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Moving Toward SCORM Compliant Content Production at Educational Software Company: Technical and Administrative Challenges

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Abstract

The Shareable Content Object Reference Model (SCORM) aims to standardize electronic course content, its packaging and delivery. Instructional designers and e-learning material producer organizations accept SCORM's significant impact on instructional design/delivery process, however not much known about how such standards will be implemented to this process. This paper presents a project at an educational software production company that has decided to change its production line to conform to the SCORM standards. The paper provides the technical details of the project such as technical platform and the infrastructure for related components. The technical issues and decisions of asset management system, SCO development and repository will also be mentioned. Secondly, administrative issues of this process will be discussed. Administrative issues can be summarized as the changes in the work practices of the instructional design/development process, organizational resistance, and new roles and responsibilities of people in the standards compliant instructional design/development process.

Introduction

Today many universities and organizations offer courses through online learning systems. Especially, e-learning or Internet-based distance learning have gained significant importance and it is the most rapidly growing aspect of education and training in the world (Cagiltay, Graham, Lim, Craner, & Duffy, 2002; Lytras, Pouloudi & Poulymenakou, 2002). According to Murray (2000), "In the future, education will increasingly utilize distributed learning technologies" (p. 1).While he and other researchers argue that there is promising future in the use of personal computers and the Web in education, there is no satisfying answer for the question of how these technologies can best be used to develop instructional materials in an efficient and effective way.

Educational materials for online learning environments generally include a computer interface, several different data formats (e.g. text, graphics, image, voice and movie), an evaluation system to assess students' progress, and several other support tools to support the learning environment (Robson, 2000). As stated above, preparing online educational systems has several unknown issues. An important issue is "how to produce and deliver quality content for online learning experiences" (p.1) (Robson, 2000). Generally the volumes of the materials that are prepared for online learning environments are very high. This makes it so hard to keep the content up to date and most of the times it is hard to update the content regularly. Formatting these materials in several different ways for different purposes is another difficulty. There are always portability and compatibility problems among online educational systems.

Actually similar problems were also faced in software development field. Until early 80s creating new information systems were very clumsy work. For every new software project, programmers had to write a new code. Software developers' solution to this problem was using object-oriented approaches. This brought modularity and speed to the software development process. A similar approach called

"reusable learning objects (RLO)" is becoming very popular among instructional designers of on-line systems.

As stated by Robson (2000), reusable-learning objects represent an alternative approach to content development. In this approach the content is divided in small chunks. Each chunk is called as a "Learning Object" (LO) and each LO has a special educational role in the system (Robson, 2000: p. 1). Basically, the concept of learning objects helps instructional material developers to divide these materials in small chunks such a way that they can be reused for different instructional purposes.

As stated above, Learning Objects are grounded in the object-oriented paradigm of computer science (Wiley, 2000). According to Wiley (2000), there will be a major change in the way educational materials designed, developed, and delivered in the near future. According to him, "learning objects" leads other approaches (Wiley, 2000) for implementing such a change. So, compliance with Learning Objects (LO) or Reusable Learning Objects (RLO) standards is a big challenge for the educational institutions.

An important issue is the standards for defining the LO. For example IEEE Learning Object Metadata Working Group is working on some metadata standards for defining a learning object (IEEE, 2002). Other e-learning standards body the IMS Global Learning Consortium "develops and promotes the adoption of open technical specifications for interoperable learning technology" (IMS, 2004, p.1). The Advanced Distributed Learning (ADL) Initiative adapts these and other organizations' collection of specifications to form a new high level standard which is the Sharable Content Object Reference Model (SCORM). The SCORM defines "the interrelationships of course components, data models and protocols so that learning content objects are sharable across systems that conform with the same model" (ADL, 2004, p. 6).

Purpose of the Study

The SCORM promises many opportunities for those who develop large scale educational e-materials. However, there are many unknowns about the implementation of SCORM specifications and guidelines to real life instructional design/development process. These unknowns can be grouped under two main headings. One of them is technical issues and the other one is administrative ones. In this study we will report and share our experiences of how the changes to SCORM compliant content production process planned, developed and implemented at an educational software company.

The Organization and the Project

The company has been providing software products, services and creative multimedia content on cross platforms including internet, mobile, digital TV and electronic media since its foundation in 2001. As results of the undertaken projects and works done, the company has managed to produce over 400,000 digital objects during the 2 years period. Consequently, the company staff encountered problems of archiving, retrieving and re-using existing objects as well as newly created objects. So, the company has decided to establish and re-engineer the production process and digital objects archive. A pioneering team was established and the initial steps were taken. The team proposed ADL SCORM as a base of the project and the proposal was accepted by the company board. Then a dedicated project team was established. The team consists of one systems analyst, one software engineer, one instructional technologist, and one library and information specialist as full time staff members. The project entitled "Standard Learning Objects Creation, Searching and Publishing Platform" and received support grant from Technology Forecasting and Assessment Directorate/ The Scientific and Technical Research Council of Turkey.

