**Adaptive Online Lecture Model: A New Perspective of ~~Hybrid~~ e-Learning 2.0 Paradigm**

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**ABSTRACT**

Different Learning Paradigms can be presented by different educators as a result of utilizing several types of Information and Communication Technology "ICT" in the Learning Process to overcome ~~certain~~ time and place challenges, and to enhance the learning process. The three abstract Learning Delivery Models are: Traditional, Distance, and Hybrid Learning. Hybrid Learning attempts to maintain the best of Traditional Learning and provides the hopes and objectives of Distance Learning in a model that maintains the Learning Process on the right road. The widespread of Web 2.0~~; the Internet created by collaborative activities of different users~~ resulted in the appearance of the acronym “e-Learning 2.0”. ~~e-Learning 2.0 is supposed to make use of different Web 2.0 capabilities.~~ Web 2.0 is a big resource that changed the way everyone ~~around~~ thinks about, ~~accesses~~ utilizes the Internet, and greatly will touch the coming generations; the generations that ~~we~~ instructors are currently ~~presenting~~ delivering education to. ~~Another~~ Other big challenges to consider in learning nowadays is the growing numbers of students that is hardly met by growing numbers of instructors. ~~We remember that~~ One of the ICT utilization in learning main objectives was to ~~come over~~ overcome ~~this~~ ~~issue~~ those challenge. This has lead to a form of Synchronous Distance Learning Model that utilizes online communications methods to deliver learning via online meeting methods. Those meetings are challenged by spaces and miles between instructors and students that might prevent proper ways of communication between both. This ~~chapter~~ paper presents a proposed Pedagogical, and Architectural ~~technical~~ specifications models of utilizing Web 2.0 features to present an "Adaptive Online Lecture Model". In order to present an Adaptive Online Lecture Model, ~~a utilization of different aspects todays Web 2.0 features students is addressed~~ different Web 2.0 technologies will be utilized, so instructor can make decisions immediately based on students' feedback via the resources they like and utilize; Web 2.0 technologies. Proposed model tends to help instructors interact~~s~~ closely with students; ~~especially in circumstances of large lectures with more than 300 attending students at a time, and to~~ reach to students easily via Web 2.0 technologies, .

**1. INTRODUCTION**

E-learning 2.0 has lighted a new torch over processes and roles in acquiring knowledge. A heterogeneous community of teachers and learners can dialectically share and improve their knowledge, lit up by Web 2.0 facilities and massive multimedia employment. This trend has a particularly strong impact on e-learning, finally offering new tools and methodologies to effectively work as in an on line community of practice, articulated and promoted by people. The traditional way pursued by e-learning has been overcome by the wide use of Web 2.0 applications, from blog to podcast, from wiki to media sharing. From the accessibility point of view, e-learning 2.0 and its related novel Internet technologies represent a pitfall challenge (Ferretti et al., 2008).

~~I have a dream about a "Learning Model" that hopefully will become true via utilizing different Web 2.0 technologies. This dream entitles something I call: "Adaptive Lecture".~~ ~~In order to achieve "Adaptive Lecture",~~ Students ~~need~~ access ~~to~~ different online resources during the ~~lecture~~ online meetings conducted with instructors, ~~immediately~~, either via   her/his cell / smart phone and Tablet/Mobile PC. Instructor can assign tasks to students, and they immediately ~~switch to their mobile computing devices and~~ start working on them. Instructors can share the presentations from ~~his~~ their laptops with the ~~whole class that is connected via wireless connection~~ attendees. Instructors are not just telling students some information and giving them some assignments, they are ensuring that they can retrieve the information, understand, apply the information to become  "knowledge". Though current online meeting applications provide abovementioned capabilities, they suffer real-time communication shortages between instructors and students. Students might not be involved enough in the learning process with the instructor might be missing some important prerequisites for understanding certain topic, might need repetition of some parts while instructor can’t define those requirements due to distances between them. This is not the case of course when students and instructors are at the same place; because instructors can feel students immediately, and start asking them “What is wrong?” and “Is there something unclear?” questions. Even with the existence of web cams, students can easily fool them by starting them and starring at the monitors; only God knows what they starring at!

## 1.1 CURRENT ONLINE LECTURE MODEL “PROBLEM DEFINITION”

~~I'm not quiet sure who started the Current Lecture Model or when, all what I am sure of is that: it really exists for a long time.~~ Students login to online meeting system ~~go to some place~~, ~~where there are teaching stuff~~ instructors are already waiting, started the class, shared the files, presenting lecture~~s~~, defining assignments, defining ~~sections, and~~ labs to be followed ~~by teaching assistants~~ later, take questions, and leave. They wait for assignments before due time, mark them, repeat the scenario for another meeting/lecture, and so on. This model is the same exactly of the Traditional Learning Model; ~~This~~ the model used to work fine when the number of students used to exceed by more than hundreds the number of professors, but ~~is it still working the same quiet fine as it used to?~~ It is not working the same quiet fine as it used to. This system, is too much stable: students know the courses they are going to attend, they have question banks, and ~~all that~~ different academic ~~stuff~~ resources available today. This system has stabilized to the extent that under some circumstances it is killing innovation and preventing students and professors from “Knowledge”. ~~Why?~~ One of the reasons that affect this model efficiency is the lack of connection between students and instructors. With this huge number of students, there are doubts about the instructor's capability to connect with everyone individually ~~sitting in front of her/him~~. Of course this is a matter that differs with experience and varies from instructor to another; however it is till a matter to question.

This lecture model might be acceptable in countries with acceptable student-teacher ratio. However, based on the Arab Knowledge Report (2009), higher education in the Arab region suffers a considerable shortage of teachers. In 2005, the student-teacher ratio was 25:1, compared to the global average of 16:1. The Arab student teacher ratio is the highest among all regions of the world, including sub-Saharan Africa. The shortage is more severe in some countries than in others. The student-teacher ratio is at least double the global average in Yemen, Egypt, Algeria, and Palestine, and one-and-a-half times the global average in Jordan, Bahrain, Mauritania, Libya, the UAE, and Saudi Arabia. Hopefully proposed Adaptive Online Lecture Model will enhance the ~~lecture~~ learning experience and might help to overcome such a challenge; especially in Arab region.

Even in countries with acceptable student-teacher ratio, the current online lecture model doesn’t entitle students to feel a real utilization of new technologies in the learning process. The 2009 21-st Century Campus Report (2009) presents some facts that are important in imaging the current situation, and hopefully will be leading the move to the new model. One of the facts is the different views between instructors and students rate for utilizing technology. Instructors rate their use and understanding of technology as high, but students disagree with that assessment. Students rate faculty lack of tech knowledge as the biggest obstacle to classroom technology integration and see it as a growing problem.

**1.2 PROPOSED ADAPTIVE ONLINE LECTURE MODEL**

Adaptive Online Lecture is the lecture where ~~the lecture supports~~ one or more forms of adaptivity is supported via utilizing one/more of Web 2.0 technologies. Adaptivity features are many, and include (not only):

* Table of Contents / List of Lecture Topics
* Contents, Learning Materials, and Presentations
* Order of Topics and Contents
* Time Required for a topic
* Assessments

Adaptive Online Lecture is no new concept, because Adaptive Online Lectures make the difference between professors that students ~~you~~ really want to attend lectures of, and others. However, ~~our~~ proposed trend with Adaptive Online Lecture focuses on the (Engineering) of the (Online Lecture) process and moving it from the static model that it used to be on right now, to the dynamic and engineered model. Treating Learning as a process hopefully will present "Learning Process Management" advantages to e-Learning systems.

