

Beyond the SCORM

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Abstract

Appreciating all efforts to develop the Sharable Content Object Reference Model (SCORM), as the first step to standardize computer based education systems, hereby we point to its drawbacks. We also try to show how these weak points are recovered in our suggested infrastructure called SOSCA (Subject-based Objects of Source and Curriculum Architecture).

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1. SCORM

To be able to review the SCORM, first we try to summarize the SCORM and its related key concepts. This section is extracted (mostly quoted) from the SCORM's report(ADL, 2000).

1.1. Background

The Department of Defense (DoD) of United States established the ADL¹ initiative to develop a DoD-wide strategy to use learning and information

technologies to modernize education and training. In order to leverage existing practices, promote the use of technology-based learning and provide a sound economic basis for investments, the ADL initiative has defined high level requirements for learning content such as content reusability, accessibility, durability and interoperability.

The work of the ADL initiative to develop the SCORM is also a process to knit disparate groups and interests together. Groups such as ARIADNE² IMS³, AICC⁴ and LTSC⁵. ADL's role is that of an integrator and tester of specifications, bridging the gap between the early stage development and industry adoption.

1.2. Goals

The principle goal of the ADL initiative is to provide high quality instruction anytime, anywhere and tailored to each learner's needs. By high quality they mean the instruction that achieves its objectives dependably (for all students) and efficiently (with minimal costs and maximum effectiveness).

The ADL initiative assumes that high-quality instruction that is both dependable and efficient will adopt itself to the unique needs, abilities, background, interests and cognitive style of each learner. It will tailor the content, pace, detail, difficulty, etc. of its presentations as needed by specific individuals at specific times.

The development of reusable, sharable learning objects is a key to ADL's long term vision. Once a sharable learning object exists and is commonly available, they can be real-time, on demand and then delivered to learners as needed. Thus the ADL initiative focus the design of sharable learning content objects and the development of an instructional object economy.

Long term vision of the ADL initiative is proving sharable content objects from across the World Wide Web; assembled in real-time, on demand, to provide learning and assistance anytime, anywhere.

1.3. SCORM

The Sharable Content Object Reference Model (SCORM) defines a Web-based learning "Content Aggregation Model" and "Run-time Environment" for learning objects. At its simplest, it is a reference model that refers to an asset of interrelated technical specifications and guidelines designed to meet DoD's high level requirements for Web-based learning contents. These requirements include, but are not limited to, reusability, accessibility, durability and interoperability.

The SCORM refers to a collection of specifications and guidelines developed in order organizations and adapte them to form a more complete, implementable model.

1.4. Learning Management System

Learning Management System (LMS) is a suite of services that manage the delivery and tracking of learning concepts to a learner. The SCORM does not specify functionality within the LMS.

The term LMS is being used as a superset description of many possible capabilities. Within the SCORM context, implementations are expected to vary widely. The SCORM focuses on key interface points between content and LMS environments and is silent about the specific features and capabilities provided within a particular LMS.

Within the SCORM, the term LMS implies a server-based environment in which the intelligence resides to control the delivery of learning content to students. In other words, in the SCORM, the LMS has the smarts about what and when to deliver, and tracks student progress through the learning content.

Learning content, therefore, has no management role in the SCORM since that function is entirely within the LMS. This means that the SCORM content does not determine (on its own on the client-side) how to navigate through a course, or when a student has completed a section of the course; such navigation functionality belongs to the LMS.

1.5. Content Aggregation Model

The purpose of the SCORM Content Aggregation Model is to provide a common means of composing learning content from discoverable, reusable, sharable and interoperable courses. The SCORM Content Aggregation Model further defines how learning content can be identified and described, aggregated into a course or portion of a course and moved from one LMS to another or between repositories. The SCORM Content Aggregation Model defines the technical methods of accomplishing the first two processes, and anticipates the mechanism that will soon be available for the last. The Model includes specifications for Content Structure Format and Meta-data.

The SCORM Content Aggregation Model has the following components:

- **Assets:** electronic representations of media, text, images, sound, WebPages, assessment objects or other pieces of data that can be delivered to Web clients.
- **Content Package:** The mechanism of binding Assets to Row Media Meta-data is Content Package (that will be introduced in the future version of the SCORM).
- **Sharable Content Object (SCO):** A SCO represents a collection of one or more Assets that utilize the SCORM Run-time Environment to communicate with LMSs. A SCO represents the lowest level of granularity of content that can be tracked by an LMS using the SCORM Run-time Environment.
- **Block:** A Block is hierarchical representation of SCOs and/or other Blocks to form a higher level unit of instruction. A Block is an independent learning taxonomy allowing virtually any taxonomy to be represented. The taxonomic labels applied to Blocks at various levels in a block hierarchy are defined within the Content Structure Format (see below).
- **Content Structure Format (CSF):** The CSF is a hierarchical map that can be used by an LMS to aggregate learning content into a cohesive unit of instruction (e.g. course, chapter, module, etc.), apply structure and associate learning taxonomies. The purpose of the CSF is to provide the content developer with a means of aggregation Blocks into a cohesive unit of instruction, applying structure and associating learning taxonomies so that the structure and behavior can be uniformly represented,
- **Meta-data:** Meta-data represents a mapping and recommended usage of IEEE LTC Learning Object Metadata element for each of the SCORM Content Aggregation Model elements. The purpose of meta-data (data about data) is to provide a common nomenclature so that learning

content can be self-describing. Meta data is in turn divided to **Row**, **Content** and **Course** meta data.

