

# Web-based dynamic presentation in learning management system for distance education

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# Web-Based Dynamic Presentations in Learning Management System for Distance Education

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## Abstract

*In line with the advancement of ICT, distance education today is expected to be highly interactive and personalized to produce maximum learning efficiency. The intention is to share learning objects that are more effective by dynamically altering the appearance of the material without changing its content. From the studies, data content can be separated from presentation where Sharable Content Object (SCO) content is written in XML and XSL is used to define the layout in order to perform dynamic method in SCORM Conformant LMS. This paper will focus on the design and development of Web-based presentation generator that create different presentations dynamically at run-time environment. The proposed system was developed using Microsoft .NET architecture and have taken SCORM standard into the consideration. The prototype is not intended to be full service LMS. Instead it is intended to be closely focused toward generation of media presentation dynamically through XML/XSLT technologies. The paper will also highlight how the research prototype works. The XSL stylesheet development begins and the SCOs media layouts were selected for respective courses. The XSL stylesheets were determined and XSLT SCOs pages development began. After the XSLT SCOs pages were completed, testing was carried out for the Conceptual Model Instance (CMI) data. The CMI data captured for findings include time spent, media selection for each SCO and raw score for assessment.*

## OVERVIEW OF LMS AND SCORM

A Learning Management System (LMS) simplifies the process of administering education and training (Apostolopoulos et al., 2003). It is a complex system used by managers, administrators, instructors, and learners to schedule, register, bill, and track learner through courses and other learning events. It lets learners find and register progress through a course or program of learning. Finally, it helps administrators manage training programs and compile statistics and reports. LMSs help create and offer courses and curricula. Their primary function is to offer a collection of courses. They may also include capabilities for assembling individual courses into organized curricula or certificate programs (Lewis et al., 1998). At the course level, LMSs provide an ability to launch and track performance within courses.

Pure LMSs work primarily at the curriculum level, tracking what courses learners have taken (Weber et al., 2001). Some systems track classroom training events as well as online training. Others can also assemble courses into certificate programs, tracks or curricula. An LMS integrates courses created in content creation tools (Web-based and course authoring tools).

Sharable Content Object Reference Model (SCORM) is defined as a set of specifications for development, packaging and delivering high-quality educational and training materials (Enrico, 2003). It is published by ADL as a standard mean of construction and packaging distributed learning courses (Advanced Distributed Learning, 2004). In a nutshell, SCORM is a set of specifications for developing, packaging and delivering high-quality education and training materials whenever and wherever they are needed (Brown, 2002).

Learning management in SCORM is handled by an LMS, whose key function is to manage and deliver content objects to learners through Web-based training (Sonwalkar, 2002). In many commercial implementations, an LMS for Web-based training often acts as the focal point for communication between the learning package and the learner, the coach, the Computer-Mediated Communication (CMC) tools and enterprise information systems. LMSs are based on a variety of development platforms, from Java EE based architectures to Microsoft .NET and usually employ the use of a robust database back-end (Beck et al., 2002). LMSs support portability and standards and should be able to personalize content and enable knowledge reuse.

