of Table 2 reveals that the LOM specification does not cover **collaborative** or **socio-constructivistic** approaches for learning. In addition, elements like interactivity level, semantic density and the difficulty level are only meaningful at the community context. These elements will not be useful if a Learning Object is going to be re-used as the community will be different.

Other issues on learning objects that have pedagogical implications are as follows: Granularity of the learning objects. For example, a learning object can be as big as a book chapter. It can also be a case study, an interactive courseware topic or a single pedagogical concept like the freezing point of water. The AICC defines five levels of granularity: Component, Lesson, Module, Course, and Programme. In contrast, the IEEE LOM standard defines three granularity levels.

So far, all the efforts in the various e-learning specification organisations are aimed at the interoperability of learning objects and content packages with different learning management systems. At the moment there are no reliable specifications to address the pedagogical approach behind a learning object. Perhaps these are early days.

At times it can be confusing for people following the development of learning objects. Some authors like Rob Koper argue that the concept of the Learning Object is pedagogically neutral. Other authors like Kraan and Wilson have mentioned that the SCORM specification has a pedagogical model that is single learner, self-paced and self-directed.

4 Simple Sequencing

Some specifications on learning objects and content packages have been developed by the IMS and then adopted by the ADL SCORM group. However, there are researchers, like Rob Koper, who felt that it is the learning environment and the activities proposed to the learner that actually defines the pedagogical context of the use of Learning Objects. Subsequently, important efforts were made to characterise and normalise how learning activities can be structured according to the needs, the specific actions and the performance of different users. These efforts led to the development of the IMS Simple Sequencing specification. Figure 1 shows the pedagogical range of simple sequencing.

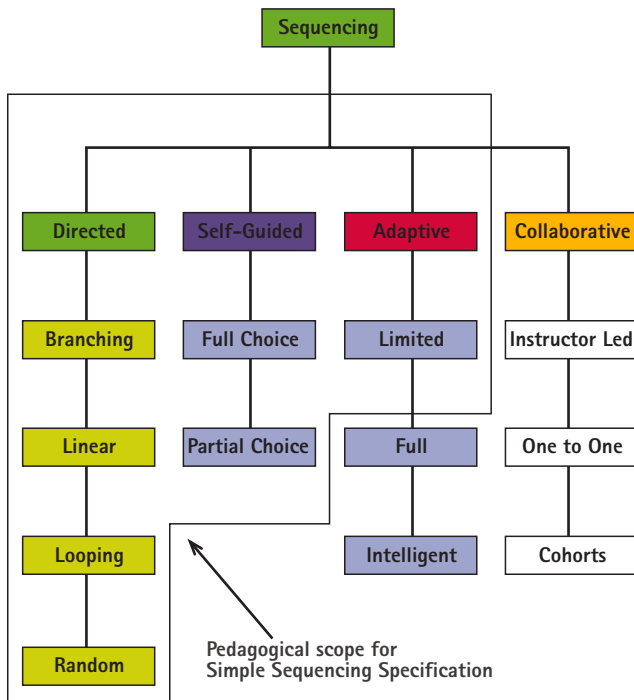


Figure 1: Pedagogical range of Simple Sequencing [7]

The basic idea behind this specification is that the sequence and choice of Learning Objects to be presented are determined by predefined parameters. These parameters can be the pre-test score marks, the predefined sequence of elements and child elements, the learner's choice, the learner's performance at a specific task or learning objective, and others. The steps of the sequencing process are shown in Figure 2.

Figure 2 shows that Simple Sequencing only covers directed, self-guided and partially adapted e-learning situations. It completely omits collaborative approaches of learning.

In addition, since the different aspects of LO like granularity, semantic density, difficulty, and others are not covered by any specification, it makes it difficult to reuse existing LO other than in a closed context like SCORM.