For the project, "reusability" was a critical word and it should be well defined in order to meet the expectations. The company aimed to keep its dynamic and productive skill in a cost-benefit way. For this purpose, reusability is understood in two ways. One is using the assets previously produced in new projects as they are. Other understanding is using the assets previously produced while producing similar assets to shorten the production time and effort. Identifying the assets clearly and searching them easily are critical functions.

The users of this system are asset producers (Graphic Designers, multi-media developers, etc.), teachers or designers seeking learning objects to use in their work, e-content developers, and managers of asset production units. These users interact with three basic modules which are "Defining RLOs and SCOs", "Searching RLOs and SCOs" and "Publishing the output". These users, the modules and their relations are showed in a structured way in Figure-1. Users are showed as User-I, User-II and User-III since they can represent different people from different disciplines.

General Issues for Administrative and Technical Challenges

The aims and expectations described above were critical for designing the platform. Different people from different disciplines, who were usually working in different units, should have roles in content production. In such environments effective communication is important and having a common language within these subgroups is critical. Technical platform used in such environments can help setting a common way of working and forming a common language.

This project was seen as creating an online-archiving environment which is conformant to SCORM standard and it is clearly set that some cultural changes in the company should be expected and promoted in this period. For the administrative side, the procedures and workflow is criticized and redesigned according to learning objects approach. And a new role is defined in this workflow. This role is positioned as a RLO-Librarian for controlling and entering the metadata of the learning objects.

The technical platform is also designed with the idea of changing some parts of workflow which people are already familiar. First it is thought that learning objects should be stored in a common place regarding the projects that are used. So handling a project and handling the RLO Repository are different from each other. For staff, who used to think just as working in a project, this mechanism is completely new. Common repository concept is required to be accepted and supported by the staff. It is expected by the administration that internalizing such a concept will affect the production style of staff. It is hoped that the frequency of the number of reusable assets produced will be higher as this approach is supported.

Technical Issues

Technical Platform

Usually, content production tools are used for packaging and generating required files of SCORM standard. The outputs of these tools are usually files which are stored in the hard disks. In the company, it is observed that asset production occurs in producers' personal computers and after completing their production, their products are carried to the related project folders. However, after a while in such a system, only the people who worked in those projects remember their previous works and only they can reuse them, or it takes time to search many projects for similar assets. As the number of projects increase, this nonstandard way of production becomes a cultural characteristic of the company or production units.

To help this change, support of technical platform on the workflow and production style, and a change in technical procedures is considered as critical. It is decided to store only the resource files of approved assets in a common place. In addition, metadata of these assets and some relevant information are decided to be stored in the database. By this design it is believed that the learning objects will be searched in the database and new packages will be generated easily, whenever it is needed.

The production process takes time and includes different people. This means there are different states of RLO during the production cycle. The new RLO-Librarian role has responsibilities of controlling the whole process, entering relevant metadata, controlling the metadata entry of different people, and approving/regretting the production. Approving is important for protection of the repository from junk/meaningless objects. For this reason, the working environment is determined as three parts: Local, temporary and actual RLO repositories (Figure-2). Use of temporary and actual RLO Repositories is shown in the asset production process (Figure-3).

Components of the Platform

There are four sub-modules of the platform which are used for defining the metadata of assets and SCOs, for searching RLOs over metadata defined, for packaging according to SCORM and for publishing the packaged content. Publishing module seems unrelated to content production concept, but since the clients may not have SCORM compliant tools, it is added to the project in order to facilitate the use of RLOs. For SCORM compliant content production, availability of SCORM compliant content publishing tools may become a challenge.

Another challenge had occurred during the development was the sequence of implementation. One way is considering the packaging module first and handling metadata definition within this module. The other way is considering definition module independent from packaging module. Although, the first way seems more practical, the second way is selected since, focus of the administration is on the control of the asset production and handling the repository is considered independent from handling the projects.

Procedural Components

Parallel to technical development, the company believed that the procedures and change in the production cycles or styles are critical. Since this is a system and RLO is a way of thinking, all related components should be consistent with the approach. With criticizing the previous experiences and organizational structure of the company, "Asset Production Process" (Figure-3), "SCO Production Process" (Figure-4) and "SCO Evaluation Process" (Figure-5) are defined for new projects. The company decided to convert the previously developed material to SCORM compliant versions. In addition to the procedures above, "Migration to SCORM compliant process" (Figure-6) and some additional forms (Figure-7) are defined.