## OVERVIEW OF PROTOTYPE STRUCTURE

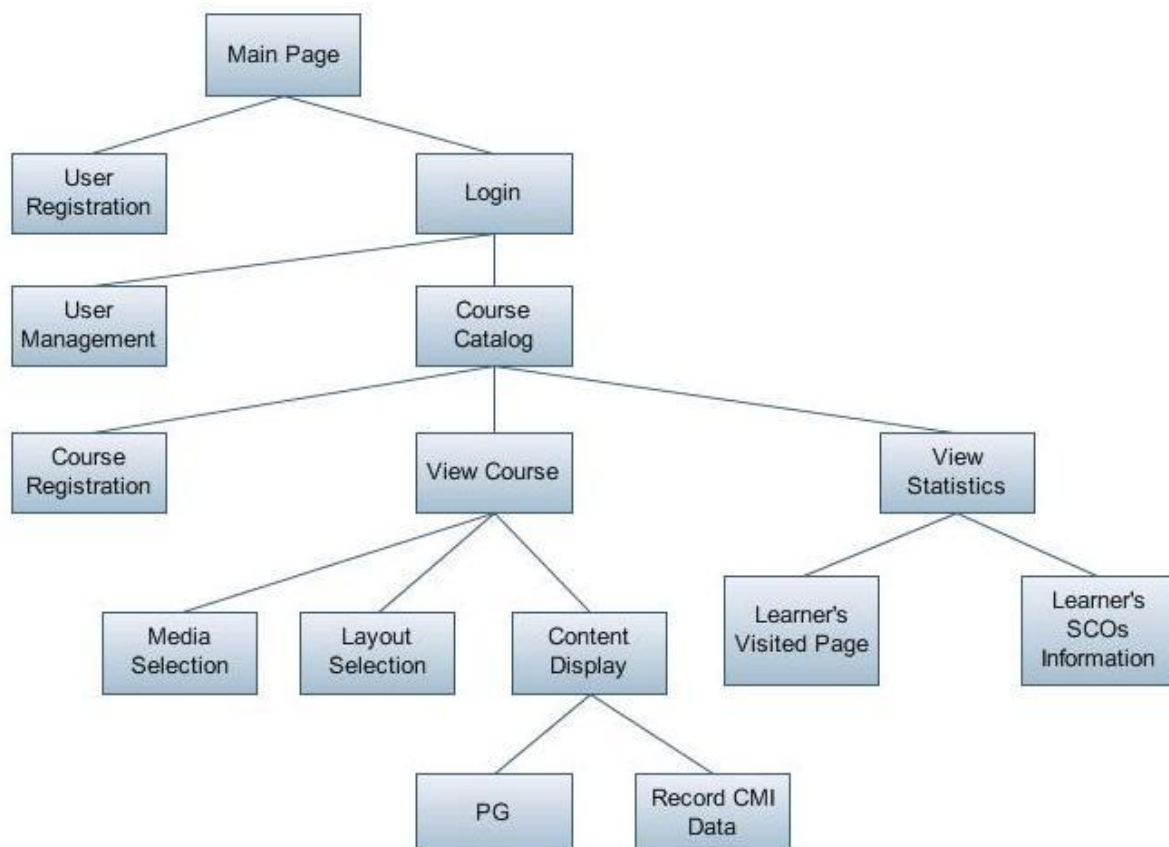


Figure 1: Software Diagram for Prototype Structure

There are 14 modules in the research prototype system as shown in Figure 1. The Main Page consists of Login module and User Registration module. Login function is for registered learners and User Registration function is for new learners who have not registered before. Once login and authenticated, a learner has full access to the course catalogue module only but not User Management module. Only administrator can access User Management module.

A learner can select a course from the course catalogue and register for that course if the learner has never registered before. A learner may start to view or study the registered course. A learner chooses the preferred media at the beginning of the course. Presentation Generator (PG) will display the possible layouts based on the media chosen by the learner. PG will then generate the media presentation and display to students through SCORM player based on their selections. The CMI data (assessment score, time spent and selected media) will be recorded and stored in database. Administrator is able to access User Management and view each learner's statistics (visited page and SCOs information). Only certain modules will be discussed further in this paper.

