EDUX: EDucation with an aUthoring tool using XML

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ABSTRACT

EDUX (EDucation with an aUthoring tool using XML) is an e-learning system using the intelligent hypertexts language; Extensible Markup Language (XML). EDUX enable students to follow courses at their own pace, based on their ability. EDUX is designed as an adaptable e-learning environment, which can meet the needs of the individual student. It has the intelligent agent features where for each and every student the system will generate different type of layout or presentation, based on their understanding on the subject or course. The learning process comprises of two main components: an instructor component and a student component. Instructors will be provided with a tool that has functionality for the creation of course. Students will also have a tool with three integrated functionalities for the collaborative curriculum. EDUX acts as a portal with customize web page for the instructors and students.

INTRODUCTION TO THE EDUX

An education that stresses the ubiquity of technology in the business world needs to integrate technology into all aspects of the curriculum. Furthermore, an educational system that deals with large amounts of document information typically requires an XML authoring and editing tool that easily integrates with content management tools and content delivery tools.

EDUX is a web-based application that consists of all the collaborative technological features, in other word, it use a portal concept. According to Johnson & Johnson (2000), collaborative learning allows thousands of people usually students, instructors, and experts from different location having their teaching and learning, communications, discussions and sharing information in virtual classroom environment without time limits. Collaborative learning allows students to discover a commonality with other students, but just as importantly, provides for negotiating an understanding of "uncommon" experiences (Langlois & Litoff, 2000). EDUX is designed as an adaptable e-learning environment, which can meet the needs of the individual student.

The goal of EDUX is to enable students to follow courses at their own pace, based on their ability. Besides that, students can also access elements of the course that relate to them. It has the intelligent agent features where for each and every student the system will generate different type of layout or presentation, based on their understanding on the subject or course. It is possible to combine other languages for example Extensible Stylesheet Language (XSL), JavaScript and VBScript inside the educational application because XML separate document content of the presentation itself, which generates new presentation possibilities for a single content and enable contents labeling based on logic structure, interactively level, learning difficulty and resources.

The ultimate goal of the EDUX project is to provide information and support for instructors for curriculum-based experiments that focus on reforming curriculum development and delivery approaches including:

- Establishing mechanisms for institutions to restructure the school day and school experience so that students and instructors may engage in collaborative projects on site, between universities, and with other locations throughout the world.

- Developing a series of models for collaborative curriculum development and delivery of learning environments that incorporate online network access and interactive multimedia components into learning settings.
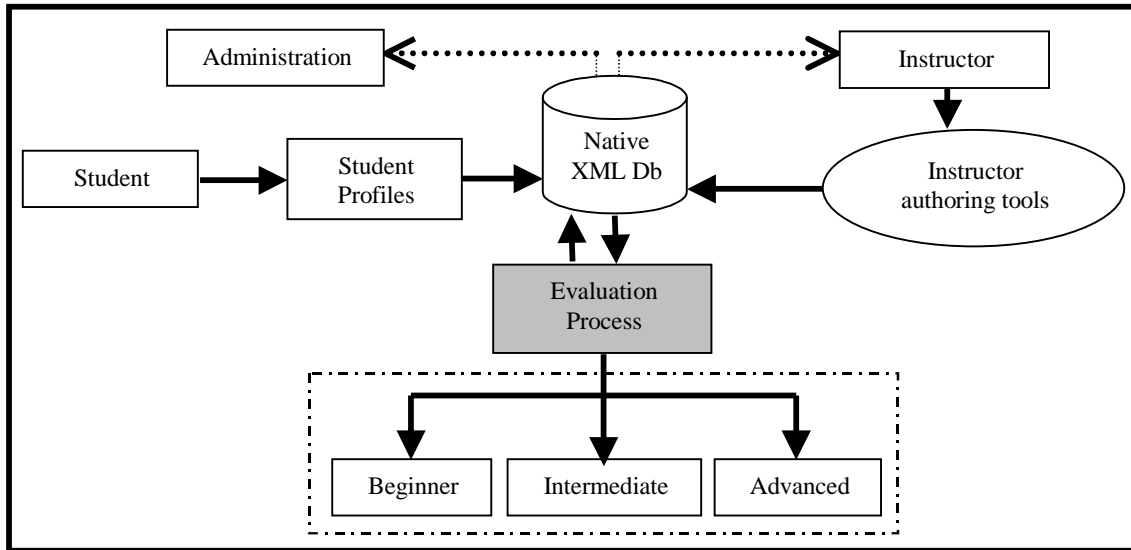
EDUX SYSTEM ARCHITECTURE

Figure 1: EDUX System Architecture

Figure 1 is the EDUX System Architecture. A detail explanation regarding the architecture is discussed below.