The rest of this chapter goes as follows: Section two presents a comparison between Current Online Lecture Model and Proposed Adaptive Online Lecture Model highlighting the expected advantageous features of it. Section three presents the proposed different and current suitable Web 2.0 technologies to support adaptive lecture model, and Section four presents the proposed IT infrastructure and technical model that satisfies adaptive lecture requirements. Section five present strategies to support adaptive lecture model in the near future. Section six discusses the expected outcomes of the proposed adaptive lecture model. Section seven discusses instructor challenges and attempts to define the expected outcomes of the proposed model. Section eight highlights future directions regarding adaptive learning. Section nine concludes the chapter and presents future work. References are present at section ten.

## 2. CURRENT LECTURE MODEL VS. PROPOSED ADAPTIVE LECTURE MODEL

Adaptive Online Lecture is the hype of Tutoring and Current Online Lecture Model. Tutoring is always the best solution to provide learning; however it is hard to afford tutoring due to the increasing number of students, ~~beside I would rather think about presenting "tutoring" to current lecture model as a problem that needs solution and can be challenged and solved by new technologies.~~ Table 1 presents a comparison between the Current Online Lecture Model and Proposed Adaptive Online Lecture Model ~~based on the adaptivity features presented in section 1.2~~.

*Table 1: Comparison between Current Lecture Model and Proposed Adaptive Model features*

|  |  |  |
| --- | --- | --- |
|  | Current Online Lecture Model | Proposed Adaptive Online Lecture Model |
| List of Lecture Topics | Static | Variable |
| Contents, Learning Materials, Presentations | Static | Variable |
| Order of Topics and Contents | Static, Predefined | Varies |
| Time Required for a Topic | Static, Predefined | Varies |
| Assessments | Predefined | Varies |

**2.1 LECTURE TOPICS**

In Current Online Lecture Model, list of topics within the lecture is already predefined by the instructor. Students are supposed to be satisfying course prerequisites  before attempting current course, so instructors might not pay much attention to different students needs. This is not the case with Adaptive Online Lecture Model because instructor is easily connected with students and capable of determining either it is accepted to move on with the predefined list of topics, or take sometime to present some of the prerequisites upon need before discussing the main lecture topics.

**2.2 CONTENTS, LEARNING MATERIALS, AND PRESENTATIONS**

Contents, Learning Materials, and Presentations to be presented during the online lecture also shall varies based on what students have learned before, and based on their backgrounds. One of the most taken for granted assumption is that "Students prefer animation and videos in learning". Authors have witnessed situations where students face problems with understanding what they see in the videos. It is clear that most of the videos are not created and edited by the instructors, so they have to display it the way it is. This situation took place with authors while teaching Computer Networks. After students watched the famous "Warriors of the Net: The Movie" available at <http://www.warriorsofthe.net/movie.html>, they became confused about many of the concepts they have been told about ~~kept telling them~~ during the online lecture before watching the video. Some students loose concentration during video presentations, and they just spend the time relaxing till the instructor starts talking again!

**2.3 ORDER OF TOPICS AND CONTENTS**

Order of Topics to be presented in the Online Lecture is mainly an instructor's responsibility. Authors ~~I~~ doubt the students' ability to define the order of topics to learn during a lecture; especially if all the proposed topics are new to them. However, students can easily define the order of contents displayed to them. Personal differences and out of control surrounding circumstances might drive the Online lecture in different paths. For example, if the lecture includes a presentation and a video file, there are different scenarios for driving the lecture:

* Watch the Video and then illustrate and start discussions with students
* Illustrate the video and take feedback from students, conclude the discussion with the video
* Introduce a brief about the video contents, watch the video, and ten talk about it
* Begin watching the video immediately, illustrate and talk about it, conclude the discussion by watching it for a second time

~~What is the best choice?~~ There is no best choice of course, however, there is always an optimal solution based on different inputs like, time, Internet connection speed and bandwidth, number of students attending Online Lecture, and other factors. Proposed Adaptive Online Lecture Model attempts to address Students themselves as an input factor to define such choices during the lecture. ~~projector availability, lightning in case projector display is affected by the high sunlight at the beginning of the lecture so delaying the video to the end of the lecture might overcome this challenge, and other factors~~. ~~The question is: Why don't add Students themselves as an input factor of the issue ?~~

**2.4 TIME REQUIRED FOR THE ONLINE 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. Thus, assuming that learning *Topic A* for example will take *Time A period* might be not acceptable assumption in some cases and for some students. Instructors’ experience in topics and with teaching students helps a lot of course in defining such confusing issues, however with the new capabilities available for connecting both instructors and students, such decisions can be taken based on both sides points of view ~~as we are in the dawn of Web 2.0, why not start using Web 2.0 capabilities in e-Learning ?~~

**2.5 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. That next topic might rely heavily on the pre-topic; understanding next topic is based on understanding the first one. Those assessments are of no importance while grading students; in most cases instructors don’t count the speed of understanding topics in grades. Such type of assessments is made feasible via proposed Adaptive Online Lecture Model.

Though Conducting Assignments is one of the most activities learners shall achieve successfully to ensure certain level of learning quality, it is not a highlighted part of Proposed Adaptive Online Lecture Model because it is already implemented in innovative ways rather than earlier days. It is almost impossible to find a learning institution without an online forum that gives the instructor the ability to define assignments after the lecture, so defining assignments can be considered as an after-lecture activity. Proposed Adaptive Online Lecture Model focuses on Real-time lecture data; that is the data needs to be captured, processed, and analyzed on-the-fly during Online lecture time to enable instructors make the appropriate decision.

**3. LEARNING INSTITUTIONS CONVERGENCE FROM CLASSICAL TO WEB 2.0 TECHNOLOGIES**

Using ICT in learning has a long history, and was handled in different ways and from different points of views over the years. Though most of the time this diversity has lead to the most inappropriate understandings and misleading implementations of the concepts, it has also opened the way for different approaches that has been under validation and evaluation over the years. As the learning institution in concern for this chapter is the University, the focus of this section will be on information systems that were presented over the years to facilitate university activities. Then, the attempts of different learning institutions to utilize Web 2.0 technologies will be presented.

**3.1 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 the two 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 stable levels of well defined requirements, existence, acceptance, implementation, and performance levels. UMIS include different sub information systems that work 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. Providing Online Lectures via Videoconferencing and recording capabilities used to be optional in LMSs.

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.

**3.2 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).

Instructors face a great challenge nowadays. 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. Instructors are surrounded by acronyms that are completely new to them, and there is not enough time to get used to one of the technologies before another becomes available. Figure 1 highlights instructor’s distraction between different acronyms that made available and easy for students to utilize, and are under study by e-Learning researchers. All those technologies are available, but there are always some questions that need answers: How to utilize them? What are the efficiencies and drawbacks on the learning process and on learners from utilizing them? And are those technologies convenient with the learning institution’s policy?

Instructor Challenges.tif

*Figure 1: Instructor Challenges between Students and Researchers*

**3.2.1 EXAMPLES OF WEB 2.0 TECHNOLOGIES**

Figure 2 presents a collection of different Web 2.0 implemented technologies that can be utilized in e-Learning 2.0. Presented list is not meant to include all presented examples; because they are plenty and the list is updated every day. However, it is meant to include the most accepted and highly deployed implementations of Web 2.0 technologies. Those examples gained a huge acceptance and access from online users. This chapter does not tend to present a full coverage and/or a list of highlighted Web sites’ users. The following numbers are just for proof of concept.