## COURSE CATALOGUE

A course catalogue is developed to allow learners to see what courses are available to be registered. The learner can select and register for a course from the course catalogue. This module provides user controls for showing what courses a learner has registered. The course catalogue will indicate the current registered courses. A learner can study the registered course. This module also allows administrator to access user management where an administrator can view all registered learners. Figure 2 illustrates a small part of the code to bind the registered courses into the data grid as shown in Figure 3.

```
object RegisteredCourses =
UserCoursesController.GetUserCourses(UserInfo.GetUserID(User.Identity.Name));
foreach (int objItem in RegisteredCourses) {
    string strBuild = "";
    strBuild = "<a href=\"javascript:openBrWindow('sp/rtp.aspx?evt="
+ objItem.EventID + "','course_win','width=" + objItem.ContentWidth
+ ",height=" + objItem.ContentHeight + ", status=0')\">";
    strBuild = strBuild + objItem.CourseTitle + "</a>";
    CourseArray.Add(strBuild);
}
if (CourseArray.Count == 0) {
    CoursePanel.Visible = false;
} else {
    Grid1.DataSource = CourseArray;
    Grid1.DataBind();
}
```

*Figure 2: Bind Registered Course Sub Function*

## COURSE REGISTRATION

The course registration must be done by a student before the student can study a particular course. A student can register for any course he/she has not registered before (marked 'false') by clicking the 'Register' link. If a student has ever registered the particular course and attempt to register for second time or more, there will be a warning message as shown in Figure 3. The course registration verification is being implemented to authenticate the course. Figure 4 illustrates the function to validate the registered course.

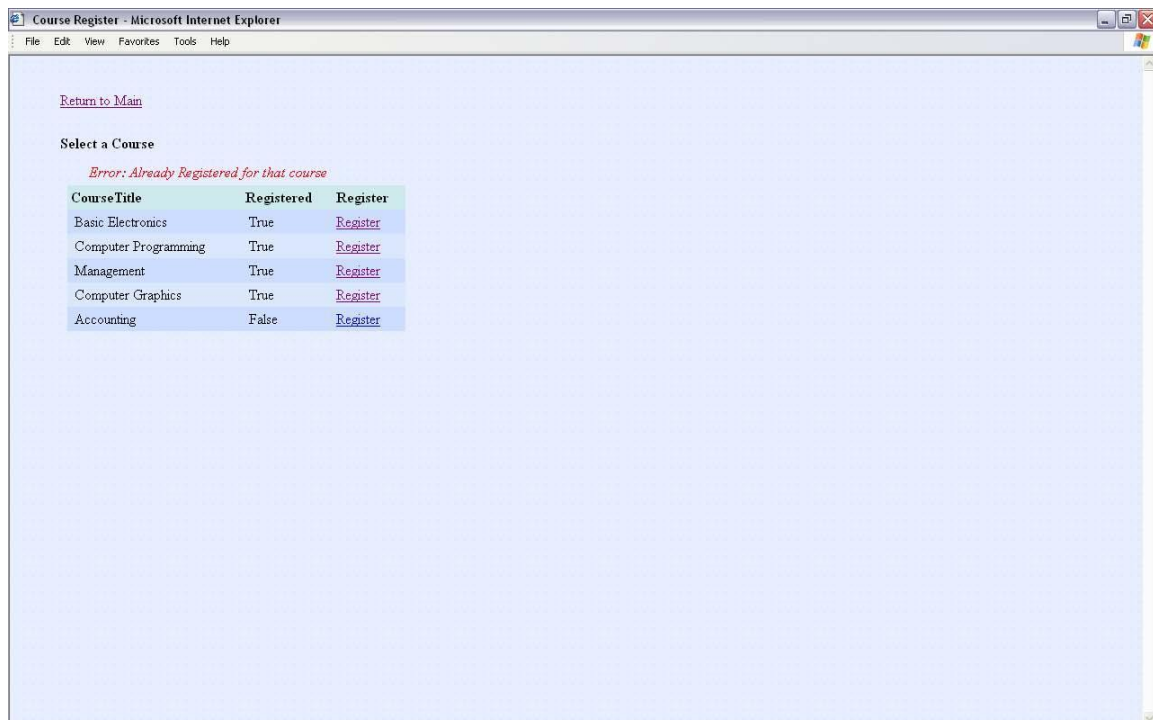


Figure 3: Course Registration Validation

```
int courseID = Convert.ToInt32(e.Item.Cells(2).Text);
int eventID;
eventID = UserCoursesController.RegisterCourse
(UserInfo.GetUserID(user.Identity.Name), courseID, user.Identity.Name);
if (eventID == 0) {
    lblValidate.Visible = true;
} else {
    Response.Redirect("catalogue.aspx");
}
```