A student profile is the key element in the EDUX education process. It is the information set that characterizes a student and is useful for the learning process. In accessing a course, a student sends

a request that contains his personal information and curriculum vitae. This personal information is filled in a form provided in the system, then submitted for revision. Forms are divided into two; one for the first semester student, and the other one for other semester student. For the first semester student, the student will enter his details based on his high school or college result. For those registered student, he will enter his previous semester result. This registration is valid if the student has all the knowledge necessary to start this course, which is based on his result. The system generates a student profile based on this information and stores it in the database. Besides that, instructor or administration staffs can also access the student profiles from the database. This process is view as a dotted line from the database to the instructors and administrators in the EDUX System Architecture.

The instructor of a generic course use the instructor authoring tools to parameterize the various sequences of the course according to the objectives that are pursued and the prerequisites necessary for reaching a specific educational sequences. A key element must be taken into account, the modeling of the generic materials, which will assist in the creation of multiple notes that is presented in different presentation for each student. The course structure is stored in a database and can be retrieved for changes. The databases in EDUX are designed to store data pertinent to administration, students, instructors, and the learning and teaching environment in general. Data in the databases is retrieved and stored by the servers. For example, a profile server handles demographic information, preferences, assessment results, and etc. A more elaborate explanation regarding the storage method will be discussed in the **"Storage and Connectivity"** topic.

EDUX APPLICATION TOOLS

INSTRUCTOR AUTHORING TOOL

Instructors will be provided with a tool for the creation of course. The functions of this tool are:

i.   *Generate Materials*
     The services provided by an EDUX are centered on course content in preparing, presenting and managing materials for online learning or training. EDUX provides ways to offer multimedia course materials to students in their classes, labs, dorms and homes, and create online course materials, supplements and documents. Instructors will use forms in the authoring tool for entering their notes. Integrating multimedia files and other files will produce a presentation composed of a sequence of "abstract scenes".

ii. *Online discussion*
     EDUX also provide online discussion where the types of discussions can be divided into two main parts, which consist of Synchronous (e.g.: Chat rooms) and Asynchronous (e.g.: Threaded Discussion). Another typical Synchronous examples are *Internet Relay Chat* and *Yahoo Messenger*, while for Asynchronous, is electronic mail. The main feature of this component is, it is opened to public and private users. The private user is defined as "registered users", and the public user is the people who are not in the boundaries of registered users. Furthermore, this component will ensure 100 percent participation, since it provide an ample time and space for passive students to express their opinion. Therefore, it

will give very thoughtful and articulate responses. In addition, the benefits include "time on task" with content and fast reply-interaction for Q and A session.

iii.   *Quizzes*
In order to monitor students' performances, variety of quizzes will be applied, such as "True-False", "Multiple Choice", "Matching", "Short Answer", "Calculated", and "Paragraph Answer". These quizzes are restricted according to the time frame given where the questions are derived from the pool of questions set. Based on this, it will save class time, holds students accountable for reading, provide immediate feedback, and can be done repeatedly.

STUDENT AUTHORING TOOL

Students will also have a tool with three integrated functionalities for the collaborative curriculum. The functions are:

i.   *Collaborative Writing*
When an instructor gives a project, students will discuss in a real time chat or emails. Students in a group would edit the same document for that particular group's project. Members of a group can always find out when someone has edited the group's document by checking the page. A person, mostly their group leader will combine and edit all ideas and suggestion regarding the project

ii.   *Student assignment hand-in*
Another common use of the EDUX is a "hand-in" site, where students would post their homework assignments when it is completed through the web.   While perhaps not appropriate for every class, a public hand-in system provides the students an opportunity to see each other work and even comment on them. The outcome from the comments, which are the result from a serious and content class discussion, can be developed into essays that can be submitted via the EDUX.

iii.   *Project Case Library*
In some classes, students are invited to post their homework assignments after grading, particularly if the grade is high, so that other students can use it as references. It also depends on the instructors who check the assignment to decide weather it is suitable for other student reference. The EDUX becomes a project case library for exemplary projects. Students used these projects (that are stored in EDUX) as examples of projects, as sources for ideas (particularly when two or more students posted their unique solutions to the same problem), and in programming classes, as sources for coding that could be re-used in new projects.

STUDENT TOOLS

The student authoring tool is the application used by the students to attend a course. Its navigation system is flexible in supporting the way for each student to attend the course, right from the beginning, resuming the course at the point he left it, or as a reference book (for example,

consulting a topic). The student tool will be able to show the information of a course with different layouts. According to Shuman J.E (1998), layout view can be set up in a variety of ways, including sequential, hierarchical and relational layout.

i. *Sequential layout (Beginner)*
    With the contents of the course displayed one after another, following a time or a logical order, as in a guided tour. This layout is used in making sure the student follows each of the topic discussed in the syllabus.

ii. *Hierarchical layout (Intermediate)*
    Used for the intermediate level. This layout is suitable for courses with concepts of different levels of complexity. In this layout, a table of contents helps to navigate through the course, and to have a clear view of the organization for the whole course.