Table 2 presents some facts about Web 2.0 online usage statistics based on Google Ad Planner statistics on November 9, 2009. All statistics are in approximate.

*Table 2: Some Facts (Statistics) about Most Popular Web 2.0 Sites Usage Statistics*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Cookies | Visitors | Reach | Page Views | Total Visits | Avg. Visits | Avg. Time |
| Twitter | 120 M | 66 M | 5.2 % | 4.4 B | 600 M | 9 | 12:10 |
| Facebook | 710 M | 410 M | 32 % | 220 B | 10 B | 25 | 23:20 |
| MySpace | 190 M | 99 M | 7.6 % | 29 B | 1.1 B | 12 | 21:40 |
| WikiSpaces | 3.8 M | 2.2 M | 0.2 % | 50 M | 6.7 M | 3.1 | 8:10 |
| LinkedIn | 67 M | 35 M | 2.7 % | 1.7 B | 190 M | 5.5 | 9:50 |
| Blogger | 66 M | 42 M | 3.2 % | 1.7 B | 210 M | 5 | 10:50 |
| MindMeister | 290 K | 170 K | 0 % | 3.8 M | 760 K | 4.6 | 10:40 |
| LiveStream | 1.4 M | 740 K | 0.1 % | 15 M | 2.9 M | 3.9 | 12:00 |
| Flickr | 120 M | 65 M | 5.1 % | 3 B | 250 M | 3.8 | 9:00 |
| Zoho | 1.5 M | 830 K | 0.1 % | 51 M | 5.6 M | 6.8 | 15:50 |
| SlideShare | 16 M | 9.1 M | 0.7 % | 66 M | 21 M | 2.4 | 6:00 |

Google Ad Planner is a free media planning tool that can help identifying websites where audience is likely to visit. Table 2 Columns details are:

* **Cookies:** Approximate number of cookies on a site over a specific month.
* **Visitors:** Estimated, unduplicated number of people who visit a site over a month.
* **Reach:** Total estimated number of users you can reach on a specific site.
* **Page Views:** Total estimated number of times pages on a site have been accessed.
* **Total Visits:** Estimated number of times a site is accessed by unique visitors.
* **Average Visits Per Visitor:** Estimated number of times a unique visitor accesses a site over a specific month.
* **Average Time on Site:** Estimated average amount of time, in seconds, that a unique visitor spends on a site.

Total number of users and visits mentioned in table 2 exceeds billions. What really matters the most is the Growth Rate of Web 2.0 sites. Twitter; for example is a phenomena that shall be closely studied and made use of in different aspects of twitters’ users’ lives.In December 2008, 11% of online adults said they use Twitter or another service to update their status online (Lenhart and Fox, 2009). In April 2009 study shows that the percent has increased to 19% of internet users (Fox et al., 2009). Table 3 presents a new survey from Nielsen about the five fastest growing "member community destinations" in the U.S.

F:\PhD\Adaptive Lecture\e-Learning 2 Technologies.tif

*Figure 2: e-Learning 2.0 Supportive Technologies Online Implementations*

*Table 3: Survey from Nielsen about the five fastest growing "member desinations" in the U.S*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RANK | Site | Feb 08 | Feb 09 | % Growth |
| 1 | Twitter.com | 475,000 | 7,038,000 | 1382% |
| 2 | Zimbio | 809,000 | 2,752,000 | 240% |
| 3 | Facebook | 20,043,000 | 65,704,000 | 228% |
| 4 | Multiply | 821,000 | 2,394,000 | 192% |
| 5 | Wikia | 1,381,000 | 3,758,000 | 172% |
| Source: Nielsen NetView, 2/09, U.S., Home and Work  <http://blog.nielsen.com/nielsenwire/online_mobile/twitters-tweet-smell-of-success/> | | | | |

Table 4 presents a comparison between the top rated technology tools used in conjunction with education from students’ perspective, and the same tools utilization in teaching from instructors’ perspective based on data from the 2009 21-st Century Campus Report (2009). There is a huge gap that hopefully will be addressed by models like the proposed adaptive lecture. Though both use Web 2.0 technology outside of class, faculty and students still rely on traditional methods to communicate with each other.

*Table 4: Percentages of Technology tools conjunction with education/teaching by Students / Instructors based on The 2009 21-st Century Campus Report (2009)*

|  |  |  |
| --- | --- | --- |
|  | Students | Instructors |
| Social Networking Sites | 52% | 14% |
| Web Applications | 31% | 12% |
| iPod / MP3 player | 31% | 8% |
| Wikis | 28% | 11% |

**3.2.2 WEB 2.0 UTILIZATION IN LEARNING INSTITUTIONS BETWEEN THEORY, PRACTICE, AND EVALUATION**

Web 2.0 research in e-Learning is a research point of interest ~~for long~~. Collaboration, Semantic Web, Ontologies, Web services, SOA, and many other technologies has been presented, utilized, and evaluated within the learning domain. This section presents different research papers, implementation practices, and case studies of adopting Web 2.0 technologies in learning institutions. Web 2.0 platforms are seen to have an emerging role to transform teaching and learning (Alexander & Levine, 2008). One of the research papers that addresses different scenarios for utilizing Web 2.0 technologies in e-Learning is the one presented by Grosseck (2009). Author renders some possibilities and examples of using Web 2.0 technologies as a support for preparing and collecting didactic materials, evaluating and analyzing the progress made by students, putting together informative and formative presentations, time management, planning the timetable and the calendar of activities, developing projects in collaboration, digital storytelling, students’ e-portfolios etc. Rendered Web 2.0 technologies include: Blogging, Microblogging, Wikis, Photo/Slides Sharing, Video Sharing, Syndication of Content through RSS, Social Bookmarking, Social Networking, and other tools. Author addressed advantages and challenges of utilizing Web 2.0 technologies in the learning process, and the need to invent pedagogy 2.0 that goes a long with e-Learning 2.0 enabled by Web 2.0 technologies’ utilization in the learning process.

One of the available online guides for implementing Web 2.0 in e-Learning is the one presented by (Downes ,2008). This article presents a ten things to do (via different technologies) to make the maximum benefits out of web 2.0. Learning activities include: Podcasting, Video casting, Blogging, Slide Sharing, Googling, and Commenting on others' posts and activities, socializing via facebook, and other activities.

The three main players in the learning process need to co-operate to adopt and implement Web 2.0 technologies in the learning process. They are: Learning Institution’s Management, Instructor, and Student. Learning Institution’s Management; represented by Chief Information Officers (CIOs) give high priority for advanced learning features provided by new technology trends. Agee et al. states that Teaching and Learning with Technology is ranked #5 this year, moving up from #9 in the 2008 survey as the top priority of CIOs (2009). CIOs have become crucial to instructional units because they provide leadership in evaluating and supporting the teaching technologies that underlie multiple forms of distributed learning. A growing proportion of learning takes place outside the traditional boundaries of the classroom, facilitated by applications such as social networks and technologies that support a culture in which everyone creates and shares. CIOs are being asked to provide technological direction for cultural transformations—such as information fluency—that involve library faculty, department faculty, technology specialists, and students as co-creators of knowledge. Finding the proper balance between systemic and ad hoc technologies will be fundamental for IT leaders as they respond to a student generation that prefers less passive and more agile learning. These instructional modalities will foster transformational innovations such as the need for e-portfolios in a reflective, contextual, authentic, and active learning environment.