1.6. Run-Time Environment

The purpose of the SCORM Run-time Environment is to provide a means of interoperability between Sharable Content Object-based learning content and LMSs. A requirement of the SCORM is that learning content be interoperable across multiple LMSs regardless of the tools used to create the content. For this to be possible there must be a common way to store content, a common way for content to communicate with an LMS and predefined data elements that are exchanged between an LMS and content during its execution. The three components of the SCORM Run-time Environment are **Launch**(to define a common way for LMSs to start Web-based learning content), application program interface (**API**) as a communication mechanism, and **Data Model**, as a standard list of elements.

2. Discussion about SCORM

Using the points noted in the previous section, now we are in a position to review the weak points of the SCORM. These points are categorized on the goals, course development, education process, and what we called the realization of some points regarding tools, technology and implementation. In the next section we will show an alternative architecture called SOSCA, which provides an infrastructure to reduce these infirmities.

2.1. Strategic mistakes

Restricted goal

The principle goals of the ADL initiative are interesting, attractive long-lived human goals in education: providing high quality (for all, with minimal cost and maximum effectiveness) instruction, anytime, anywhere and tailored to each learner's needs. But how do we want to achieve these goals? In this regard the main goal of the SCORM is transferring content between LMS. In other words sharing the content is the strategic mean of the SCORM for achieving those high, interesting goals. It is assumed that as a mean to the end, "using technology to integrate and deliver sharable content may be the best to reach this goal"; which is not sufficient. Integration and delivery of the contents is also assigned to LMSs; another mistake that we'll address very soon.

It is true that content should be shared, but it is not the entire story. There are many other things that should be considered in education; like educational models and evaluation methods and education management.

LMS dependency

Let us quote some phrases about the SCORM from its official reference (ADL, 2001, pp. 3-5):

- "The main goal of SCORM is transferring of content between LMS. In other words in the SCORM, the LMS has the control about what to deliver and when, and track student progress through the learning content".

- “The SCORM focuses on key interface points between content and LMS environments and is silent about the specific features and capabilities provided within a particular LMS”.
- "Actually SCORM is a standard for connecting LMSs to have access to sharable contents".
- “LMS is responsible to manage the sequencing and navigation between SCOs”.

In other words, any student may have access to any content, only through LMSs (Fig. 1); the actual education can take place only through LMSs; Without the LMS support, no learner can access any course contents. In fact the education is limited to LMSs, their strategies and capabilities. Therefore a major part of those goals, like any time, anywhere and tailored to each learner's needs, depends on the LMSs.

Silence about the LMS

We saw that SCORM is LMS based and LMS dependent. Actual education is left to the LMSs. This is while the SCORM is silent about the LMS and its functionality. This crucial role of the LMSs has many unpleasant results in different ways. Its footprints are visible in the following issues too.

2.2. Course development

Content Aggregation

Content Aggregation Model is the major means of the SCORM for course development. It composes SCOs to develop new courses. This model includes specifications for a Content Structure Format and Meta-data.” (ADL, 2001, pp. 1-30 last para). “The mechanism of binding SCOs to Content Meta-data is the Content Packager that will be introduced in a future version of the SCORM” (ADL, 2001, pp. 2-5). But *scorm* already has the necessary mechanism.

Self-organizing SCORM does not consider the semantical relations between contents or subjects. Therefore construction of new courseware depends on LMS and its developers. Moreover simple aggregation of the contents can not be a successful method for course development. As an example, there are a lot of books that are aggregated from selected related articles; any of the collected papers are necessary and useful, but this book could not work even as an ordinary textbook.

Side effects of LMSs

The crucial role of the LMSs has many unpleasant results in the course development, including:

- Since the main goal in the SCORM is sharing the SCOs between LMSs, lower level agents (students, teachers, and education designers) do not have any major role in decision-making (ADL, 2001, pp. 2-5). In other words LMS dictates the role of course designers, teachers, students and course developers.
- Course developers should only work in an LMS framework, therefore the content needs restructuring in using side.
- A knowledgeable student should be able to develop his/her required course by using the available resources and methods. In the SCORM there

is no developing position for the student (an attribute which is a must for future education).

- Especially it makes the customization of courseware and content more difficult. While a knowledgeable learner himself should be able to reconfigure the course for him/herself.