Other Technical Issues and Experiences

While producing the assets, the producers are expected to fill out some parts of metadata of the asset they work on. Some times these assets are very small and they can be produced in a very short time. For SCORM standard, there are more than 70 tags. Some of them should be defined by clearly thinking like key words. When the number of tags is high, to facilitate the efficient use of the system, the time and effort of the producers should not be so much. Decreasing the effort and time of data entry is one of the major aims of the platform. To achieve this aim, some templates are used for automatic filling, and some shortcuts are generated.

For countries whose language is not English, translation of metadata tags and the need for studies about concepts are challenging aspects that should be considered before starting to such project. During this project, the company tried to translate the metadata information and their explanations for the user interface. However, it was seen that one-to-one translation may not be satisfactory. Some conceptual changes are required. This is critical especially to decrease the time of entering metadata information to the database. For example, when a 2D animator uses the system to enter a new image, the labels and the explanations of the metadata should be easily understood.

A conceptual study about the predefined terms is needed in order to explain them clearly and to have a common language. These are especially necessary for terms or words which can have different meanings for different groups. For example, the meaning of high or low can change according to perception. Such terms should be clearly defined for each of the groups. And, they should have common meanings for all. Usually it is easier to have a common language when these people are from the same discipline. Use of same platform, filling out same fields with different views will probably cause problems especially when the number of assets recorded becomes very high.

In addition to conceptual studies, additional standards can be used within SCORM where it is not clearly set. In this company, these places are "keyword" and "classification" tags of the metadata set. Since the system can be considered as an archiving system, searching should be very effective. Again, if different people define different key words with same or similar meanings, search results will be less reliable. While filling these fields, it will be beneficial to use some internationally accepted standards like "Thesaurus of ERIC Descriptors" or "Library of Congress Subject Headings (LCSH)". For the classification field, "Dewey Decimal Classification System" which is a well known system in school and public libraries. Using such standards is a challenging point that very little examples are found in the literature to compare and discuss.

Administrative Issues

Changes in Work Practices

Learning Objects requires a different approach from previous work approaches. For the management side, this change is very valuable since cost of such material is very high, and reusing the learning objects motivates them. For instructional technologists and instructional designers, the way of thinking becomes consistent with the learning objects approach. The way the asset producers use to work is expected to change. They began to transfer some parts of the metadata, their knowledge and ideas about their products through the platform. Finishing a task means not just drawing for a graphic designer, but entering its metadata which he/she could know and is expected to fill.

As the number of RLOs increase and as the benefits of the system is accepted by the users, probably the first attempt to produce an asset will be searching. It was observed that because of the communication problems in a crowded team, sometimes similar or already same assets are produced by different people at different times.

Another expectation from changes can be development of new viewpoints of designing or producing more reusable assets. Here reusability can be re-using as it is or re-using it as a base. Yet, it was seen that asset-producers could prefer reproducing instead of making revisions.

Organizational Resistance

Organizational resistance was an expected issue in this project. So, from the beginning the change should be considered for everyone affected. Aiming to be SCORM conformant is not enough, it is critical to answer the how questions. Because it seems that answering these questions will give hints about how the users, designers, developers and managers will change. Therefore, probably in every aspect there will be some resistance.

First of all the resistance expected from the asset producers, because this change increases their responsibilities. It is observed that they were unwilling for using this system, especially when they have noticed the number of tags expected to be entered. Their argument was they cannot finish neither their production nor entering these data, and due dates of the projects will be affected. In order to overcome this resistance, project team paid more attention to usability. Some additional mechanisms are added to the system. For example, when a new project is started, a new template can be generated in order to fill some fields by default values. So, users only enter necessary items or make revisions. In addition to templates, if some fields can be filled due to another field, those automatic operations are developed in the platform. For example, when an image is selected, some properties which can be gathered from the system (e.g. file extension, type, file size, etc) are filled to related tags.

Another solution to improve usability is separating the related fields and unrelated fields according to the users' role. While trying to determine the relationship between the fields and the roles it is seen that the usability efforts are very meaningful to overcome the resistance. Figure-8 shows the list of "Translations & Explanations of Fields" which is prepared for reference purposes. Figure-9 shows the first worksheet which is prepared to be used while interviewing with the team-leaders of different production units. When the interviews began, they showed resistance to the idea and mentioned that they cannot fill all that fields and this system will be blocked due to their work-load. Observing this resistance, another version of worksheet is prepared (Figure-10). This time, within a column, it is given that the field was automatically filled or who's (as role) responsible for that field. New format of the worksheet was very effective. The results show that nearly all fields are considered as needed although they can be optional. These results are consolidated according to roles (Figure-11)