On the other hand, Ajjan and Hartshorne (2008) assess faculty’s staff members’ awareness of the benefits of Web 2.0 to supplement in-class learning and better understand faculty’s decisions to adopt these tools. Findings indicated that while some faculty members feel that some Web 2.0 technologies could improve student’s learning, their interaction with faculty and with other peers, their writing abilities, and their satisfaction with the course; few choose to use them in the classroom. Additional results indicated that faculty’s attitude and their perceived behavioral control are strong indicators of their intention to use Web 2.0. The results highlight that while a somewhat considerable proportion of the faculty felt that selected Web 2.0 technologies would likely provide their students with many benefits, only few chose to use it. The lack of experience with most Web 2.0 technologies examined in this study could drive faculty members to avoid their adoption, although they realize that this adoption would provide their students with many important benefits.

Küfi and Özgür (2009) present an elaboration on the effectiveness of the most recent web-based tools from the student perspective. The present study aimed to develop a comprehensive insight into two hundred freshman students’ perceptions regarding the use of an interactive web environment in English communication courses offered by the department of General Education at Eastern Mediterranean University. Utilized Web 2.0 technologies include: Wiki and Moodle. Though utilized technologies are really so simple, they achieved the required objectives and provided students with the suitable environment to create their own interactive web environment for their classes. The analysis of data shows that the majority of students is positive about the use of an interactive web environment and finds its use beneficial for their learning. Based on the research results, 50% of students enjoyed learning English by using Wiki/Moodle, and 52.5% of them agrees that the interactive web environment created for English course (by the use of Wiki/Moodle) helped them to improve their English.

**3.2.3 REAL WORLD EXAMPLES OF UTILIZING WEB 2.0 TECHNOLOGIES IN LARNING INSTITUTIONS**

An example of adopting Community Platform for Educators is the one presented by College of Liberal and Professional Studies at the University of Pennsylvania "<http://www.sas.upenn.edu/lps/>". College sought a platform that would provide a more engaging and participatory environment its online courses based on the two utilized Open Source Modules utilized in the College: Moodle; for managing learning activities, and Drupal; that is the Content Management System. GoingOn "<http://www.goingon.com>" built a platform for a University of Pennsylvania psychology course in the institution's continuing-education program. The psychology department had graduates who had become psychologists who wanted to learn more to improve their professional practice, as well as learners who wanted to improve their lives. Nearly a thousand student took the course, called "Foundations of Positive Psychology." The interface allowed students to form their own "affinity groups" based on topics of particular interest. And the entire platform was able to draw student information from Moodlerooms, also built on open-source applications “Source: <http://www.sas.upenn.edu/lps/news_110409> ”.

Another example is Epsilen "<http://www.epsilen.com>"; an e-learning platform that is built around social networking. Epsilen announced a partnership with SunGard Higher Education "<http://www.sungardhe.com>" to draw on student information in a similar way. The Epsilen environment lets faculty members use online material from The New York Times both for assignments and to promote discussion. An example of this utilization was achieved by a Professor of international affairs who left his Epsilen group open after the class finished and final grades were posted. Months later, there was a spike in online activity and discussions. Students were watching the Olympics, and had started discussing the athletic competition in the context of the international-politics issues raised during the class. Epsilen partners list include Bowling Green State University, Ohio.

Utilizing Collaborative Digital Information Tracking in Universities is facilitated by iParadigms “<http://www.iparadigms.com>” one of the leaders in the field of textual intellectual property protection. iParadigms has announced an update for its peer review Web service named PeerMark to include collaborative features (Schaffhauser, 2009). iParadigms lets instructors create and manage assignments in which students read and provide comments on each others' work. Faculty use a Web interface to set up assignments, provide structured guidance, and monitor the results with minimal effort. Students upload, review, and comment on each other's papers, prompted by instructor-supplied questions and guidelines. iParadigms list of users is available at <http://www.iparadigms.com/our_users.html>

ConnectYard “<http://www.connectyard.com>” which builds education-related applications has developed a widget that can be added to a course management system for delivering queries to the user via social networking sites and other means. QuickConnect Widget works with Blackboard, Moodle, Sakai, and other LMS platforms, according to the company. Students post homework and study questions via an HTML form on the QuickConnect Widget. Those questions are then delivered to other class members via their preferred method. Both students and instructors have the option of replying to questions via Facebook, Twitter, text message, or e-mail. All responses are then added to the discussion thread within the course management system for other students and instructors to view and respond to. Threaded discussions can be forwarded to other classes and groups to expand the conversation.

Purdue University (<http://www.purdue.edu/>) in West Lafayette, Indiana, USA, has recently brought Social Networking to the Classroom (McCrea, 2009). Some professors especially those who teach in large lecture halls have come to embrace social networking as an instructional aid via using an application developed on campus. Hotseat (<http://www.itap.purdue.edu/tlt/hotseat/>) allows students to comment on the class and then enables other participants including professors, students, and teaching assistants to view those messages. Students either use their Twitter, Facebook or MySpace accounts to post the messages or log in to the Hotseat Web site to send text messages. The application resides on the Web; there is no software for professors or students to install. Hotseat was intended as a way to manage the logistics of teaching a classroom of 100-plus students.Hotseat provides a better way for students to engage the instructor and each other in terms of classroom discussion, and to encourage that type of interaction both in and out of the classroom.

**4. TAXONOMY OF WEB 2.0 TECHNOLOGIES THAT SUPPORT PROPOSED ADAPTIVE ONLINE LECTURE MODEL**

Figure 3 presents Taxonomy of Web 2.0 technologies that can be utilized in the proposed adaptive lecture model. Though some of those technologies were available before the presence of web 2.0, however they are meant to be utilized in different ways that will unleash their capabilities in supporting e-Learning. Web 2.0 is argued to be about the way people utilize Web 1.0. Web 2.0 Technologies will be categorized into: In-Lecture, and After Lecture. As the category name indicates: In-Lecture technologies will be utilized during the lecture to provide the functionalities and enable specifications of adaptive lecture model, while After-Lecture technologies are presented to enable the new trend e-Learning; that is based on what students’ really utilize, not just what learning institutions used to make available to them. Learning process is not simply and easily divided like mentioned here, because a certain overlap between In-Lecture and After-Lecture shall be presented to ensure students’ involvement in the learning process, and to provide the most mature learning environment. It is well known that no single model fits all situations, and it is instructor’s responsibility with the learning institution to evaluate their current situation, judge different technologies, and decide what technologies to utilize during the learning process. Besides, though the same technology can be utilized in more than one learning activity, it is important to ensure that this technology is used where it fits. Slight pedagogical differences between In-Lecture and After-Lecture activities shall be considered as presented in table 5.