2.3. Education process

No managerial role

“Learning content has no management role in the SCORM since that function is entirely within the LMS. This means that the SCORM content does not determine (on its own on the client side) how to navigate through a course, or when a student has completed a section of the course; such navigation functionality belongs to the LMS”. (ADL, 2001, pp. 1-29, last paragraph).

Based on our daily educational experiment, the content has a clear role in the education and decision about how education should be done. To have a better feeling, consider the role of self study texts, or directives and hints which a writer adds to his book, to have more effective education. We want to emphasize that content and managing points have mutual effects on each other. In the SCORM this clear fact is neglected. In the SOSCA the managerial specifications are embedded in the properties of the subject (ADL, Section 1-5).

Side effects of LMSs

The crucial role of the LMSs also has unpleasant effects in the education process, including:

- SCORM forgets the role of the learners in the education process. The LMS dictates the role of the learners.
- SCORM forgets the role of the teachers in the education process. The LMS dictates the role of the teacher.
- There is no direct relation between a learner and a teacher.
- There is no direct relation between any two learners. SCORM does not support the collaborative education between learners.
- SCORM does not support the learner modeling(also see ADL, 2001, pp.1-31). It is left to the LMSS. Therefore there is no mass customization in the SCORM.
- SCORM forgets or postpones important issues like knowledge structuring, evaluation and educational methods, tutoring strategy and scenario.

2.4. Realization

Here we point to some notes which are important in realization of the education and its expansion and improvement in the future and are not considered properly in the SCORM, or it is left to the LMSs or future.

Administration

- Certificates. Though the meaning of the certificates and degrees will change in the future (Majidi, 2002), it should be considered very clearly and specifically. Because it is a basis for many decisions in the employment

story and a basis for conducting the education process and general interactions.

- **Shares.** In practice an education process is the result of cooperation of many agents. Each of them should be able to receive his/her appropriate share from the benefits and also be responsible for negative activities. This point is very important because it has a crucial role in the expansion of education. We note that the “rights” is considered as a category of the SCORM’s meta-datat(ADL, 2001, pp. 2-15).
- **Responsibility.** When everything goes well usually there is no question about the responle agents. But on bad cases, this question would be arised very soon. We think in a standard like the SCORM it should be cosidered exclusively.

Technology

- SCORM has a hierarchical view to knowledge by making a block as a hierarchical representation of SCOs (ADL, 2001, pp. 2-7) and having a hierarchical map for aggregated learning content into a cohesive unit of instruction (ADL, 2001, pp. 2-7). While human knowledge could be represented by graphs better.
- There is no inheritance relation between SCOs or other structures of contents in the SCORM, so we can not have any template or object class for educational and evaluation models.
- SCORM is web based. This approach is very useful in our current web technology. But we do not know what will come in the future. We think such technology should not make any limitation for an infrastructure like the SCORM.

3. SOSCA, An Alternative infrastructure

3.1. Background

In 1997, a team was working on in strategic and development planning of Payam'e Noor University, in the field of Computer Aided Education(CAE). Two key aspects of these plans were focused on spreading the education process outside the walls of university (both in learnears and courseware developer sides), and tailoring the needs of different learners in a wide range of application and specification domains. **See also : (Majidi and Moshkenani, 1999).** One of the key characteristics of these plans was constructablity by existing (not future) technologies **(for these key aspects and charactersitsics see Gharibi 2000).**

This effort led us to designing the SOSCA in 1998-1999; and to develop a prototype called MESBAH⁶, which shows how SOSCA can fulfill and satisfy its goals **(Majidi, 1998).** This effort continues. In 2002, we published a book “Excelsior System: Future of the Education and Education of the future”,to explain differnt aspects of education in near future. In other words in this book we discuss specifications of the next education era. The era in which the essence and meaning of many concepts and processes, like student, license, education, learning, work, classroom and so on will be changed (Majidi 2002). Though at the moment SOSCA is not developed more than a prototype, it shows key points in both strategic planning and implementation aspects. It also clarifies the weak points and bottlenecks and also solutions to existing models like the SCORM.

3.2. Strategic goals

SOSCA has the general goals of the SCORM: to provide high quality instruction anytime, anywhere and tailored to each learner's needs. But for achieving these goals it attacks the main obstacles of the CBE systems (Majidi, 2002):

- Vast number of working areas and different levels of education
- Development costs
- Development time
- Difficulties in customized products
- Limited producing capabilities.

Based on our experience the main roots of these obstacles are:

- Production complexities
- Lack of suitable tools
- Development methods and structures

SOSCA also tries to tackle the current apprehensions of educational systems (Majidi, 2002) :

- Education and evaluation quality
- Applying efficient educational and teaching methods
- Quality of education structuring
- Human resources for education structuring
- Distribution of the education
- Considering background and interests of students and motivation
- Diversity of learners' needs and specifications
- Dispersion of the learners
- Investment, and motivation for investment in educational affairs
- Open educational management.