New roles and responsibilities

At the beginning of the project a new librarian-like position was suggested to the management. Until that time, when there was something about content, just instructional technologists and content experts were seen as related people. Since the number of RLOs is expected to be very high in the future, it is believed that tracking and classification of those objects requires the know-how of librarians. The responsibilities of this role are entering some fields, ensuring the required fields are filled correctly, and by approving uploading the end-products to the actual repository. Moreover, since a learning object is generated to be used in somewhere, the uploaded and approved learning objects are stored as they were. When it is needed some versions are kept with the determined methods. A rule was set that "updating an approved learning object is possible just for bug fixing". By this way the local copies which are found in developers' computers are the ones that they are working on and the ones which can be neglected.

Summary

In this paper, experiences of a company trying to move toward SCORM compliant content production are explained. It is seen that, administrative issues are also critical as technical issues for such a period. Moving toward a SCORM compliant content production can be seen as forming a common language between different subgroups in the company. Changes in the production style and workflow can cause resistance and should carefully be considered. To overcome these resistances there may be many topics to go on like conceptual studies, additional standards, usability factors.

For the technical side, the understanding of "reusability" and expectations of the system is critical and should be carefully discussed at the beginning of such a movement. Reusability is understood in more than one way in the company. One is reusing the assets produced as they were; the other is reusing the assets produced as a base while producing new assets. These expectations cause the solution to include an

archiving system in which storing a reusable learning object means different entries of different users in a workflow. As a result use of common storage mechanism as approved and temporary bring additional constraints while designing such a system.

References

ADL (2004). ADL Overview. [On-Line]: http://www.adlnet.org/index.cfm?fuseaction=abtadl (Accessed January 26th 2004).

Cagiltay, K., Graham, C.R., Lim, B.R., Craner, J. & Duffy, T. (2002). "The Seven Principles of Good Practice: A Practical Approach to Evaluating Online Courses". Hacettepe University Journal of Education, 20(2), 40-50.

IEEE (2002) . IEEE P1484.12.2/D1, 2002-09-13 Draft Standard for Learning Technology - Learning Object Metadata - ISO/IEC 11404 [On-Line]: http://ltsc.ieee.org/wg12/index.html (Accessed June 10th 2003)

IMS (2004). About IMS. [On-line] http://www.imsglobal.org/aboutims.cfm (Accessed January 26th 2004

Murray (2000). Students' criteria for course selection: Towards a metadata standard for distributed higher education. Unpublished Ph.D. Dissertation, UNIVERSITY OF NORTH TEXAS, August, 2000.

Robson, R. (2000). "All about learning objects". Eduworks. [On-Line]: http://www.eduworks.com/LOTT/tutorial/learningobjects.html [02.08.2002].

Wiley, D. A. (2000). Learning Object design and sequence theory. Unpublished Ph.D. Dissertation, Brigham Young University, 2000. [On-Line]: http://wiley.ed.usu.edu/docs/dissertation.pdf [02.08.2002].