*Table 5: Pedagogical Differences between In-Lecture and After-Lecture Similar Activities*

|  |  |  |
| --- | --- | --- |
|  | In-Lecture | After-Lecture |
| Polls / Surveys | Informative | Summative |
| Interaction from Student to Instructor | Questions | Discussions |
| Interaction from Instructor to Student | Assessment for Learning | Assessment of Learning |
| Student Activity | Simple Tasks | Assignments |

Same Polls / Surveys technology can be used In-Lecture of After-Lecture, however it must be clear for instructor that when it is used In-Lecture, it is used in an Informative way to get an idea on student’s following, understanding of the topics, and their satisfaction with the learning flow, topics, content, and any other instructor’s points of interest. However, when the same Polls / Surveys technology used After-Lecture, it is used to give a Summative feedback on the learning experience took place during the previous lecture/session. That means, informative knowledge can affect the lecture flow immediately, while summative knowledge affects the next time activity. They both differ in nature and importance, and can be achieved via same technology.

*Figure 3: Taxonomy of Adaptive Lecture Innovative Supporting Technology*

**4.1 IN-LECTURE WEB 2.0 TECHNOLOGIES**

Lecture Management System is the Information System used to manage lecture activities. From author’s point of view, it is important to consider three lecture aspects during choosing and designing the Adaptive Lecture supporting Information System: Basic required functionalities, Real-time Data, and Mobility. Basic required functionalities will be provided via the standard Web application, due to high requirements that is still hard to provide over mobile devices. Real-time data plays an important role in monitoring students’ status, performance, and satisfaction during lecture. Mobility shall be considered, facilitated, and managed effectively. Mobile devices include Mobile Phones, Smart Phones, PDAs, and any other handheld devices.

**4.1.1 WEB APPLICATION TECHNOLOGIES**

Technically, Web applications are applications that reside on a Web server; that is accessible over computer networks via a simple user client; mainly Web browser, and requires no user installations. From User Experience, Web applications are the most desirable user applications because they take the entire load off the user and provide all the required functionalities. Learning Institutions have been using Web applications in the learning process for a while. El-Ghareeb (2009) presents a list of Open Source, Free, and Commercial Learning Management Systems (LMSs) that can be utilized in learning institutions. While most of those features might be already in use, utilizing the following technologies within a Pedagogical aspect gives their utilization a new wider affect on the learning process. Different Web application technologies that can be utilized in proposed Adaptive Lecture Model include:

* **Polls / Surveys:** Polls / Surveys are important in the learning process, because they give instructors a suitable start point to begin at and an indicator on students’ performance during lecture. Instructors can use Polls/Surveys capabilities to check how many students have prepared for the lecture, have background on the topic to be discussed, interested in learning the current topic, and many other criteria that affects the lecture path. Polls/Surveys are easily integrated in the learning process from technical point of view, and they produce a high value in the learning process from the pedagogical aspect. They give the lecture a personalized theme that students can feel based on their feedback and responses.
* **Questions:** Instructors might permit questions during lecture, or at the end of a lecture’s sections, or at the end of the lecture. This varies based on instructor’s evaluation of the situation and the point s/he is discussing. One of the mechanisms that can be presented to students is to submit questions using the Lecture Management System. Students submit questions while instructor is discussing the topic. When instructor feels it is appropriate to take questions, s/he reads submitted questions and starts answering them. Different implementations for Questions can be presented in the lecture. One of the models includes presenting an (Ask Question) application for student to utilize during lecture. Students can submit questions online during lecture, and they immediately appear to instructor. It is instructor’s choice to answer this question immediately or later. Options like making questions viewable by all attendees, and/or identifying who asked the question are controlled by instructor. Another model might give students the capability to digitally raise hands, so they indicate they have a question without the capability for them to post their questions. A third model might make use of available teaching assistants and allows them to handle questions during the lecture, so questions don’t interrupt the lecture flow.
* **Assessments:** The measure for students’ progress in learning new topics is based on assessments. Different types, standards of quality, and utilization of assessments is available online. Assessment is used mainly to measure student’s progress and act as a starting point in enhancing the student’s learning experience. Different types of questions are made available via computers. IMS QTI (<http://www.imsglobal.org/question/>) standard addresses 11 types of questions that can be presented and handled via computer technologies.
* **Recording:** The 2009 21-st Century Campus Report (2009) stated that 61% of students identified the need for a video or voice recording mechanism for lectures, where only 36% of instructors paid attention to this point. Recording is an activity that produces a digital audio and/or video file that records all lecture activities, and gives students the ability to subscribe to and download via RSS feed to digital devices like an iPod or a desktop computer. A camera needs to be installed in the classroom to record class activities and upload them to the server.
* **Conferencing:** Conferencing facilitates students’ attendance, because they help students overcome challenges that might prevent them from attending sometimes. The 2009 21-st Century Campus Report (2009) stated that 70% of students identified the need for distance learning capabilities to connect students in multiple locations, against only 40% of instructors who paid attention to this requirement. Students can join the conference from their locations, and it is equivalent to attending the lecture. Seamless integration might be required if instructors/learning institution utilize attendance tracking system.
* **Widget / Gadget:** Widget / Gadget is a piece of reusable code that can be plugged into virtually any website. Widgets / Gadgets have gained popularity because they give different capabilities for Internet users, like accessing different sites from their Web page. They don’t have to leave their page to check for their social network sites, update their status, send emails, contact using messengers, and do many other activities. One of the largest online Widget/Gadget galleries is the one presented and maintained by iGoogle (<http://www.google.com/ig/directory>). Widget / Gadget as a technology that takes the implementation responsibility off the Web site owners shoulder and still presents the capability to integrate different functionalities from different sites can be utilized as both concept and products in the learning portals.

**4.1.2 REAL-TIME WEB APPLICATION TECHNOLOGIES**

Real-time Classroom solution is an important part of the proposed Adaptive Lecture Model. Different technologies that enable users to communicate in Real-time are available, however utilizing those technologies hasn’t been addressed in the optimum way. Further advanced research on available technologies, and enhancements to them is required. Real-time technologies that can be utilized in the proposed Adaptive Lecture Model include:

* **Micro Blogging:** Micro Blogging is simply about sharing ideas, thoughts, activities, actions, and updates in a small number of characters. Twitter is the most famous Micro Blog available, giving the capability to share whatever user wants to within 140 characters. Micro Blogging is a real effective and touching technology. It is an easy way of sharing updates at real time. Students can easily access twitter from lecture, and they are intimidating to do so already. It is surprising that Twitter users tend to utilize news, so they can consume learning inside lecture as they consume news(Lenhart and Fox, 2009).
* **Instant Messaging (IM):** is a form of real-time communication between two or more people based on typed text. The text is conveyed via devices connected over a network such as the Local Institution Network, or the Internet. IM can be used mainly in the Questions activity mentioned in the Web application section, and of course in many others. IM has taken new shape lately with the presence of Converged Networks, and the capability of Multimedia Networks. Voice over IP (VoIP) and Multimedia enabled communication devices will revolutionize the way we utilize IM in the near future.
* **Natural Language Processor (NLP):** A field of Computer Science and Linguistics concerned with the interactions between computers and human natural languages. Natural Language Generation Systems convert information from computer databases into readable human language. Natural Language Understanding Systems convert samples of human language into more formal representations that can be altered and processed to generate useful information based on students’ submitted data. Proposed Adaptive Lecture Model can make use of further research on Mining Student’s Real-time data in generating useful information about students’ satisfaction with lecture content and flow instead of relying on teaching assistants for summarizing and analyzing students’ feedback. Besides, when suitable NLP languages become available, they can be applied on students’ offline discussions later to acquire their feedback.
* **Response Systems:** Response System allows users to respond with short answers immediately. Response System consists of two parts: the two ways True/False Clicker (TF Clicker) that students can use to answer questions immediately, and an administration application that enables instructors to initiate questions and analyzes answers. Figure 4 presents a block diagram of RF Clicker. Students can respond to open-ended questions with alphanumeric answers by typing in text in a way similar to texting on mobile phone (Nagel ,2009). Renaissance Learning “<http://www.renlearn.com>” is one of the leading companies in providing Response Systems.