Figure 4: Course Registration Validation Sub Function

## VIEW COURSE

After a student registers a course, a student is allowed to view a course. SCORM player is launched to display the course content. SCORM player is a SCORM engine implemented on the client side. SCORM player captures and observes the navigation and delivery services to the learner by extracting information from the SCORM package. The learner's progress is stored temporarily on the learner's machine. The SCORM player is a module incorporated within the LMS main project developed. This contains the *runtimeplayer.aspx* and *lmspostback.aspx* page as well as all the *TinyLMS* Run Time Environment (RTE) support files. The Web services communicate by using HTTP and GET method to retrieve and send data to the server. Figure 5 illustrates the developed SCORM player and log window.

The SCORM player was initialized using the SCO function *LMSInitialize()* when a SCO page is launched using *loadPage()* SCO function. The SCORM player ended when a SCO page is unloaded by calling *LMSFinish()*. All processing relative to the current SCO page must be performed prior to calling the *LMSFinish()*.



Figure 5: SCORM Player

## CONTENT DISPLAY

Each student chooses the preferred media and layout at the beginning of lesson, first SCO page. The same media and layout chosen by students will be applied throughout the all lessons of the course. For instance, Figure 7 and Figure 8 show the use of the same media and layouts for SCO 1 and SCO 2 page. If a student does not prefer the same media and layouts to be applied throughout the lessons of course, the student may choose different layout and media for each SCO by clicking the particular SCO at side menu as illustrated in Figure 7. However, the same media and layout is applied throughout the whole course for the evaluation purpose. Figure 6 shows the presentation generation from one SCO page to another SCO page.