Figures and Graphics

Figure-1: General Structure 1

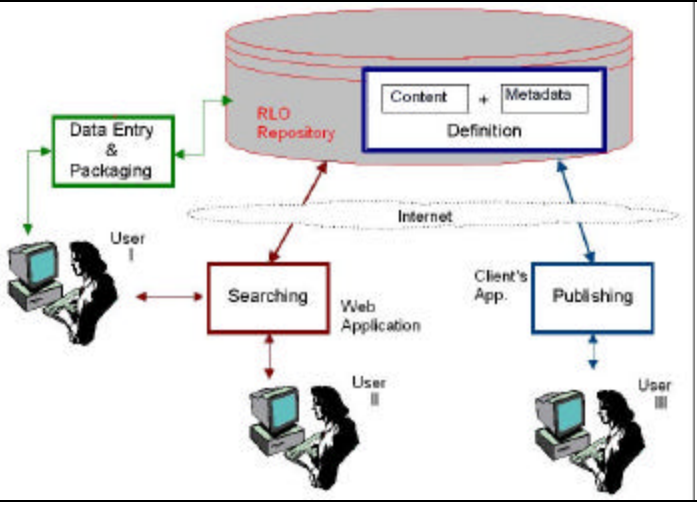


Figure-2: General Structure 2

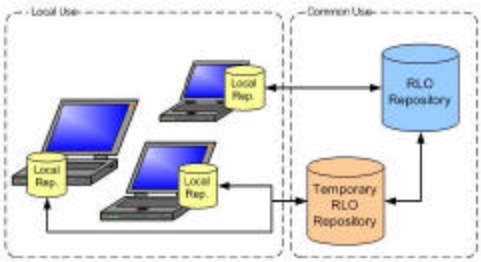


Figure-3: Asset Production Process

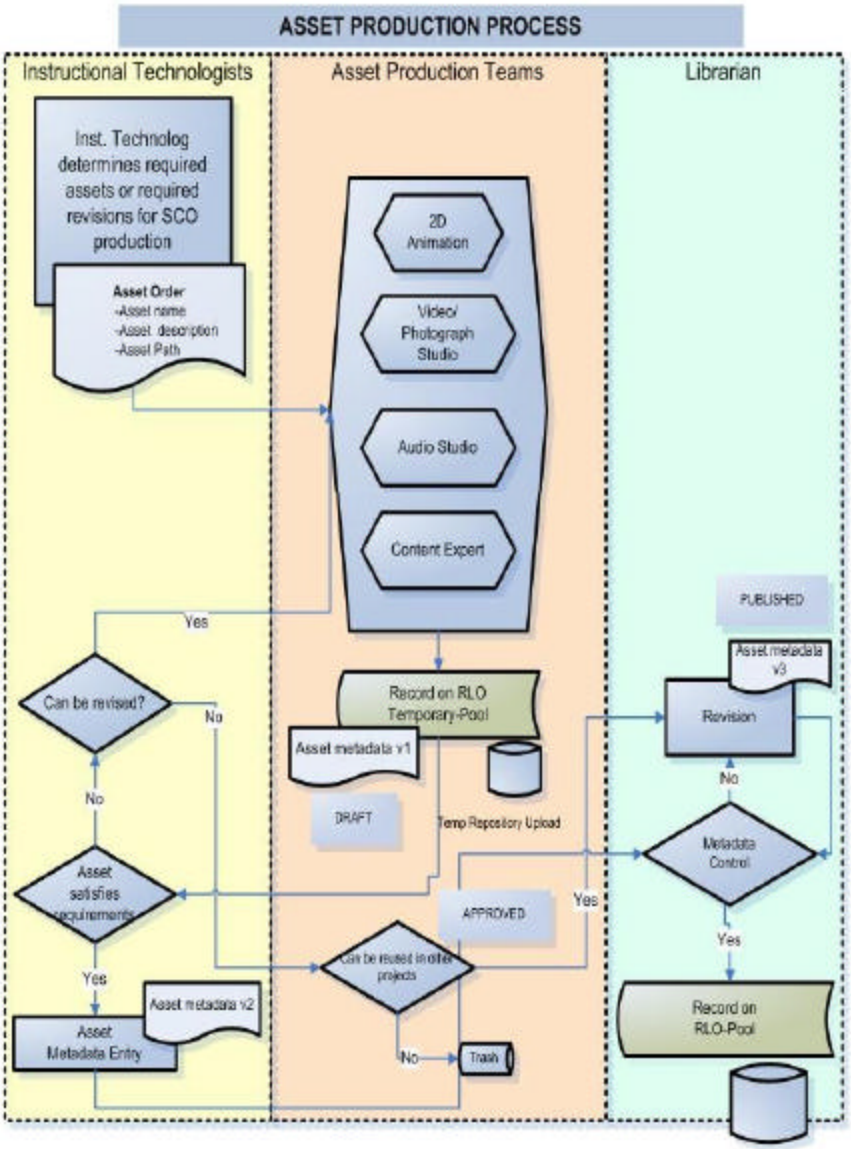