Responder.tif

*Figure 4: Block Diagram of TF Clicker*

**4.1.3 MOBILE APPLICATIONS**

Utilizing Mobile in learning is a wide area of research that is under evaluation, arguments, and challenges. Mobile Learning (M-Learning) is an approach to e-Learning that simply utilizes mobile devices, yet it can also be viewed as a quiet different learning experience (Hulme and John, 2005). M-learning has been used as a pre and/or post activity to other types of learning (Rogers et al., 2004). Mobile phones are widely popular and made available to almost everyone in the globe, and it is only a matter of time till everyone holds a mobile phone. Users can achieve different activities from their mobile phones, like accessing emails, creating and editing documents, attaching and emailing them, updating calendars, and many other activities. More than three-quarters (76%) of Twitter users use the internet wirelessly; either on a laptop with a wireless connection, or via PDA, handheld or cell phone. In comparison, 57% of those who go online but do not use Twitter, and 59% of internet users as a whole connect to the internet wirelessly (Lenhart and Fox, 2009). On the other hand, utilizing Mobile phones is challenged and limited by Mobile computing capabilities, small screen size, low screen resolution, short battery life, and other challenges that are still limiting its wide utilization in different life aspects. Riad and El-Ghareeb presented a Mobile Utilization in the Assessment activity as a form of utilizing Mobile technologies in the learning process (2008). Mobile applications are enabled mainly via:

* **Short Messaging Service (SMS):** SMS is the simplest way of communication using Mobile phone. Sending SMS is an activity that includes editing the text message; within a pre-defined number of characters, defining the recipient number, and submitting the message. It is possible to force series of interactive SMS exchanges between student and LMS to achieve completion of a task or goal. Student will take part, and complete the task (Stone et al., 2002). SMS utilization in proposed Adaptive Lecture Model can fit within Polls / Surveys.
* **Smart Clients:** Smart Client applications provide users with a rich and responsive user interface, the ability to work offline, and a way to take advantage of local hardware and software resources. In addition, they can be designed to run on a broad spectrum of client devices, including Tablet PCs, and handheld mobile devices such as Pocket PCs and Smart phones. Smart clients give users access to information and remote services within a powerful and intuitive client environment, and are an effective solution for flexible user-oriented applications and for increasing user productivity and satisfaction. Smart clients share some or all of the following characteristics: Make use of local resources, Make use of network resources, Support occasionally connected users, Provide intelligent installation and update, and Provide client device flexibility (Hill et al., 2004).

**4.2 AFTER LECTURE WEB 2.0 TECHNOLOGIES**

After Lecture activities are very important in the learning process. Those activities ensures that learning is moving from acquiring, gaining, and recalling information to utilizing information in real-life situations and scenarios to become knowledge. Discussions, collaboration, and socially utilizing information gained in lectures are important in all fields. From author’s point of view, Collaboration tools and Social Networks are the most important today’s available online tools to integrate the informal learning in the learning process.

* + 1. **COLLABORATION TOOLS**

Utilizing the different Collaboration Technologies that exist shall result in pedagogical effect. Educational Collaboration Information Systems are Information Systems responsible for facilitating collaboration technologies utilization within learning institutions. Different online tools that utilize those technologies were discussed in Section 3.2.1. Collaboration Technologies and tools include:

* **Online Editing Tools:** Wikis, Blogs, Online Documents Editing, and Mind Mapping tools are some of the examples of collaboration tools that can be made available to students and to enrich learning process by motivating learning stakeholders to enrich learning.
  + **Wiki**: is simple collaborative editing software application which encourages users to be not only readers, but also content providers and editors (Küfi and Özgür, 2009). Wikis have proven gained pedagogical and educational benefits. They encourage collaboration, and enhance writing, editing, discussion, and critical skills.
  + **Blog (abbreviated from weblogs)**: are user journal entries in the form of text, images, and links to web content, such as websites or other blogs that have a variety of formats and might include the user expressing their opinion about a topic or documenting activities. Blogs are interactive in the sense that other users could provide comments on the information posted by the blog author. Educational applications of blogs include researching, tracking, interpreting, and evaluating blogs for political commentary (multiple perspectives), cultural events, business, or other news and for examining changes over time (Ajjan and Hartshorne, 2008).
  + **Mind Mapping Tools:** Mind Mapping Tools are important in putting different ideas into work, then start discussions in attempt to get the best out of them, and to relate and organize those ideas. Mind Mapping Tools can be best used in Problem Solving sessions.
  + **Online Documents Editing Tools:** Online Documents Editing Tools provide different services that enable more than one to edit online documents and see changes immediately. Other complementary services include the ability to upload files from users desktops, and save them online, editing online files anytime, anywhere without the need to install software; only via browser, defining who can access those files, storing files securely online, importing and exporting different types of files, publishing those documents online when finished, so students can easily publish online documents that are accessible, enabling readers to leave comments, and other features.
* **Online Resources Sharing Tools:** Online Workspaces and Web drives for sharing files, maintaining versions, managing and arranging files within virtual folders, and storing files online. Complimentary services like bulk files uploading, downloading, file sharing, mailing short links to available online files and other services are provided by multiple Online Resources Sharing service providers.
  + **Sky drives / Web drives:** Different Web sites provides the service of uploading files and presenting short links for them to be downloaded later. Though this service has enabled files sharing online, obligations, restrictions, and considerations about copyrights must be taken into consideration. The most suitable scenario for students is the Workspaces.
  + **Workspaces:** Store online files to be shared between students and combines the functionality of Online Documents Editing Tools, so students need a Web browser and Internet connection to access the online stored files, open and edit them via Web browser anytime and anywhere, so students can easily collaborate and share files in a productive manner.
* **Online Collaborative Thinking Enabling Tools:** Collaborative Thinking tools are important in sharing resources that students feel important to them in formalizing their ideas about some topic. Students might be working in groups in different topics in their graduation projects / lab projects, and they might incorporate an online article that they feel the need for the rest to take a look. Social Bookmarking services present this ability. Besides, Online Mind Mapping tools are important in finalizing the overall ideas of the project they are working on, the document they are editing, and whatever collaborative activity they are attempting.
  + **Social Bookmarking:** Social bookmarking sites allow users to store, describe, and share numerous web addresses with others. Users can explore bookmark collections of others by subscribing to their bookmark pages. If users are interested in a site they could tag it using few words to help others find it easily. Educators could use social bookmarking to facilitate collaborative information discovery. They could create a social bookmarking page to save important pages about a topic. Students could also collaborate on group projects using bookmarking sites, sharing links, and uploading resources discovered, while educators could follow their students bookmark pages to gain insight on their research process and progress (Ajjan and Hartshorne, 2008).
  + **Mind Mapping Tools:** they don’t edit the thing together. They share it for each other and receive comments on it. Generally, Mind Mapping Tools don’t need so much collaboration in editing; it needs much collaboration in discussion. So, they are separated into a separate category.
* **Internet Telephony:** Internet Telephony has witnessed a huge advancement in the late years as a result of the widespread of Voice over IP (VoIP) communication devices that utilize Internet communication infrastructure in making phone calls. Different scenarios for conducting Internet Telephony are available. Students can communicate from PC to PC free of charge using Headsets and a free service provider. Another scenario is the ability to communicate from PC to Phone using Headsets and a simple charge for the service provider. Students can use their emails as a “Voice Mail” and leave each other recorded voice files.
  + 1. **SOCIAL NETWORKS**

Social networks are a social structure of nodes that represent individuals (or organizations) and the relationships between them within a certain domain. Therefore, social networks are usually built based on the strength of relationships and trust between the members "nodes" (Liccardi et al., 2007). People have been forming themselves into groups without the gratuitous nature of the internet or social software. Online communities are not new. So what is new about the interaction of people within online social networks may be different is understanding the role social networks play in forming communities.

