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An Institutional Web-Based Learning Objects Repository System

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Abstract — *Learning objects are reusable entities either digital or otherwise used to support learning. With the advent of technology-based learning, different digital learning objects are being created by different instructors and bodies. However, there is a need to organize them on an institutional basis to facilitate reuse and easy access as well as reduce efforts wasted in re-inventing the wheel. This work aims to design a suitable architecture for an institutional repository of learning objects. This would help to enhance the creation of instructional materials because faculty members would be able to integrate learning objects in their courses with minimal cost and effort by reusing and modifying exiting ones.*

Keyword — Learning objects, Repository, web, e-learning, HBCU.

I.INTRODUCTION

The availability of technology, hardware, and software, learning objects have become fundamental to the learning process and change the way in which learning materials are designed. Adewunmi & Omoregbe (2010) reviewed the features, architecture, design and implementation technologies of institutional repositories and highlights the importance in Digital libraries. The penetration of technology has compelled educators and students to modify their roles. Teachers become facilitators, while learners became active and responsible for selecting modes and styles of learning. Assuming this attitude of implementing technology in the learning process and seeking new methods of facilitating learning, universities and colleges should adopt new techniques. The use learning objects is a proud example of these techniques. Learning Objects came about in the early 1990s because of an initial work by Wayne Hodgins of Autodesk who promoted this idea of interoperable pieces of learning. Between 1992 and 1995, both the Learning Object Metadata Group and Computer Education Management Association, began defining issues with Learning Objects such as modularity, database centricity and metadata. According to IEEE, learning objects are "Any entity, digital or non-digital, that may be used for learning, education or training" (IEEE, 2002) while Wiley (2003), defined it as "any digital resource that can be reused to support learning". Learning objects are small units of educational content that are self-contained and reusable. They can be aggregated to form whole courses, and are usually annotated with metadata for descriptive purposes. Learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science which values the creation of components (called "objects") that can be reused in multiple contexts. This is the fundamental idea behind learning objects: instructional designers can build small (relative to the size of an entire course) instructional components that can be reused a number of times in different learning contexts. Compared to traditional media, learning objects are scalable, ubiquitous, internet enabled on-demand entities. Learning objects enthusiasts have the opportunity to partner and benefit from newer models. These are significant differences between learning objects and other instructional media that have existed previously (Wiley, 2003). They serve in parallel with adaptive and intelligent Web-based educational systems (AIWBES) which is an alternative to the traditional way of dumping information on the web in the areas of Open Educational Resources. Learning Object Repositories (LOR) are databases or digital libraries that help to store learning objects for organization and accessibility purposes. The usefulness of these institutional LORs cannot be overemphasized. As a scenario, there are thousands of colleges and universities, each of which teaches a course in introductory trigonometry and a topic in that course is the sine wave function. Year after year, different instructors are assigned to take the course. Traditionally, what happens is that each instructor builds the content required for that course from the scratch. What we then have are a collection of similar descriptions of sine wave functions. However, with a repository, learning objects used in a previous year can be easily accessed and reused as well as improved upon. This can also be extended across several institutions. It would help to save cost and time because, educational content is not inexpensive to produce. Even a plain webpage, authored by a mathematics professor, can cost hundreds of dollars. If graphics, little animations and interactive exercises are to be included, then the cost increases sporadically. It is expedient to not that producing multiple versions of similar learning objects leads to financial redundancy compared with producing single versions of the same learning objects which saves lots of cost and resources for institutions. There will be sharing, because no institution producing its own materials on its own could compete with institutions sharing learning materials (Downes, 2001). A project which was initiated at London Metropolitan University in March 2002 to solve a real educational problem that is, to improve pass rates and

retention in introductory programming further validates this. A set of multimedia learning objects was developed as part of the project. In the university, introductory programming is taught to over 600 students each year on modular courses at HND, BSc, and M.Sc levels, and several problems were being faced. Student numbers had increased dramatically in computing courses, and the adoption of widening access policies in the university had broadened the range of ability and experience within the student population. In addition, programming is a difficult subject to teach to novice students, who need to grasp several complex and abstract concepts to become proficient. The project has introduced a blended learning approach, which incorporates traditional and new elements. Learning objects were incorporated into the modules, designed to improve student learning, and to provide online materials that would support their face-to-face teaching (which was not reduced). More traditional changes included the move to a common base curriculum that would teach Java in all the modules, changes to the assessment strategy, and organizational changes that would provide more effective tutorial support for students (Jenkins, 2002). While learning object repositories exist for the general public, they are also needed on institutional basis to enhance reusability of learning objects created and to be reused within the institution (Boyle & Cook, 2001). Therefore, the aim of this work is to design a learning object repository for the Southern University to enhance the instructional development of the institution.