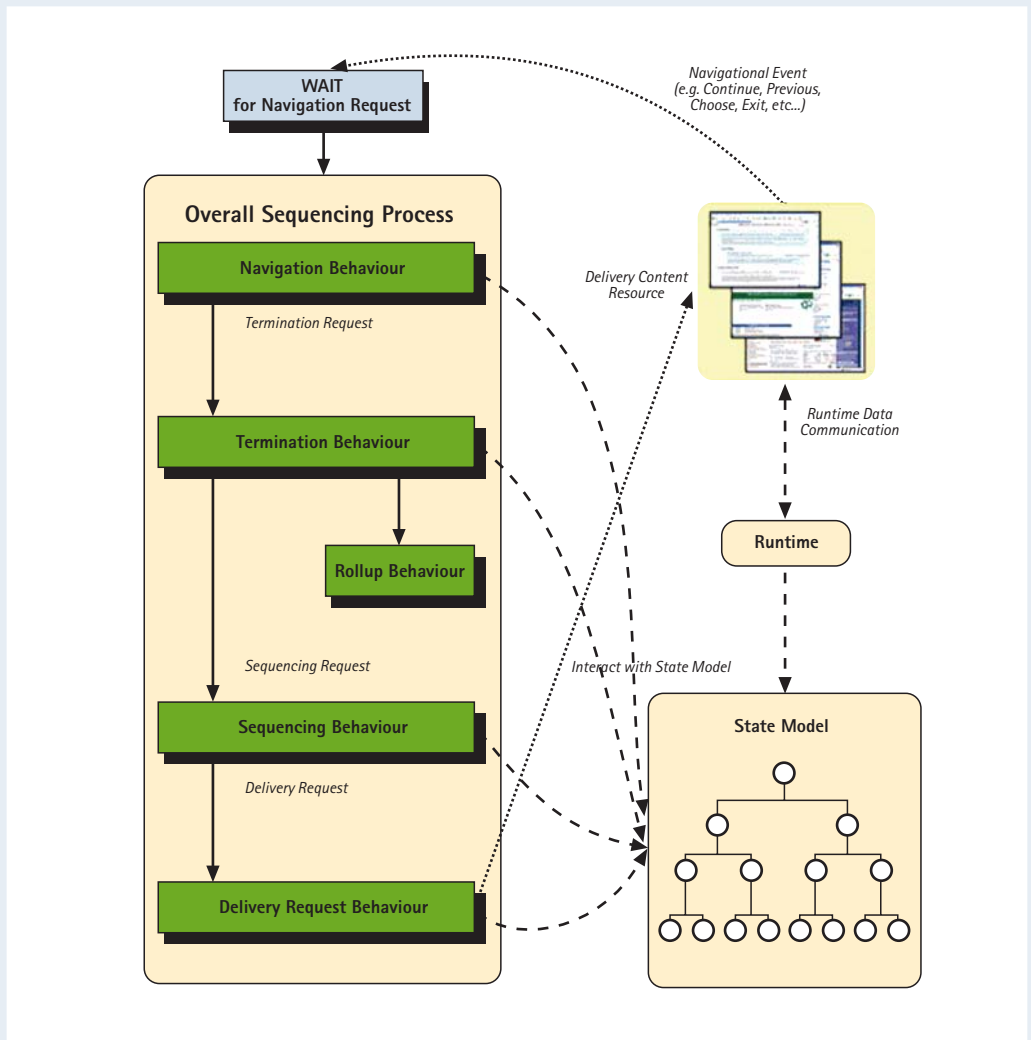


Figure 2: The steps of Simple Sequencing

5 Learning Design Specification

The IMS has published the Learning Design Specification on 13 February 2003 [8]. The IMS Learning Design Specification defines Learning Design (LD) as 'a description of a method enabling learners to attain certain learning objectives by performing certain learning activities in a certain order in the context of a certain learning environment'.

This specification is perhaps the specification which incorporates much pedagogical principles. This Learning Design (LD) specification starts with the following assumptions:

- The learning environment can be single- or multi-learner environment with flexible groupings of learners;
- The primary focus is on sequencing of the learning activities and not on the learning content, unlike that of the IMS Simple Sequencing specification;
- Interactivity is provided by discussion groups, chat rooms, etc, as well as by self-tests and simulations;
- It includes content delivery as one type of learning activity; and
- It is able to describe long-term learning.

When one reflects on the pedagogical theories behind this LD specification, one can see that it supports the different models such as the constructivist, transmission, behaviourist and cognitivist models. In the LD specification, the computer is regarded as a gateway to other learners and resources, not as the 'instructor', unlike the case of CBT (Computer-Based Training). Whatever it is, learning is still broken down into 'chunks'.

The objectives of this IMS LD Specification can be summarised to be the achievement of completeness in the following areas:

- Integration of the activities of both the learners and teachers;
- Integration of resources and services used during learning;
- Support for a wide variety of approaches to learning;
- Support for both single- and multiple-user models of learning; and
- Support mixed mode (i.e. blended learning) as well as pure online learning.