To tackle above problems, and apprehensions, the SOSCA has the following three strategic goals (Fig. 2):

- Abstraction of the experts from non-professional activities.
- Providing appropriate working environment for developing the systems, without or with minimum programming.
- Providing an environment for sharing the resources. If you remember, SCORM emphasizes only the third goal.

And as a design goal, we tried to design a **simple** architecture, which with simple and clear concepts and components, is efficient, flexible and powerful enough to satisfy the above mentioned goals.

3.3. SOSCA

Subject-based Objects of Source and Curriculum Architecture (SOSCA) is an infrastructure for computer based education systems. It lets the science expert and education planner to design and develop course material and curriculums without (or with minimum) need of programmer and programming. In this architecture, any agent who usually has some role in an education process (curriculum designer, course material designer, student, teacher and administrator) has an abstract view from the others and has his/her independent interface to the system.

3.4. Subject class

Subject is the major concept in the SOSCA architecture. A course content is divided to individual and independent units, called subjects. Course design and contents are structured based on the subject. Any subject may be constructed out of other subjects. This lets us define a hierarchical structure of subjects. A subject contains a distinguishable and abstractable topic of learning material. It presents a specific subject of a specific domain of knowledge. It also contains some metaknowledge for using this subject in developing, organizing and managing curriculum and course material. SOSCA makes possible that a great educational system to be built from small components by organizing subjects as abstract low dependent components.

Subject properties

Each subject includes its own specification and properties. These properties specify how to construct a complex learning structure from the subject. Some standard properties are shared by all subjects, and some specific properties may be shared in a group of subjects. Subject properties take important role in self organization of coursewares. They show the meaning of the subject, the place of the subject with respect to other subjects, the specifications of the subject against student specifications, the relation of the subject to ontological graph, metaknowledge and management aspects, and more (Fig. 3).

Subject presentation

Abstractly a subject has no appearance before its presentation. Subject presentation, is presentation of the subject content in one of the existing presentation methods, like HTML, environments like web, and formats, with a bunch of suitable media types. A subject may have different presentations in different levels, aspects, and also different presentation environments. Subject presentation and its specifications are specified in the subject properties (Fig. 3).

Subject evaluation

We should know what the learner knows about the content of a subject. This requires a specific effort. Each subject has some evaluational efforts and functions, used to find what the learner knows. This evaluations will be used for interaction with the learner and conduction of the educational process. Evaluations should cover all contents of a subject, and should have necessary relations to subject presentations.

3.5. Creational and evolutionary construction

How could each subject be created? And how could this creation be performed in an almost selforganized evolutionary process?

Object oriented subject

Each subject is an object, and is treated as an object in the object model; with all specifications of objects in this model; such as inheritance, abstraction, polymorphism and encapsulation. In addition to classical benefits of object orientation in creation, development and reorganization of educational systems, this helps a SOSCA-based educational system reach a level of self organization and become a semi-alive system. A system which can accept evolutions and new generations with different people in different aspects of specific jobs, with abstraction of programming tasks. Some important effects of this specification are described later.

Presentation class

In SOSCA a presentation is also considered an an object. So we can have presentation classes. One of the most important things in educational process is educational methods and models (EMM). Applying suitable EMM in a courseware can increase knowledge transmission performance, and learning simplicity. One of the main problems of courseware development teams is recognition, selecting and applying suitable EMM. Object shape of subjects and presentations makes it possible that any type of subject presentation can be generated in a presentation class. In presentation class we can apply a specific EMM for specific reason and application. So we can have many presentation classes, each of which is suitable for a specific type of education and subject. A subject presentation class has all tasks and functions required for educational process, including teaching strategy and the skeleton of a dynamic teaching scenario. So with efficient tools, a courseware developer should only select proper presentation class and generate an object of this subject and its presentation from a selected presentation class, by filling relevant contents in proper media and adjust its parameters and properties.

Now with efficient and powerful tools and good designed presentation classes, the courseware developer does not need to do any programming tasks. So he/she can develop a courseware in his/her field of study independent of the other related agents. Educational technologists also can perform their work in designing new presentation classes with specific EMMs. They can also generate new presentation classes inherited and as a child in existing presentation classes. This has interesting results:

1. It helps fast evolution of EMMs, and developing a vast variety of them.
2. It abstracts educational technologists from other people in the courseware development process.
3. It propagates the usage of the best EMMs in educational process, as a wish of educational science people.

Evaluation class

Like subjects and presentations, the concept of evaluation is considered as an object in the SOSCA and we can have evaluation classes. Therefore subject evaluation objects can also be generated from an evaluation class. And we have the same aspects and the same benefits of presentation classes in evaluation classes.