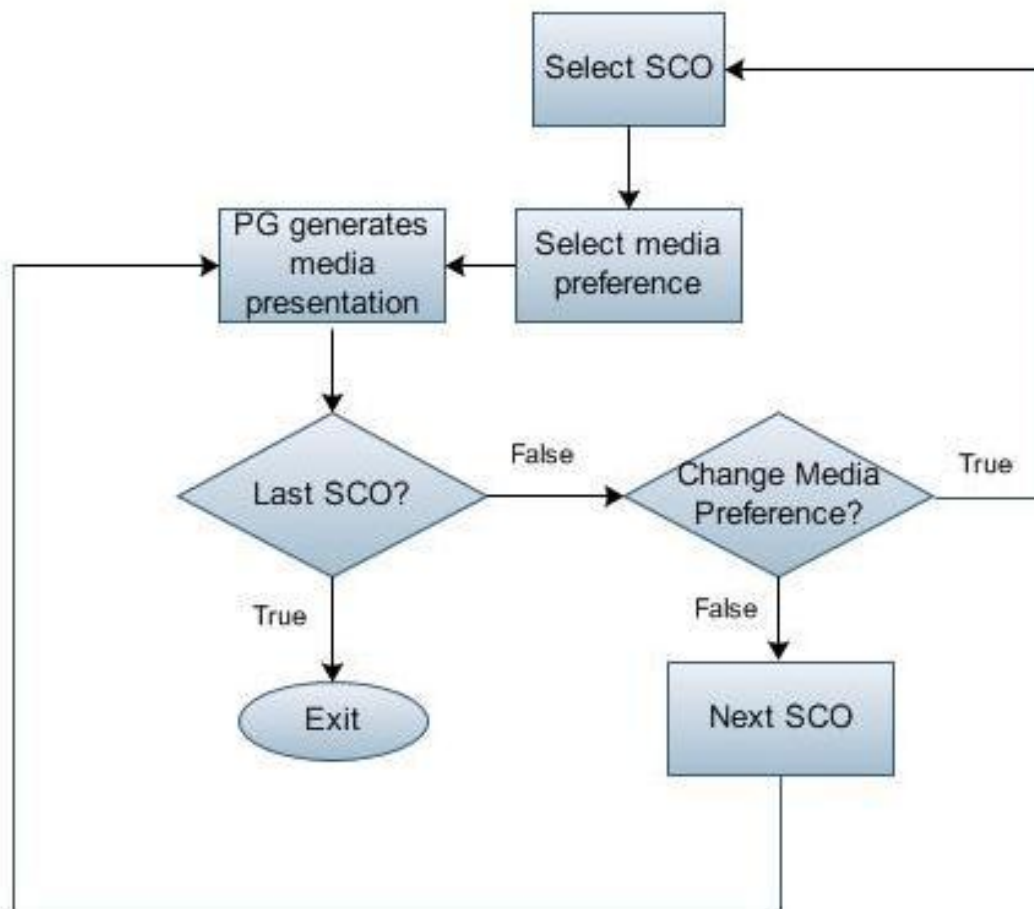


Figure 6: SCO1 to SCO2 Flow Chart

There will be a question for every SCO page. A student will have to answer the question after finished reading every SCO page. The answer of the respective question will be displayed after a student click on *View Answer* button as shown in Figure 7 or Figure 8. Next, LMS will launch SCO 2 content as shown in Figure 8 in a same frameset. As observed from Figure 7 and Figure 8, the side menu explains the status of each SCO by indicating a tick ✓( next to SCO 1 when user completed the SCO. The indicator highlights the user current SCO's page (refer to Figure 8) and indicates the user has completed SCO 1 and currently reading SCO 2.



XSLT SCORM-compliant PG - Microsoft Internet Explorer

File Edit View Favorites Tools Help

## SCORM-Compliant LMS Implementation

Please select from one of the following:

**User Options:**  
[Register for a Course](#)  
[Log out](#)

**Show Statistics:**  
[List All Learners](#)  
[User SCOs Info](#)

**Basic Electronics**

- Course Structure
  - Lesson 1
    - SCO 1
    - SCO 2
    - SCO 3
    - SCO 4
    - SCO 5
  - Assessment
    - Lesson 2
      - SCO 1
      - SCO 2
      - SCO 3
      - SCO 4
      - SCO 5
    - Lesson 3
      - SCO 1
      - SCO 2
      - SCO 3
      - SCO 4
      - SCO 5
    - Final Exam

Logout:  
 Menu  
 Previous  
 Next  
 \* O I

### Text and Animation

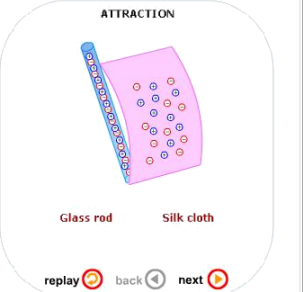
#### SCO 1

It was discovered that when a piece of glass tube is being rubbed by a piece of silk, the two materials tended to stick together.

Indeed, there is an attractive force that was demonstrated when the two materials are separated.

This phenomenon became more interesting when it was discovered that identical material, for example, when a glass rod is rubbed to another glass rod, or when a silk cloth is rubbed to another silk cloth, would repel each other after being rubbed against each other.

Some other materials such as paraffin wax and wool cloth were also found to have the same characteristics.



**replay** **back** **next**

**Question:** Explain the characteristic when two identical materials being rubbed to each other.

Please view the answer of the review question to complete this SCO

[View Answer](#)

Figure 7: Content Presentation for SCO 1 using Text and Animation Media

XSLT SCORM-compliant PG - Microsoft Internet Explorer

File Edit View Favorites Tools Help

## SCORM-Compliant LMS Implementation

Please select from one of the following:

