# Adaptive Online Lecture Model

1 A. M. Riad, 2 Hamdy K. El-Minir, 3 Haitham A. El-Ghareeb

1,3 Information Systems Department, Faculty of Computers and Information Sciences, Mansoura University, Egypt

{amriad2000 | helghareeb} @mans.edu.eg

2 Head of Communications Department, Misr Engineering and Technology Institute, Misr Higher Education Institute, Egypt

hamdy\_elminir2@yahoo.com

# Abstract

In a previous research paper, we proposed an adaptive e-Learning model that supports different blended learning activities. Proposed model relied on the transform ability from adaptive mode to blended mode; when student is faced by challenges and proposed system identifies student's incapability of handling them alone, and back to the adaptive mode after attending meetings with instructor(s) and solving the outstanding issues. The need for conducting and attending lectures and meetings in learning is clear for both learners and students, and can be managed easily when both exists in the same place on a certain time "Traditional Model of Learning". Situation differs when instructors and students are experiencing either time and/or place differences / distances. Here comes "e-Learning" as the solution. Online meetings / conferences facilitates this functionality and addresses required objectives by presenting different capabilities. Different online meetings / conferences software and applications; in both Web and desktop forms are available however they still lack certain required amount of interactivity between instructors and students, and tracking of different students' activities that promotes them into the level of "Online Lectures". Being a one way presenter is not lecturing.

This paper presents a proposed Adaptive Online Lecture Model that tends to utilize different technologies available to educational institutions, instructors, and students in an innovative way to provide deeper communication between instructors and students during online sessions needed to support e-Learning. Web 2.0 technologies enriched both instructors' and students’ lives with contents generated by Internet users, and the ability to provide real-time feedback, among other many different capabilities. Software Architecture and IT Infra Structure Architecture required to enable proposed adaptive online lecture model is presented, highlighting different challenges and presenting solutions for them.

## Introduction

### 1.1 Current Widely Spread Technologies in Learning Institutions

Utilizing ICT in the learning process in universities can be categorized mainly under two categories: University Management Information Systems (UMISs), and Learning Management Systems (LMSs). A comparison between both systems’ components, scopes, interest, usage, features, and utilization in universities yields that (El-Ghareeb, 2009):

* **UMIS:** used in handling and managing Managerial aspects of the university. They have almost nothing to do with the pedagogical process. However, their existence is almost a must. UMIS exceeds LMS by decades, and has reached a stable levels of well-defined requirements, existence, acceptance, implementation, and performance levels. UMIS include different sub information systems works to facilitate and manage the activities of different parts of the university as an organization. Examples of those sub information systems are: Student Information System (SIS), Library Information System, Faculty Information System, and Finance System.
* **LMS:** used in handling and managing the learning process. LMS implements technologies that enable virtual/digital university, and/or personal learning environments. LMS features can be categorized into four sub systems which concerned with courses, exams, assessments, and collaborative features. LMS can be thought of as the integration of four sub systems; each presenting specific functionalities via specific tools.

Both UMIS and LMS have to integrate and operate together to support educational institutions and e-Learning. One of the international initiatives that provide information to institutions on investing in and using information technology infrastructure is e-framework "<http://www.e-framework.org>". The e-Framework for Education and Research has been established to help the education and research arenas take advantage of the opportunities offered by the service-oriented approach. The primary goal of the e-Framework is to facilitate technical interoperability within and across education and research through improved strategic planning and implementation processes. The e-Framework is a collaborative effort that recognizes greater coherence in development is needed and thus aims to provide an overview of current development and experiences in services-oriented approaches.