Polymorphism

By considering the polymorphism in the SOSCA, we can perform some specific educational function in a domain, while its specification and process would be defined later. This late binding has two interesting results:

1. It helps the educational systems to adapt with student actions, reactions and specifications, and adjust the learning process by student modeling feedbacks.
2. It pushes the educational systems to a state of evolution and improvement, because a function can be performed in shape of future requirements. In other words it helps the system to have in self organizing reactions.

3.6. Constructive composition

How each subject can be related and joined to other subjects in a unified construction? There are two semantical and presentational aspects for this composition.

Semantic construction: Ontological graph

When we talk about building the courseware from low dependent components (subjects), and when we want to construct the courseware and combine these small components almost automatically (because of the self organization of the system), subjects should know how they are connected together. If you remember, subject's properties contain the necessary information about their place and relation to other subjects. But how can this be possible, and what are the types of this information? An ontological graph can show taxonomic and semantic relation of subjects. In subject property, we should present its place in ontological graph. And in courseware construction time, subjects can join others by leading this ontological graph, . We do not want to have a single standard ontological graph in all the world. We can have many graphs, and a subject could be linked to different positions of different graphs. But when we want to implement a courseware, we should select which of ontological graphs should be used for this purpose. This also helps the dynamic modeling of the student by relating a student's knowledge to an ontological graph and mapping his/her knowledge by this graph. [See also, \(Aroyo and Kommers, 1999\).](#)

Presentation construction: curriculum

In the education and teaching process, the order of presented content is not the same as its semantic order in its construction. A curriculum defines how the subjects should join each other in an order, in the presenting time. It also specifies that in the presentation of each subject, what aspects should be presented (we remember that a subject may abstractly have different aspects). Curriculum also has the scenario of the teaching process (for role of curriculum structures see: Wang and Chen 97). In the SOSCA we can have a dynamic scenario in a dynamic curriculum, which may have behavioral changes in learning time, by considering the specification and behavior of the student and environment.

Distributed object repository

To enable greater collaboration among people, educational materials should be sharable across the Internet or in a social learning environment (Suthers & Jones, 1997). SOSCA provides a suitable infrastructure for a distributed environment. But it does not define how this distribution should be managed and organized. SOSCA only lets courseware components come from different and far positions around the world. A complementary architecture called DSCA (Distributed Source and Curriculum Architecture) takes this role, and we do not want to pay attention to that architecture in this paper. With these two complementary architectures, we can connect different sources in a courseware and have sharing of subjects and sources in contents.

4. Discussion about SOSCA

What is the behavior of SOSCA? And how much does it satisfy its goals specially compared with the above-mentioned mistakes of the SCORM. Table 1 compares some aspects of SCORM with SOSCA.

4.1. Strategic power

By the components and construction mentioned above, SOSCA shows two important behaviors:

Independency from LMS

By self organization and self description in subject properties, and by creation and evolutionary construction of the SOSCA architecture, there is no need to any compulsory intermediate organization like LMS. A courseware can be constructed

from existing subjects without (or with minimum) programming task, in any place in the world. This means that any organization and even any student, can construct or reorganize his/her courseware. In addition to expanding the system development power, and providing development condition of the system by minimum effort, it simplifies the course development in interdisciplinary fields. Because each field expert or each student with suggestions of an expert, can select subjects, and by leading to an ontological graph, he or she can define a courseware for a curriculum. A courseware which only one student may take. **Also see : (Martinez and Bunderson, 2000).**

Of course this does not mean that we do not need educational centers and systems, to manage the education. We need their activities for organizing the education. But it is not compulsory and the education process can proceed dependent on educational centers and their systems. **See : (Majidi, 2001) and (Majidi, 2001-2).**

Abstract view

As mentioned above, educational method designer and educational technologist, build the presentation and evaluation class abstractly. Then each expert in his/her field can design each related subject abstractly. And then educational planner can design the curriculum abstractly. Or a student with suggestions of an expert or educational planner, can design his/her own specific curriculum abstractly. They need minimum relation to each other in their work, and they can work in different times and in separate places around the world, with no coordination, and they need not know each other. Also they do not need any programming task in their work, so they do not need any cooperation with programmers (the point which makes the courseware development expensive and slow). Each one of the related agents does his/her job with appropriate tools and only in his/her related field.

4.2. Behaviors and benefits

Based on the above strategic power of the SOSCA, we summarize some of its behaviors and benefits in four aspects of course development, education process, administration and implementation.

4.2.1. Course development

- It does not need programming for course development or for using educational resource.
- It makes abstract views for different agents and independent from each other.
- So by easier management, it tackles the real development problem.
- It has generality and integrity in development of the whole system and in curriculum editing.
- It makes course components and resources reusable and shareable.
- By defining template objects from existing classes, it causes more reusability.
- It permits to design new evaluation methods.
- Possibility of designing new educational methods.
- It permits open curriculum design (suitable for inter disciplinary and exploration studies).
- It simplifies necessary engines for self extracted education guidance.
- It makes the development and maintenance of the courseware structures easy.
- It minimize the time and cost of development. Therefore it makes the education more accessible for a wider population of the interested audience.
- It helps for a better change management.
- It invites investments by reducing the development and sharing the benefits.