This specification captures the learning processes rather than the content.

The core concepts in the IMS LD specification are:

- Persons can play in different roles (See Person and Role in Figure 3);
- There are structured learning activities (See Activity in Figure 3);
- There must be learning objects and services in an environment (See the Environment block in Figure 3); and
- Learning objectives must be stated clearly (See Learning Objectives block in Figure 3).

Figure 3 shows the conceptual structure of the IMS Learning Design Specification.



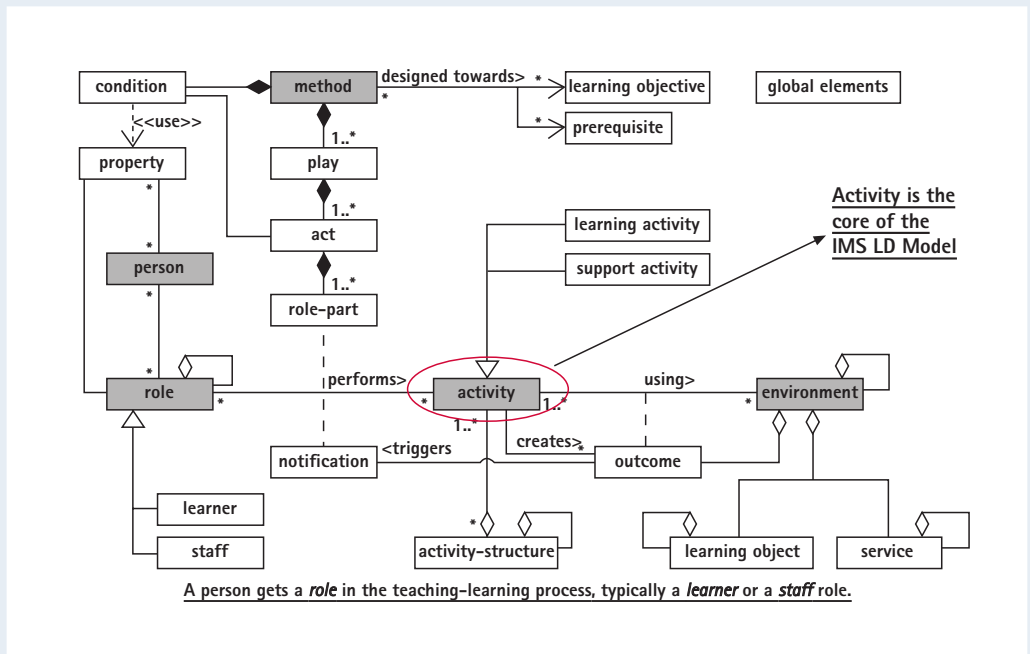


Figure 3: Conceptual Structure of the IMS Learning Design Specification

6 Conclusions

In general, ICT in schools is increasingly being used to enrich the classroom teaching. However, ICT can be used to provide additional sources of learning materials which learners can use at any time and in any place. E-learning standards are helpful in situations in which additional sources of learning materials are provided to the learner.

We have discussed the pedagogical principles in learning objects, in simple sequencing and finally in the Learning Design specification.

For learning objects, we have the following constraints:

- There is no universal agreement on the definition of Learning Objects;
- There is no consensus on the granularity of Learning Objects;
- Learning Objects are still very instructivistic in pedagogic approach; and
- Many of the metadata attributes of a Learning Object are exclusive. This means that they are registered for one specific use only.

The IMS Simple Sequencing specification is also limited in the pedagogical coverage. It currently supports the directed, self-guided and the adaptive models. The collaborative model is not covered at all.

By introducing the learning activities concept, the IMS Learning Design specification helps to move into a more collaborative and cooperative learning environment. In this model, learning content does not play a central role. It is the activities that have taken centre stage in the IMS LD specification.

7 References

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- [2] IMS Global Learning Consortium - <http://www.imsglobal.org>
- [3] IEEE Learning Technology Standards Committee - <http://ieeeltsc.org>
- [4] Advanced Distributed Learning Project (ADL) - <http://www.adlnet.gov>
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- [6] Standards E-learning and their possible support for a rich pedagogic approach in an 'Integrated Learning' context - <http://tecfaseed.unige.ch/staf18/modules/ePBL/uploads/proj3/paper81.xml>
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- [8] IMS Learning Design specification - <http://www.imsglobal.org/learningdesign/index.html>