### 1.2 Web 2.0 Technologies

Ever since group behavior became an important part of mainstream Web sites, companies have found numerous ways to exploit the behavior of Web surfers. Simple uses of Web 2.0 ideas include businesses like Amazon.com soliciting product rankings from consumers and offering shoppers hints of what others have bought. More overt notions of Web 2.0 include the many social networking Web sites that have tried to profit from the basic human need to connect with others. Facebook, MySpace, Friendster, Tribe, LinkedIn, Spoke, and countless others have looked to profit on connecting teens, communities, professionals, and just about any other type of demographic. The Web 2.0 phenomenon is more rightly described as a social and behavioral sea change. Instead of serving up static fixed content to Web surfers, the Web has become an interactive place for people to congregate and do things together — virtually. Web 2.0 is about the way people use Web 1.0, not about the Web itself (Pollock, 2009). Web 2.0 refers to the social use of the Web which allow people to collaborate, to get actively involved in creating content, to generate knowledge and to share information online (Grosseck, 2009). Most instructors are fascinated with teaching and learning, so they are interested in utilizing whatever their hands reach to in enhancing and supporting the learning process.

### 1.3 SOA as an Integration Solution

LMS and UMIS components are many, and architecturally differ from educational institution to another based on their software requirements. Service Oriented Architecture (SOA) as a design pattern that presents systems as collection of reusable services that can be exposed and consumed on the Internet with standard interfaces has many advantages that can be achieved on technical, managerial, and implementation aspects of the system. Integrating University Management Information Systems (UMIS) and Learning Management Systems (LMS) can be achieved effectively, efficiently, and with minor modifications of both systems via SOA utilization.

## Proposed Adaptive Online Lecture Model Axis

Proposed Adaptive Online Lecture Model attempts to address five different lecture aspects that are not available in current Online lecture Model. Those aspects are presented in figure 1 and can be grouped into: Identifying Next Lecture Topics based on Students’ Learning Profiles and Feedback, Lecture Contents and Order of Contents, Time required for the Lecture, Assessments, Assignments and Collaborative activities.

Figure 1: Adaptive Online Lecture Model Axis

### 2.1 Identifying Next Lecture Topics based on Students' Learning Profiles and Feedback

Before Students leave current lecture, instructors shall ensure that they are familiar with the prerequisites of the upcoming lecture. Proposed Adaptive Online Lecture can facilitate so by conducting assessments from students and ask them clearly about the prerequisites. Besides, Proposed Adaptive Online Lecture Model is part of the learning institution and an important piece of enhancing the learning process. So, Proposed Adaptive Online Lecture Model can access the Student Profile and Online Preferences for data about their previous attended sessions, courses, specifications, and other details. In case one of the students doesn't satisfy requirements defined by instructor, a personalized content can be generated for that student via Intelligent Learning Objects (LOs) Recommender, and Student's interaction with those materials is tracked.

### 2.2 Contents and Order of Contents

Students' learning models are not the same, and that shall be considered while preparing and choosing the contents to be displayed during Online Lecture. In order not to lose student during the lecture, types of contents and order of display shall be mapped with both their direct feedback and learning profiles. Displaying the video file before talking about it, or after talking about it, or twice in the lecture is one of the decisions that instructors might not pay much attention to while it is important in keeping students focused on lecture activities.

### 2.3 Time Required for the Lecture

Bloom (1984) showed twenty-five years ago, as reported in his 2 sigma paper, that almost all students can learn to the mastery level, given the right learning environment (Bloom ,1984; Moursund, 2005). One of the important factors of the abovementioned right learning environment is the "Time Factor". Bloom showed that all students reached mastery level for certain topics after different time intervals of learning. Proposed Adaptive Online Lecture Model stimulates instructors to keep track of students by facilitating real time data gathering and analysis about attendees. After Lecture video recordings and materials will be available, so students can catch up with this point.

### 2.4 Assessments

Conducting Assessments is an important learning activity that tends to estimate and measure students’ understandings of taught topics. Assessments shall go beyond such testing students’ ability of recalling data from their short/long memory to verifying students’ abilities to use the gained knowledge in an efficient manner; so they become knowledgeable about the learned topics. Bloom’s taxonomy addresses this issue in detail (Krathwohl, 2002). Instructors might need to conduct one of the on-the-fly assessments to ensure that students have reached a basic level of knowledge regarding one of the topics s/he was just talking about before moving to the next topic.