**User Options:**  
[Register for a Course](#)  
[Log out](#)

**Show Statistics:**  
[List All Learners](#)  
[User SCOs Info](#)

**Basic Electronics**

- Course Structure
  - Lesson 1
    - SCO 1
    - SCO 2
    - SCO 3
    - SCO 4
    - SCO 5
  - Assessment
    - Lesson 2
      - SCO 1
      - SCO 2
      - SCO 3
      - SCO 4
      - SCO 5
    - Lesson 3
      - SCO 1
      - SCO 2
      - SCO 3
      - SCO 4
      - SCO 5
    - Final Exam

Logout:  
 Menu  
 Previous  
 Next  
 \* O I

### Text and Animation

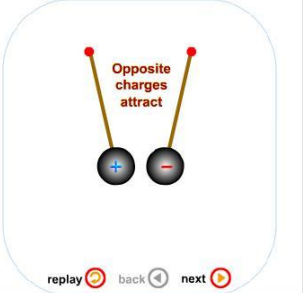
#### SCO 2

The animation on the next screen illustrates the characteristics of positive and negative charges.

Two objects with opposite charges attract each other while two objects with identical charges repel each other.

The imbalance of electrons between objects is known as static electricity.

It is called "static" because the displaced electrons are not in motion after being moved from one material to another.



**replay** **back** **next**

**Question:** Define the static electricity.

Please view the answer of the review question to complete this SCO

[View Answer](#)

Figure 8: Content Presentation for SCO 2 using Text and Animation Media



## RECORDED CMI DATA

There are several JavaScript functions that are used to record CMI data (assessment score, time spent and selected media). These functions encapsulate actions that are taken when a learner navigates between SCOs or exits the lesson. The JavaScript functions are used in two main SCO developments: SCO lesson page and SCO assessment page.

API adapter is implemented to enable SCO page to communicate with LMS and validate data being exchanged via define CMI (SCORM, 2004). The implemented CMI data elements from the Content Aggregation Model resources include *cmi.core.total\_time*, *cmi.core.score.raw* and *cmi.core.lesson\_status*.

If a student exits the course at any time, a bookmark event will mark the last completed screen allowing the user to resume at a later time. When the learner exits or completes the course, the user will be presented with a course status, media selection and time spent for each page. Course status can be *completed*, *not attempted* for any SCO content page and *passed* or *failed* for SCO assessment page.

Besides personal learning Web page for learners, the management functionalities include SCORM compliant performance tracking and report management. Figure 9 presents the user visited page statistics and status of Basic Electronics course for each SCO page. There will be four SCO pages and an assessment page for lesson one, five SCO pages and one assessment page for lesson two, three SCO pages and one assessment for lesson three.