Figure-4: SCO Production Process

Figure-5: SCO Evaluation Process

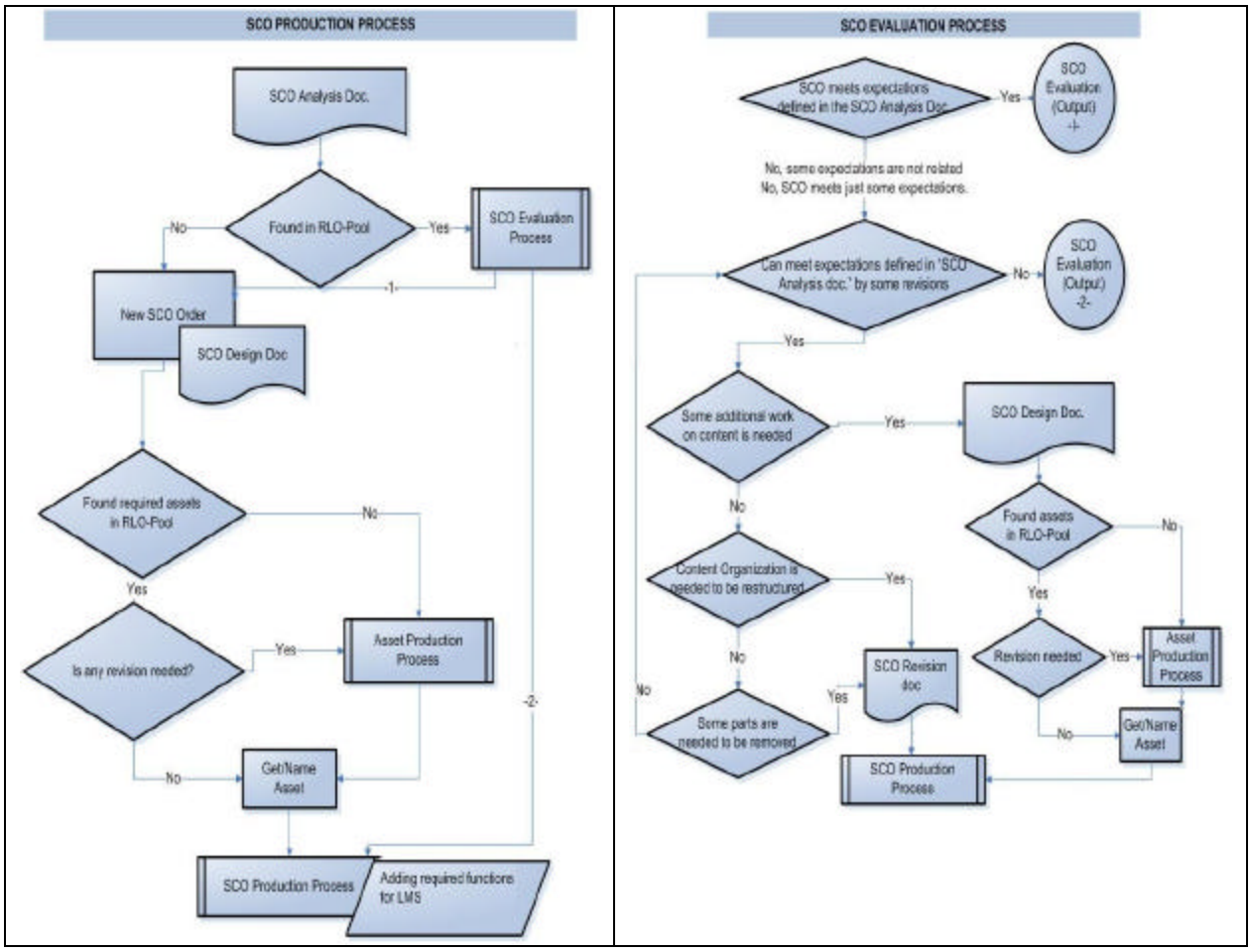


Figure-6: Migration to SCORM Compliant Structure

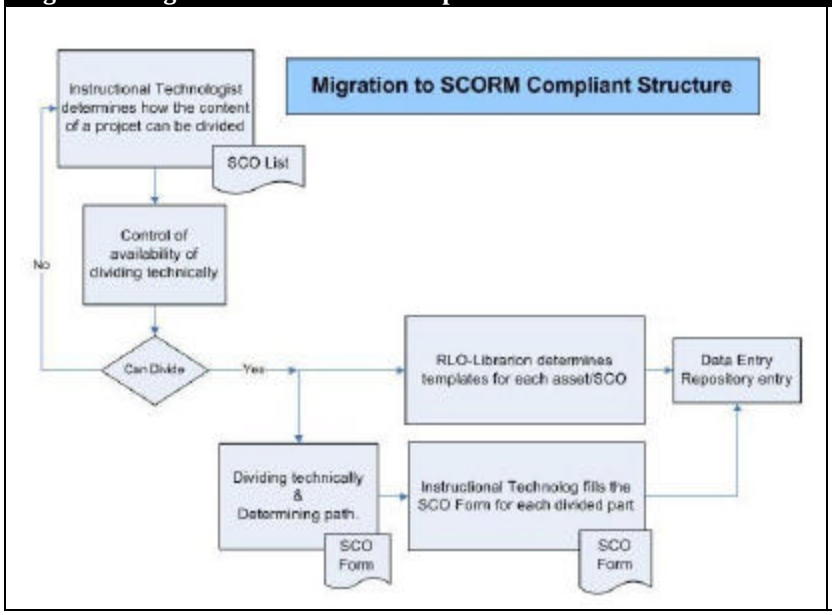
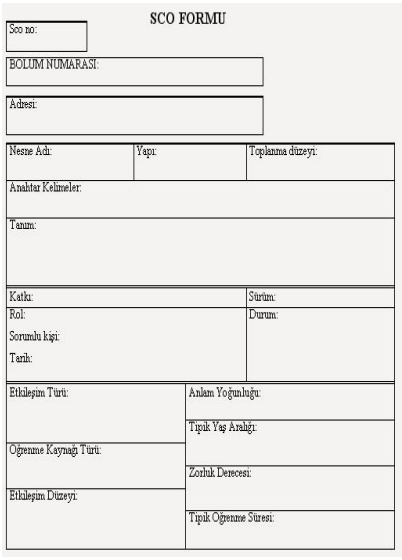