* **Groups:** Online Groups have been a widely spread method to communicate with people that sometimes don’t know each other in a productive way to share ideas and resources via sending emails to one email address; that is the group email, and the Online Group Service Provider is responsible for delivering those emails to Group subscribers based on their registration features. Registration features specifies the details of mails to be delivered, delivery rate, preferred format, and other features. Students read the emails, follow, and contribute to the conversations they feel most important to them, and ignore what they want. Though this is not the most perfect way of collaboration nowadays, Online Groups have helped; and still helps many students and professionals to communicate in an interactive way.
* **Communities:** Different types of communities exist. The most related to interest is Community of Practice (CoP). A group of people in an online group with a common interest who share knowledge and expertise. Following a learning course, the participants form a CoP hosted by a leader to share material related to a shared experience or a course, get help on problems that arise, and share best practices (Schooley, 2006).
* **Forums:** Online Information Sharing tool that allows students to submit questions and answer each other. A great tool in discussing updated topics, and searching within history of answered questions and sharing experiences. Organizing topics under headers is an available option. Forums don’t need immediate responses, so they are an important asynchronous communication form.
* **Social Network Sites:** A social networking site is an online place where a user can create a profile and build a personal network that connects him or her to other users. In the past five years, such sites have rocketed from a niche activity into a phenomenon that engages tens of millions of internet users (Lenhart and Maden, 2007).

**5. PROPOSED UNIVERSITY ARCHITECTURE TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

In Proposed Adaptive Lecture Model, Enterprise is the University, thus Enterprise Architecture and University Architecture are used interchangeable to refer to the same concept. Enterprise architecture tends to define the enterprise from the four dimensions in order to connect between them and present a complete view for the enterprise environment to face the ubiquitous challenges. It has become accepted that there is a clear need for an ‘architectural view’ of systems (Macaulay, 2004). The architectural view of systems (both business and IT systems) is defined in ANSI/IEEE standard 1471-2000 as “the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”. Enterprises can be thought of as the combination of business needs, and IT capabilities.

Different dimensions of the enterprise need to be defined in order to generate the enterprise architecture. From enterprise point of view, architectures are classified into four categories (Albin, 2003): Business Architecture, Information Technology (IT) Architecture, Information Architecture, Application (software) Architecture as depicted in figure 5.Enterprise Architecture classes utilize each other, and build over each other. Distinctions between classes are blurred because they all serve each other, and serve the enterprise.

*Figure 5: Enterprise Architecture Dimensions*

Proposed Adaptive Lecture Model requires certain amount of Enterprise Agility that is provided by utilizing SOA within the four Enterprise Dimensions. Utilizing SOA provides Educational Institution's with both Business and Technical Agility perspectives. Business agility means fast reaction to change and the ability to rapidly implement changes. Business agility needs to be holistic in scope (Evans, 2001). Technical agility refers to the ability to quickly change the type and flow of information within an organization within enterprise. Service Oriented Architecture (SOA) as a design pattern presents Applications, IT infrastructure and Information Architectures as loosely coupled, fine granular services that can address enterprises’ requirements once they are addressed 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. SOA addresses technical agility requirements by presenting composability, modularity, and loose coupling concepts as services that wrap underlying IT infrastructure, databases, and legacy systems and present them via standard interface. There is a need to stabilize IT infrastructure rather than developing new ones (Baskerville, 2005) and SOA enables this stabilization. Enterprises should balance IT to become better positioned and more agile (Leidner et al., 2003). Services are the building Blocks of an agile enterprise (Pal and Pantaleo, 2005). 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 (implied 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 (Sprott and Wilkes, 2004). SOA is 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”.

**5.1 BUSINESS ARCHITECTURE TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

A business or business process architecture defines the business strategy, governance, organization, and key business processes within an enterprise. The fields of Business Process Reengineering (BPR) and Business Process Management (BPM) focus on the analysis and design of business processes, not necessarily represented in an IT system (Albin, 2003). Business Architecture defines the business roadmap usually via defining the business processes (Bechara, 2006). Business process is a series of inter-related activities that cross functional enterprise boundaries with individual inputs and outputs (May, 2003; de Putte et al., 2004). New Business Processes need to be defined to cope with the new educational requirements presented in today's educational institutions. Years ago, a concept like proposed adaptive lecture would be far away from reality. Nowadays, author believes professors and instructors in educational institutions are forced to Shake the stagnant water of traditional practices during lectures that lead to students' loss of interest in lectures, and probably in the traditional learning overall. Business Process Management (BPM) is a systematic, structured approach to analyze, improve, control, and manage processes (Chang, 2005). BPM needs to be adopted within universities to enhance both managerial and educational aspects of educational institutions. BPM need to address pedagogical and learning processes as it addresses managerial aspects. Proposed Adaptive Lecture Model can be further studied as a Business Process, and managed by educational institution's Business Process Management System (BPMS). BPMS is an enterprise information system that supports designing, administrating, and improving the business processes (Ha et al., 2004).

**5.1.1 PROPOSED ADAPTIVE LECTURE MODEL AS BUSINESS PROCESSES**

Proposed Adaptive Lecture Model different In-Lecture and After-Lecture features needs to be further studied by educational institutions to define the most suitable scenarios for them to implement and deploy. Business Process Modeling Notation (BPMN) is one of the standards widely used to present business processes. Figure 6 presents one of the in-lecture activities of the proposed adaptive lecture model; that is reshaping the lecture based on students’ indirect feedback via Web 2.0 technologies. In proposed model, different activities performed by instructor and student are highlighted in different lanes, besides the necessity for a Real time Application that performs the analysis tasks on students feedback. In this business process, reshaping lectures is a smooth activity that might take place without students’ notifications of the process happened.

Further tasks to that business process can include the instructor’s invocation of an overall feedback on the lecture. Thus, LMS needs to define the different utilized methods that students’ uses to access the LMS, the preferences stored for them to submit the quiz. Figure 7 illustrates the sequence of activities that takes place when instructor initiates such a process. Figure 7 starts from the end point of figure 6, and continues.