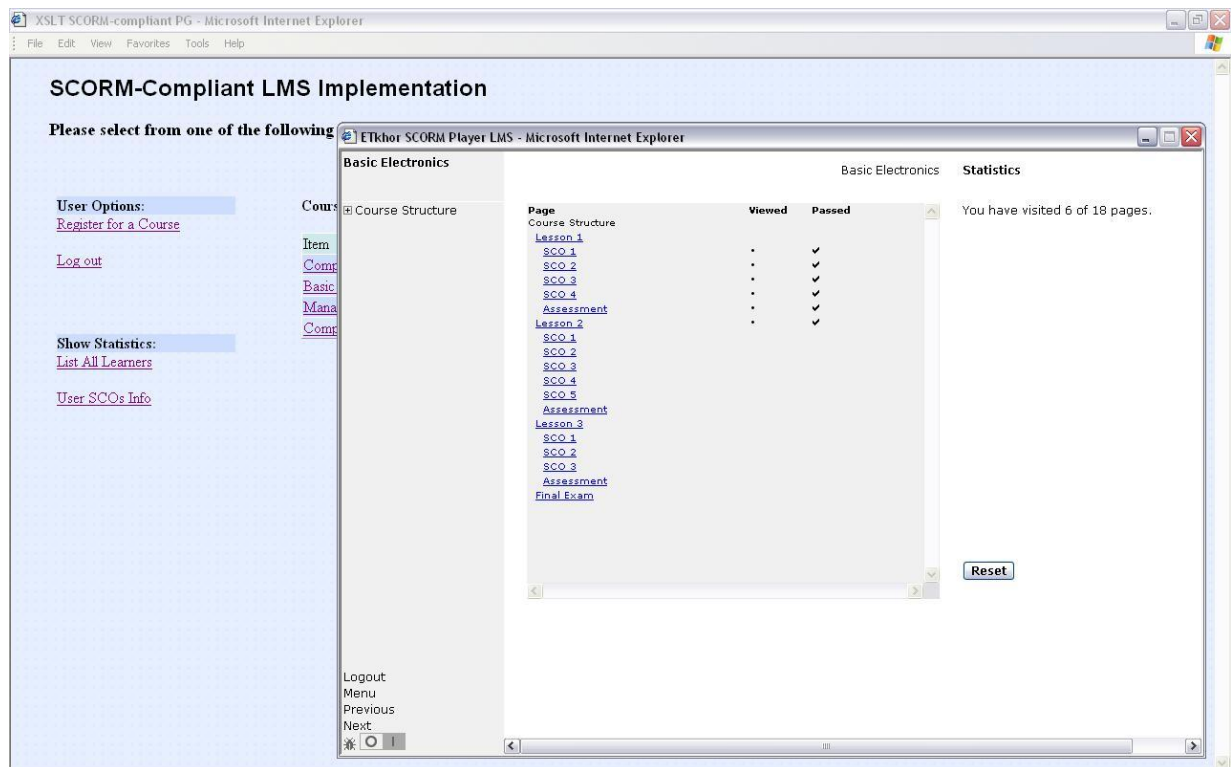


Figure 9: Statistics of Learner's Visited Page

Each student has to complete an assessment at the end of each lesson. Each student has to complete a final examination at the end of each course subject. The data to be captured for statistic data collection or findings include time spent, media selection for each SCO and raw score for assessment. Figure 10 presents the statistics of SCOs data retrieved from database.

[Return to Main](#)

User	SCO ID	Event ID	Identifier	Lesson Status	Media Selection	Raw Score	Total Time
admin	2	1	2	completed			0000:09:20:05
admin	3	2	3	completed			0000:08:00:00
admin	4	2	5	completed	Text		0000:08:03:00
admin	5	2	7	completed	Text,Video,Animation		0000:10:03:17
admin	6	2	9	completed	Text,Animation		0000:06:14:07
admin	7	2	b	completed	Text,Graphics,Audio,Animation		0000:07:34:17
admin	8	2	d	passed		5	0000:11:07:59
admin	9	2	f	completed			0000:12:45:04
admin	32	2	k	completed	Text		0000:07:45:02
admin	33	2	l	completed	Text,Graphics,Audio,Animation		0000:09:45:00
admin	34	2	m	completed	Text,Video,Animation		0000:11:45:07
admin	35	2	n	completed	Text,Animation		0000:13:25:00
admin	36	2	o	completed	Text,Graphics,Audio,Animation		0000:05:45:17
admin	37	2	p	passed		2	0000:04:12:00
admin	38	2	q	completed			0000:06:45:07
admin	39	2	r	completed	Text,Animation		0000:11:15:00
admin	40	2	s	completed	Text,Graphics,Audio,Animation		0000:14:35:80
admin	41	2	t	completed	Text		0000:10:25:04
admin	42	2	u	passed		4	0000:07:33:03
admin	43	2	v	passed		3	0000:09:45:80

*Figure 10: Statistics of Learner's SCOs Data*

## CONCLUSION

A dynamic prototype system using XML/XSLT-based technologies is proposed and discussed. The prototype demonstrated the use of XSLT and SCORM technologies to generate the presentations dynamically. Presentations with different media combinations and layouts were created using the same contents. The course contents are written in XML while the media presentation are defined using XSL. The outputs as presentations viewed by students via LMS are generated through XSL transformation process.

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