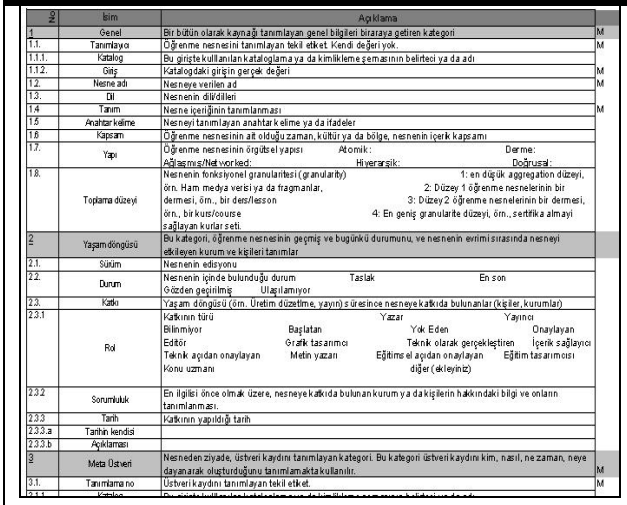
Figure-7: SCO Form



SCO FORMU

Sco no:		
BOLUM NUMARASI:		
Adresi:		
Nesne Adı:	Yapı:	Toplanma düzeyi:
Anahtar Kelimeler:		
Tanım:		
Katkı:		Sürüm:
Rol: Sorumlu kişi: Tarih:		Durum:
Etkileşim Türü:		Anlam Yoğunluğu:
		Tipik Yaş Aralığı:
Öğrenme Kaynağı Türü:		Zorluk Derecesi:
Etkileşim Düzeyi:		Tipik Öğrenme Süresi:

Figure-8: Translations & Explanations of Fields



No	İsim	Açıklama	
1	Genel	Bir bütün olarak kaynağı tanımlayan genel bilgileri biraraya getiren kategori	M
1.1.	Tanımlayıcı	Öğrenme nesnesini tanımlayan tekil etiket. Kendi değeri yok.	M
1.1.1.	Katalog	Bu girişte kullanılan kataloglama ya da kimlikleme şemasının belirteci ya da adı	
1.1.2.	Giriş	Katalogdaki girişin gerçek değeri	M
1.2.	Nesne adı	Nesneye verilen ad	M
1.3.	Dil	Nesnenin dili/dilleri	
1.4	Tanım	Nesne içeriğinin tanımlanması	M
1.5	Anahtar kelime	Nesneyi tanımlayan anahtar kelime ya da ifadeler	
1.6	Kapsam	Öğrenme nesnesinin ait olduğu zaman, kültür ya da bölge, nesnenin içerik kapsamı	
1.7.	Yapı	Öğrenme nesnesinin örgütsel yapısı Atomik: Derme: Ağlaşmış/Networked: Hiyerarşik: Doğrusal:	
1.8.	Toplama düzeyi	Nesnenin fonksiyonel granularitesi (granularity) 1: en düşük aggregation düzeyi, örn. Ham medya verisi ya da fragmanlar, 2: Düzey 1 öğrenme nesnelerinin bir dermesi, örn., bir ders/lesson 3: Düzey 2 öğrenme nesnelerinin bir dermesi, örn., bir kurs/course 4: En geniş granularite düzeyi, örn., sertifika almayı sağlayan kurlar seti.	
2	Yaşam döngüsü	Bu kategori, öğrenme nesnesinin geçmiş ve bugünkü durumunu, ve nesnenin evrimi sırasında nesneyi etkileyen kurum ve kişileri tanımlar	
2.1.	Sürüm	Nesnenin edisyonu	
2.2.	Durum	Nesnenin içinde bulunduğu durum Taslak En son Gözden geçirilmiş Ulaşılamıyor	
2.3.	Katkı	Yaşam döngüsü (örn. Üretim düzeltme, yayın) s üresince nesneye katkıda bulunanlar (kişiler, kurumlar)	
2.3.1	Rol	Katkının türü Yazar Yayıncı Bilinmiyor Başlatan Yok Eden Onaylayan Editör Grafik tasarımcı Teknik olarak gerçekleştiren İçerik sağlayıcı Teknik açıdan onaylayan Metin yazarı Eğitimsel açıdan onaylayan Eğitim tasarımcısı Konu uzmanı diğer (ekleyiniz)	
2.3.2	Sorumluluk	En ilgilisi önce olmak üzere, nesneye katkıda bulunan kurum ya da kişilerin hakkındaki bilgi ve onların tanımlanması.	
2.3.3	Tarih	Katkının yapıldığı tarih	
2.3.3.a	Tarihin kendisi		
2.3.3.b	Açıklaması		
3	Meta Üstveri	Nesneden ziyade, üstveri kaydını tanımlayan kategori. Bu kategori üstveri kaydını kim, nasıl, ne zaman, neye dayanarak oluşturduğunu tanımlamakta kullanılır.	M
3.1.	Tanımlama no	Üstveri kaydını tanımlayan tekil etiket.	M
3.1.1.	Katalog	Bu girişte kullanılan kataloglama ya da kimlikleme şemasının belirteci ya da adı	