Adaptive Lecture Process.tif

*Figure 6: Proposed In-Lecture Informal Feedback activity feature of the Proposed Adaptive Lecture*

**Complete Feedback.tif**

*Figure 7: Proposed Formal In-Lecture Feedback Process of Proposed Adaptive Lecture Model*

**5.1.2 PHILOSOPHY, OBJECTIVES, AND STRATEGIES TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

Philosophy behind proposed Adaptive Lecture Model is the attempt to enhance the learning process and elevate the learning qualities within classrooms via utilizing modern and innovative technologies that are widely spread among students. Objectives are simply to present an educated and well informed learner that is capable of facing new daily presented challenges. Learners can estimate the value of technology when they use it daily in their learning process, so they become aware of them. Different strategies shall be defined and maintained; either by Top-Level Management or by instructors themselves to innovate the learning process. Many aspects of innovative technologies discussed in section three are facilitated and made available online via different implementations. Those services shall be used to support e-Learning in an innovative manner. Strategies include:

* Utilizing Different Technologies Available Right now
* Developing the proper IT infrastructure to support Adaptive Lecture Model (wireless networks, servers, etc.)
* Providing Students with appropriate access devices (laptops, Net Books, PDAs, etc.)
* Defining the Collaboration plans with third parties to accelerate the movement, and identifying what to develop and maintain in-house.
* Evaluating different system architecture approaches to achieve required goals. One of the design approaches presented in this paper is SOA, however it is not the only one.
* Defining differences clearly between applications and each one responsibility, making sure that e-Learning that is pedagogically implemented and maintained goes further beyond just University Management Information Systems

**5.2 SOFTWARE ARCHITECTURE TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

**(SOA), Mention the IMS SOA White Paper -> it’s really important.SOA is the model enabler, it is the softwar architecture that will combine different technologies. It is clear that the system needs different technologies, as an example the figure that illustrates the (Initiate Assessment). This activity requires interaction of different kinds of systems with different data, formats, and all this stuff. Talk about SOA in Integration only as you are always directed to do; avoid talking about it outside of integration scope. You can also mention the UMIS and LMS differences, and focus on different data presentations in both systems -> reference ACM eLearn Magazine article.**

Software / Application architecture serves as the blueprint for individual application systems, their interactions, and their relationships to the business processes of the organization. A software application is a computer program or set of programs that uses existing technologies to solve some end-user problem such as the automation of an existing business process. Software architecture can be defined as “the sum of the nontrivial modules, processes, and data of the system, their structure and exact relationships to each other, how they can be and are expected to be extended and modified, and on which technologies they depend, from which one can deduce the exact capabilities and flexibilities of the system, and from which one can form a plan for the implementation or modification of the system” (Hohmann, 2003). Application Architecture defines the form and function of the applications that will be developed to deliver the required functionality of the system (Macaulay, 2004). Integrating current University Management Information Systems (UMISs) that include different components like Student Information Systems (SISs), Library Information Systems, Financial Systems, and other components with the implemented Learning Management Systems (LMSs) has been a challenge that facing educational institutions for a while.

**Initiate Assessment.tif**

*Figure 8: Proposed needed Applications to satisfy Proposed Adaptive Lecture Model functions*

**5.3 INFORMATION ARCHITECTURE TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

Information Architecture is about Organising functionality and content into a structure that people are able to navigate intuitively. If Organisations didn't recognise the importance of information architecture, they run the risk of creating great content and functionality that no one can ever find. Information architecture is the term used to describe the structure of a system, i.e the way information is grouped, the navigation methods and terminology used within the system. An effective information architecture enables people to step logically through a system confident they are getting closer to the information they require. Information architecture is most commonly associated with websites and intranets, but it can be used in the context of any information structures or computer systems (Barker , 2005).

Information Architecture plays an important role in the Web 2.0 era. Amount of information became available online is tremendous. Everyone has become a participant in the generation of content. Proposed Adaptive Lecture Model tends to make use of the Web 2.0 technologies, and thus Information System that supports it is expected to deal with a large amount of real-time, changing, and updated data. Information Architecture is necessary to keep and maintain the logic behind the supportive applications for the Proposed Adaptive Lecture Model. Applications need to provide Web 2.0 functionalities, in a way that doesn't distract students during lecture; as much as possible. Instructors need to view analysis results and reports during the lecture without leaving the interface they use for teaching. Proposed Adaptive Lecture Model Information Architecture needs to address:

* **Instructor Portal:** That Instructor uses to launch required tools to enable lecture activities; like sharing files, desktop activities, initiating quizzes, and other activities. Also, this portal shall enable instructors to initiate and manage after-lecture activities; like assignments and workspaces.
* **Student Portal:** That studens use to access different aspects of the lecture activities, besides the after-lecture activities.

Proposed Adaptive Lecture Model utilizes different technologies as presented. It is important to present portals that provide those different functionalities without loosing the users' aim. Web 2.0 Technologies include Widgets/Gadgets presented in previous paragraphs. Different Widgets can be embedded in the Portal to provide the required functionalities on different sites without leaving the portal. However, widgets are challenged by limited capabilities and features. It is not an easy task for the Information Architect to maintain. Challenges will rise during architecting the portals.

The data architecture of an organization includes logical and physical data assets and data management resources. Information is becoming one of the most important assets a company has in achieving its objectives, and the IT architecture must support it. Information Architecture spans Business and IT Architectures, brings them together, keeps them together, and provides the necessary rich contextual environment to solve the ubiquitous data-quality problem.

**5.4 INFRA STRUCTURE (IT) ARCHITECTURE TO SUPPORT PROPOSED ADAPTIVE LECTURE MODEL**

Integrating different technologies, applications, infrastructures to serve the learning process is one of the challenges that came to surface as a result of different technologies presented recently. Service Oriented Architecture (SOA) is the ….. [IMS SOA White Paper]

The IT architecture defines the hardware and software building blocks that make up the overall information system of the organization (Albin, 2003). IT architecture includes hardware and software infrastructure including database and middleware technologies. The IT architecture should enable achievement of the business goals using a software infrastructure that supports the procurement, development, and deployment of core mission-critical business applications. The purpose of the IT architecture is to enable a company to manage its IT investment in a way that meets its business needs by providing a foundation upon which data and application architectures can be built.

Cloud Computing, Virtualization, and that stuff of IT Currently Became available lately

Adaptive Lecture.tif

Figure : Adaptive Lecture IT Infrastructure

**6. INSTRUCTOR CHALLENGES AND EXPECTED OUTCOMES OF PROPOSED ADAPTIVE LECTURE MODEL**

A real educated student, not just the student mentioned in the 2008 report

In e-Learning 2.0, instructors’ capabilities are challenged by new technologies. Instructors are more information related in the information age compared to the situation in the traditional model. It is not just that instructor needs to be capable of utilizing different technologies to achieve the adaptive lecture model, it is their ability to prepare and manage different scenarios during the lecture, and utilizing different technologies made available to their students. Instructors are challenged by the involvement levels with students. Online access and facilities opened new ways for students to communicate with their instructors, and forced instructors to present minimum level of online support that entitles collaboration and communication activities that wasn’t a necessity before.

**7. Current Technologies to Support Adaptive Lecture Model**

**Google Wave**

**Windows Live**

**7. FUTURE RESEARCH DIRECTIONS**

**Web 3D:** Based on Forrester Report Web3D: The Next Major Internet Wave (Driver et al., 2009), Web3D will deliver an interactive, immersive experience much richer than the static, text-oriented or even interactive graphical interfaces of today’s Web. In the new world of work that Web3D will enable, people will be represented visually by avatars that can move in space, communicate with others, and interact with objects and information. Yet Web3D won’t leave the old world behind; it will integrate with the Web technologies we use today. Workers will use Web3D to teach and learn, innovate collaboratively, communicate and network, interact with and present information, and manage real-world systems.

**Mining Social Networks:**

**Collaborative Multimedia Authoring**

**NLP of Real-time Applications Generated Data**

**8. CONCLUSION**

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