4.2.2. Education process

- It provides an infrastructure for collaboration in all aspects of the education, including courseware design, teaching, student side and administration.
- It considers educational methods and models, not a simple sharing of contents.
- It lets education structuring and provides an open education management environment.
- It lets open strategic planning for education.
- It models the student.
- It supports continuous education based on the students' needs. Therefore
- It supports and motivates collaborative education.
- It supports continuous evaluation.

4.2.3. Administration

- There is no need to compulsory intermediate agent.
- It keeps roles and rights of any agent who has any role in the knowledge process,
- It provides suitable tools for all related agents (curriculum designers, course material designers, teachers, students and administrators).
- It supports automatic payment mechanism.

4.2.4. Technology

- It is a stable infrastructure, which makes the expansion of the system possible, without any change in the system infrastructures.
- It makes the incremental development possible.
- It uses three solutions for knowledge representation: rule-based, semantic networks and scenario-base modeling.
- It extends current methods and methodologies.
- It is object-oriented, component-based and architecture centric.

5. Conclusion

While SCORM starts with very liberal goals and wants to share all human knowledge around the world, by abandoning everything to LMSs, a lot of restrictions come in between in practice. Therefore its main goal which is resource sharing can not take place properly. On the other hand, in addition to resource sharing, there are other important issues (like educational methods, education production management, costs, limited development power, time and vast number of areas and levels with rapid changes, student modeling and tutoring strategy) which are not addressed, or are left to LMSs and to the future.

We introduced an alternative architecture SOSCA, that has addressed these important points and more. We briefly pointed to its main pivots and structure. It is object oriented, and its main objects are educational subjects. We think that working on the mentioned pitfalls of the SCORM, especially by using the encountered features of the SOSCA, improves the SCORM project dramatically. And such efforts make the achievement to the goal of free and rapid movement of the human knowledge around the world easier and faster. Hope so.

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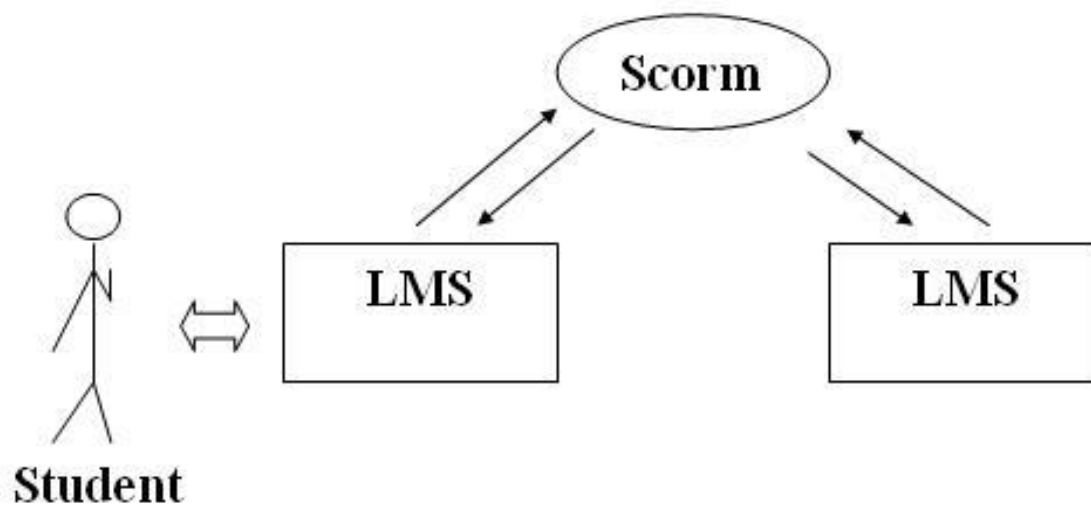


Fig. 1. LMS, SCORM and student relation.