### Assignments and Collaboration

Web 2.0 facilitated different forms of online collaboration that can be used in assignments. Online Workspaces that can be used for file sharing, interactive and collaborative online documents editing, mind mapping and tools are examples of collaborative online Web 2.0 technologies that can be used collaboratively as assignments tools. Students attending online lectures are already connected to the Internet via their laptops, have accounts on multiple Web 2.0 collaboration tools providers; like Microsoft and Google, so they can easily transform to those tools based on instructor’s directions. Their collaborative work can be marked, and discussed online as if they are in a traditional lecture.

## IT Architecture to Supports Proposed Adaptive Online Lecture Model

Figure 2 presents a proposed IT architecture to support proposed adaptive online lecture model. Educational institutions differentiates between different components required to support the learning process, and are familiar with some technologies like UMIS and LMS as mentioned in paragraph 2. IT Architecture includes the following servers list:

* Firewall:
* Active Directory (LDAP):
* Collaboration, Assessments, and Assignments:
* Students Data, Student Preferences, Learning Profiles:
* Course Specifications, and Instructors Data:
* Real-time Communication Server:
* Analyzer and Report Generator:
* Middleware:



Figure : Adaptive Online Lecture Model IT Architecture

### 3.1 Integration with Current LMS and UMIS Components

Service Oriented Architecture (SOA) is a design pattern that presents IT infrastructure and information systems architecture as loosely coupled, fine granular services that can address system requirements once they are presented either by adding new services or modifying existing ones. SOA also addresses enterprises information systems’ inefficiency by enhancing reusability, thus theoretically, shortening information systems development time and effort required. Besides reusability, interoperability and integration are other main driving forces for adopting SOA in e-Learning systems. W3C defines Service as ‘A Component capable of performing a task’. Service is ‘A vehicle by which a consumer’s need or want is satisfied according to a negotiated contract (implicit or explicit) which includes Service Agreement, Function Offered and so on’. SOA is the design pattern that utilizes services concept to achieve architectural advantages. W3C defines SOA as ‘A set of components which can be invoked, and whose interface descriptions can be published and discovered’. This definition can be expanded to include the science, art and practice of building applications, so SOA can be defined as ‘The policies, practices, frameworks that enable application functionality to be provided and consumed as sets of services published at a granularity relevant to the service consumer. Services can be invoked, published and discovered, and are abstracted away from the implementation using a single, standards based form of interface’ [51].

### 3.2 Web services and Middleware Server

Web services are applications that use standard transports, encodings, and protocols to exchange information [52]. A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. W3C defines Web service as “A software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a format that machines can process (specifically WSDL), Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with XML serialization in conjunction with other Web-related standards” [53]. Web service can also be defined as ‘A programmatic interface to a capability that is in conformance with Wsnn protocols’. Wsnn protocols are present efforts in the W3C and more recently in OASIS to reach a Web service maturity model. Wsnn protocols include WSDL, SOAP, and XML [54]. SOAP is a lightweight protocol intended for exchanging structured information in a decentralized, distributed environment [55]. XML solves a key technology requirement that appears in many places. By offering a standard, flexible and inherently extensible data format, XML significantly reduces the burden of deploying the many technologies needed to ensure the success of Web services [56]. Web services is a general framework that expedites the sharing of heterogeneous data and software resources dispersed on the internet. The standard-based resource sharing and platform-neutral characteristics of Web services have motivated many organizations to apply the technology in diverse areas, such as supply chain management, virtual enterprise, homeland defense, e-government, and e-business [57].

Here,

## 4. Proposed Adaptive Online Lecture Model as Processes



**First Steps:** Initiating Online Lecture, Define Topics and Contents, Share Resources. Authentication details are removed for sake of clearance, however it is assumed that Instructors and Students log-in with their defined roles before initiating the process.

## 5. Software Architecture to Support Proposed Adaptive Online Lecture Model