Figure-9: First Worksheet about Fields

ALAN	DEGER	NOT
1	Genel	
1.1.	Tanımlayıcı	
1.1.1.	Katalog	
1.1.2.	Giriş	
1.2.	Nesne adı	
1.3.	Dil	
1.4	Tanım	
1.5	Anahtar kelime	
1.6	Kapsam	
1.7.	Yapı	atomik / derme / ağlaşmış / hiyerarşik / doğrusal
1.8.	Toplama düzeyi	1 / 2 / 3 / 4
2	Yaşam döngüsü	
2.1.	Sürüm	
2.2.	Durum	taslak / en son / gözden geçirilmiş / ulaşılamıyor
2.3.	Katkı	
2.3.1	Rol	yazar / yayıncı / bilinmiyor / başlatan ...
2.3.2	Sorumluluk	
2.3.3	Tarih	
2.3.3.a	Tarihin kendisi	
2.3.3.b	Açıklaması	
3	Meta Üstveri	
3.1.	Tanımlama no	
3.1.1.	Katalog	
3.1.2.	Giriş	
3.2.	Katkı	
3.2.1	Rol	oluşturan / onaylayan
3.2.2	Sorumluluk	
3.2.3	Tarih	

Figure-10: Second Worksheet about fields

Figure-11: Results of different groups' acceptance

İsim		
1. Genel		
1.1. Tanımlayıcı	otomatik	
1.1.1. Katalog		
1.1.2. Giriş		
1.2. Nesne adı		
1.3. Dil		
1.4. Tanım		
1.5. Anahtar kelime	Kü.	
1.6. Kapsam		
1.7. Yapı		
1.8. Toplama düzeyi		
2. Yaşam döngüsü		
2.1. Sürüm		
2.2. Durum		
2.3. Katkı		
2.3.1. Rol		
2.3.2. Sorumluluk		
2.3.3. Tarih		
3. Meta Üstveri		
3.1. Tanımlama no	otomatik	
3.1.1. Katalog		
3.1.2. Giriş		
3.2. Katkı		
3.2.1. Rol		
3.2.2. Sorumluluk		
3.2.3. Tarih		
3.3. Üstveri şeması		
3.4. Dil		
4. Teknik		
4.1. Biçim	otomatik	
4.2. Boyut		
4.3. Yer		
4.4. Gereklilikler		
4.4.1. OrComposite (Veya		

İsim	belirlenmiş olanlar	animasyon	kurgu	grafik	eğitim tek.	
1. Genel						
1.1. Tanımlayıcı	otomatik	söz konusu verilerin eğitim teknolojisinden gelmesini bekliyorlar				
1.1.1. Katalog						
1.1.2. Giriş						
1.2. Nesne adı			√	√	√	
1.3. Dil			√		√	
1.4. Tanım			√	√	√	
1.5. Anahtar kelime	Kü.					
1.6. Kapsam			√	√	√	
1.7. Yapı					√	
1.8. Toplama düzeyi				√	√	
2. Yaşam döngüsü						
2.1. Sürüm		√	√	√		
2.2. Durum		√	√	√	√	
2.3. Katkı		√	√	√	√	
2.3.1. Rol		√	√	√	√	
2.3.2. Sorumluluk		√	√	√	√	
2.3.3. Tarih		√	√	√	√	
3. Meta Üstveri						
3.1. Tanımlama no	otomatik					
3.1.1. Katalog						
3.1.2. Giriş						
3.2. Katkı						
3.2.1. Rol						
3.2.2. Sorumluluk						
3.2.3. Tarih						
3.3. Üstveri şeması						
3.4. Dil						
4. Teknik						
4.1. Biçim	otomatik					