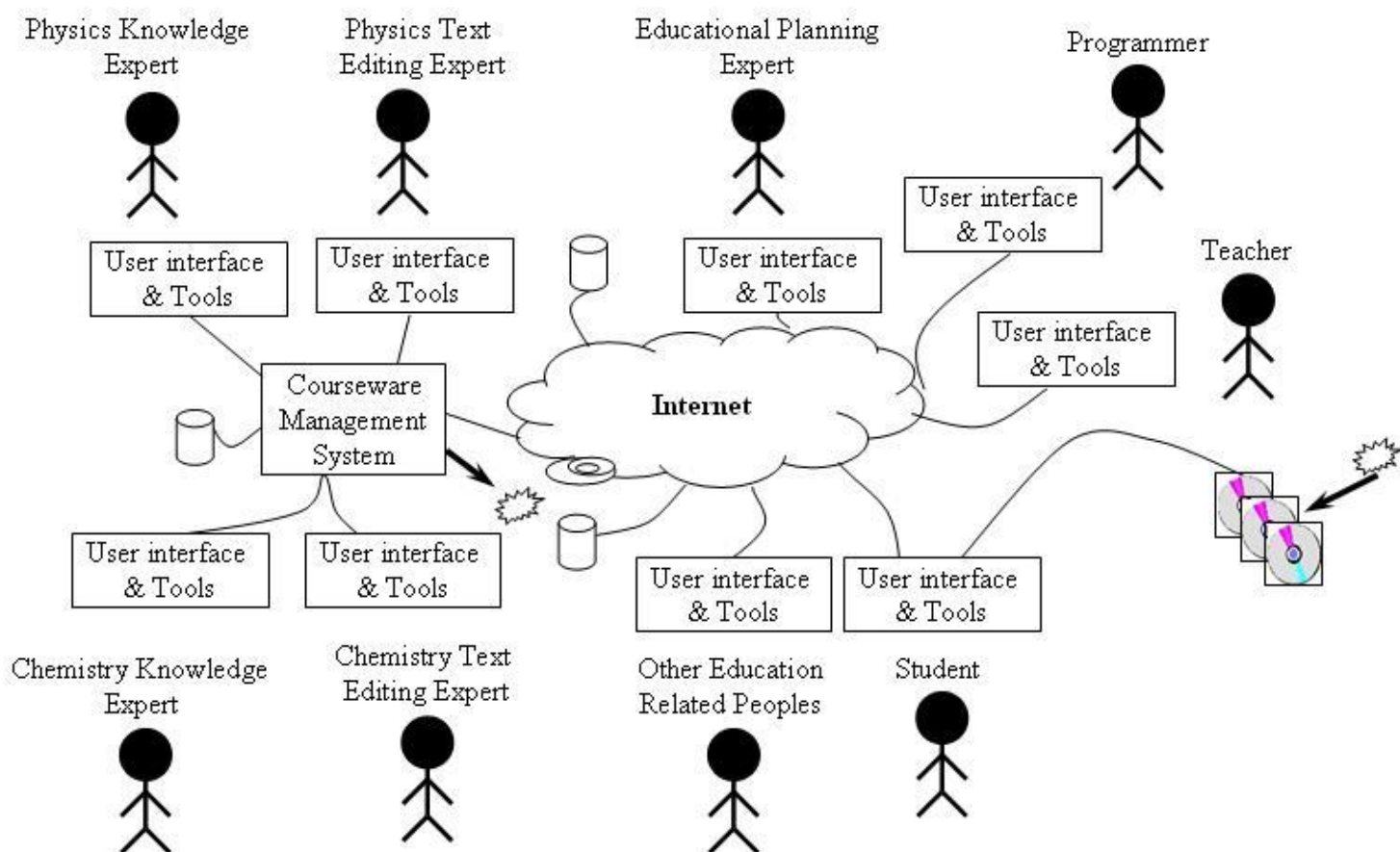


Fig. 2. Abstraction, work environment and resource sharing.