II. RELATED WORKS

Adaptive and intelligent Web-based educational systems (AIWBES) provide an alternative to the traditional "just-put-it-on-the-Web" approach in the development of Web-based educational Courseware (Brusilovsky & Peylo, 2003). AIWBES attempts to be more adaptive by building a model of the goals, preferences and knowledge of each individual student and using this model throughout the interaction with the student tailored towards adaptation of students need. They also attempt to be more intelligent by incorporating and performing some activities traditionally executed by a human teacher - such as coaching students or diagnosing their misconceptions. The first pioneer intelligent and adaptive Web-based educational systems were developed in 1995-1996. Since then many interesting systems have been developed and reported. Major Intelligent Tutoring technologies are: curriculum sequencing, intelligent solution analysis, and problem-solving support. All these technologies have been well explored in the field of ITS. The aim of curriculum sequencing technology is to afford the student with the most appropriate individually planned arrangement of topics to learn and learning tasks (examples, questions, problems, etc.) to work with. It helps the student find an "optimal path" through the learning material. In the context of Web-based education (WBE), curriculum sequencing technology becomes very important due to its ability to guide the student through the hyperspace of available information (Brusilovsky & Peylo, 2003). Web-enabled intelligent tutoring system for the SQL database language - SQLT-Web is a Web-enabled version of a previous, unconnected ITS. It describes how the components of the standalone system were reused to develop the Web-enabled system. The system observes student's actions and adapts to their knowledge and learning abilities, and also describes the system's architecture in comparison to the architectures of other existing Web-enabled tutors. All tutoring functions are performed on the server side. The system has been open to outside users since March 2000. SQLT-Web has been evaluated in the context of genuine teaching activities. The students have found the system a valuable asset to their learning (Mitrovic, 2003). Reusable eLearning Objects Authoring & Delivery (RELOAD) is a project funded under the JISC Exchange for Learning Programmed (X4L). Emerging learning technology interoperability specifications are the major drivers of the tools involved in the project. It is managed by the University of Bolton with staff located at the University of Bolton and the University of Strathclyde. The project aims to facilitate the creation, sharing and reuse of learning objects and services, as well as enhance the range of pedagogical approaches realizable using lesson plans. These aims will be achieved through the production of a suite of software tools for authoring and delivery of standard-compliant learning objects incorporating comprehensive user guides and exemplar resources. The tools will definitely add value to the JISC and wider community, because they provide the crucial "missing link" which allows users to own and transfer learning objects, in specification compliant format, between authoring and design tools, local and distributed digital repositories and VLEs (Beauvoir & Milligan, 2003). Different learning object repositories exist. Pavani, (2016) reviewed some of them including OpenStax CNX, NSDL – National Science Digital Library, MERLOT – Multimedia Educational Resource for Learning and Online Teaching, Coursera, BIOE – International Database of Educational Objects, Foundation unit – University Numérique Ingenerate et Technologies, edX, ARIADNE: Alliance of Remote Instructional Authoring and Distribution Networks for Europe, and AGORA: Ayuda a la Gestation de Objectors Reutilizables de Aprendizaje, however, these do not serve the purpose of an institutional repository. Therefore, the need for one.

III. RESEARCH METHODOLOGY

This section describes the repository architecture design. The requirements for the system were gathered and the design of the architecture represented. This is shown in Figure 1. The main components of the

architecture are the Learning Objects Repository and the Web-based User Interface. The LO Repository is the database that would be used for the storage of the individual learning objects. The design view of the repository is shown in Figure 2, showing all the tables in the e-learning repository system, their fields and the relationship between them. It would have the Users, Courses, Scores and Courses enrolled tables, to adequately capture all relevant information.

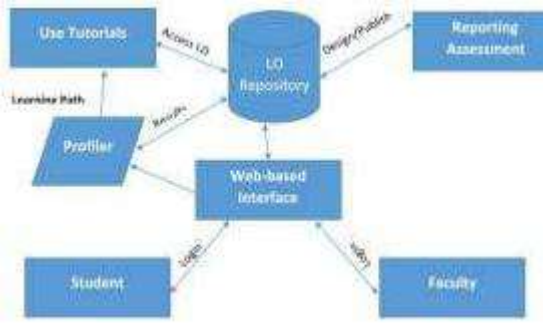

Figure 1. Learning Object Repository Architecture

The Interface is the medium through which the users will interact with the repository. It would be web-based to ensure accessibility from anywhere. The users comprise of both faculty and students. The Learning objects would be annotated with metadata which would help to describe them effectively. The LRMI schema.org would be used to ensure interoperability with other standard. These metadata would be incorporated into the search mechanism. The search mechanism would ensure easy accessibility. The learning objects would be grouped into different categories such as the subject area, the suitable audience for the material, the media type, the duration for delivery of the learning object, and the year created amongst others. The reporting assessment module will enable instructors to give their assessment on learning objects they have re-used in order to provide feedback and guidance to future users, such that users can first check the assessment report of a learning object before investing time in using it. The Use Tutorials module is accessible to the students; they will have access to different tutorials that have been created. This will help to give them initial idea on a course before enrolling for it, as well as improve their in-depth knowledge of a course in the long run as they utilize the resources. The Profiler would help to enhance the user experience on the repository. It would be able to suggest useful learning objects to users by extrapolating information from their previous use of the repository i.e.

IV. SYSTEM IMPLEMENTATION

The system was implemented in the College of Business of Southern University and A&M. The system has 3 users, namely, Faculty, Student and Administrator. The following screenshots depict how the users interact with the system. Figure 3 shows the User Authentication and Login page, Figure 4 shows the New User registration page, Figure 5 depicts the list of registered students in the database and Finally, Figure 6 shows the quiz results stored in the database.

Figure 2. User Login Page

Figure 3. List of Registered Users

Figure 4. Quiz Result Stored in the Database

V. CONCLUSION AND FUTURE WORK

This work is an integrated web based learning objects repository system aimed to support seamless instructional materials development within an institution. The system can also help students can learn more knowledge on different subjects they are enrolled for or even before enrolment to augment their decision making. It will also provide a centralized platform for faculty and students to expand the interaction and can improve relation between them. In the future, the repository can be implemented in the form of a web service so that it can be seamlessly integrated into existing Learning Management Systems such as Moodle. Learning objects can be created and uploaded in the web

system using web services, implement student faculty relation more effectively and efficiently are reserved for future enhancements. Also, live class learning objects and face interaction objects using captivate can be included in future development. Advanced security control framework for the repository will also be included in our future work. Real time communications like email alerts to the students and faculty, administrators can also be implemented.

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