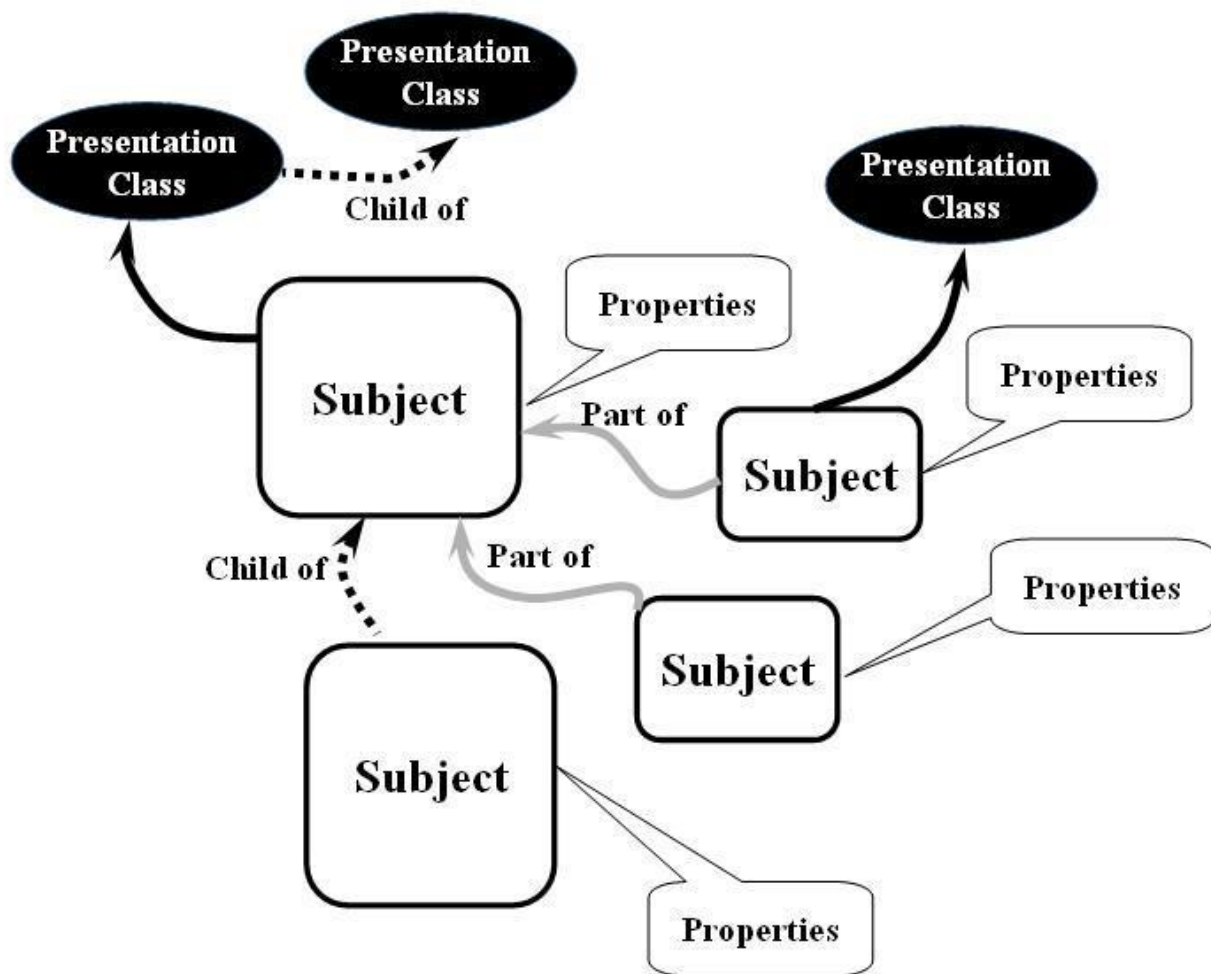


Fig. 3. Subject Properties, presentation and evaluation classes.

Table 1. SCORM vs. SOSCA

	Description	SCORM	SOSCA
Goals	Sharable content objects from across the world	Yes	Yes
	For all students	Through LMS	yes
	Minimal cost and maximum effectiveness	Can not be	Possible
	Assembled in real-time, on demand	Yes	Yes
	Learning and assistance anytime, anywhere	Through LMS	Yes
	Tailored to each learners' needs	Through LMS	Yes
	Web base	Yes	Yes & more
Course development	Teacher is free from technical issues	Through LMS	Yes
	Independence from Teacher Teaching method Contents Student type Single or multiple user	Through LMS	Yes
	Distributed computer aided course design	No	Yes
Education Process	Student ability for deciding about his/her education	Through LMS	Yes
	Dynamic in Content Using time Education period Order Education method Hardness Level of education No. Of examples and so on	Through LMS	Yes
	Mass customization by level, IQ, Age Special education for special audience Education based on feed backs and student modeling	Through LMS	Yes
	Interdisciplinary education	No	Yes
Administration	Developer's rights	Not clarifies	Yes
	Registration	Not clarifies	Yes
	Test and Evaluation	Not clarifies	Yes
	Certificates	Not clarifies	Yes
Tools	Course design	Through LMS	Yes
	Course development tools	Through LMS	Yes
	Learning tools	Through LMS	Yes
	Group tools	No	Yes
	Remote access	Yes	Yes
	Administration tools	Through LMS	Yes
	Access to data bases, contents and information sources	Through LMS	Yes
	Multilingual support	Yes	Yes
Technology	Courses development environment	Not clarified	Emphsysed
	Education environment	Web	Web & more
	Administration environment	Web	Web & more
	Knowledge representation	Not clarified	Semantic net,
	Client / Server	Yes	Yes
	Object oriented	Not clarified	Yes
	Web-based	Yes	Yes & more
	Knowledge taxonomy	Tree	Tree & Graph
	Distributed	No	Yes
	Cooperative work	No	Yes

Captions of Figures and the Table

Fig. 1. LMS, SCORM and Student Relation.

Fig. 2. Abstraction, Work Environment and Resource Sharing.

Fig. 3. Subject Properties, Presentation and Evaluation Classes.

Table 1. SCORM vs. SOSCA

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1. Advanced Distributed Learning , www.adlnet.org.
2. Alliance of Remote Instructional Authoring & Distribution Network for Europe, www.ariadne.eu-org.
- 3 . IMS Global Learning Consortium, Inc., www.imspjproject.org.
- 4 . Aviation Industry CBT(Compute-Based Training) Committee, www.aicc.org.
- 5 . IEEE Learning Technology Standards Committee, ltsc.ieee.org.
- 6 . More details of the MESBAH are available at www.pnu.ac.ir/majidi/MESBAH.html.