iii. *Relational layout (Advance)*
    Gives the advance level student a more flexible and independent way of learning. Notes are presented with lots of links connecting related topics, as in the Web. With this layout, student will find the information they search very quickly, following different paths, and jumping to other related information.
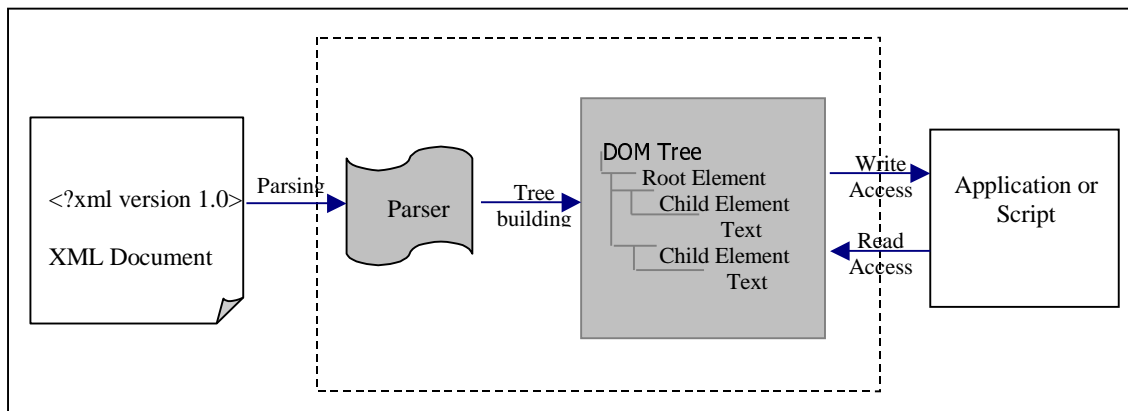
AUTHORING TOOL IN EDUX

Figure 2: Processing XML Document

EDUX interoperability data model can be defined as a hierarchical concept. Hierarchical models are convenient for representing data consisting of many elements and sub-elements. XML is perfectly suited for representing hierarchical models because it comprised of elements that have contents and attributes.

Refer to EDUX system; in order to use a form in the instructor-authoring tool for submission to an XML document, it is necessary to create a new XML document using the Document Object Model (DOM). DOM is a standard interface for HTML and XML documents. It defines the way a document can be accessed and manipulated. Using a DOM, a programmer can create a document, navigate its structure, and add, modify, or delete its elements. As shown in Figure 2, the parser analyses the document by testing whether the documents structure complies with Document Type

Definition (DTD). In the process, the parser produces a tree whose nodes represent the elements of the XML documents. As the XML document consist of different part, different node type are created (for the DTD: elements, attributes, entities, etc.).

The DOM presents an easily processed standardized interpretation of an XML document to applications and scripts. The DOM implementation in the XML Parser allows EDUX to load or create a document, access and manipulate the information and structures contained within the document, and save the document back out to an XML file. When the document is loaded, its information can be retrieved and manipulated by accessing the DOM. The DOM represents a tree view of the XML document. The documentElement is the top-level of the tree. This element has one or many childNodes that represent the branches of the tree (Microsoft Corp., 2001).

XML Data Island

XML data can also be stored inside HTML pages as "Data Islands". It uses HTML for formatting and displaying the data. It allows EDUX to script against the XML document without having to load it through script or through the <OBJECT> tag. Anything in a well-formed XML document can be inserted into a data island. HTML page presents the user with a form in EDUX. The user inputs are used in building an XML document to be added to a database. The details are then POSTed in XML to the server, where an ASP enters the information into a database and sends a confirmation in XML to the submitting client. The XML confirmation will be returned to the client as a data island.

The <XML> element marks the beginning of the data islands, and its **ID** attribute provides a name that you can use to reference the data islands. In EDUX, data islands are used in several part, and below is an example of a data island:

```
<HTML> <HEAD>
<TITLE>Student Profile – HTML with  XML Data Island</TITLE> </HEAD>
<BODY>
<XML ID='student'>
<student_details>
        <matric>82500</matric>
        <last_name>Yahaya</last_name>
        <first_name>Rohaya</first_name>
        <address>
                <street>2811, Taman Sentosa</street>
                <city>Kuala Nerang</city>
                <state>Kedah</state>
                <postal_code>06300</postal_code>
                <country>Malaysia</country>
                <email>rby78@hotmail.com</email>
        </address>
</student_details>
</XML>
</BODY>
```

EVALUATION PROCESS

In ensuring a pedagogical learning, student profile must be taken into consideration. The student profile will be generated automatically via evaluation process to provide different presentation for each student. It also involves generating the student levels, layout for each level, and also generating the notes submitted by instructors to the instructor authoring tools. This process will analyze the student profiles taken from the database and evaluate the profiles according to their knowledge level. In this case, the students' results are considered. Then, each student is classified into three levels: *Beginner*, *Intermediate* or *Advance*, as explained in the student tools topic. The same process goes to the lecture notes. Notes are generated according to student levels and presents in some classified layouts. There are three classes of layout; *sequential layout*, *hierarchical layout*, and *relational layout*, as discussed earlier. The process of transforming the XML data can be viewed in the Figure 3 and a brief explanation regarding the figure is discussed below.
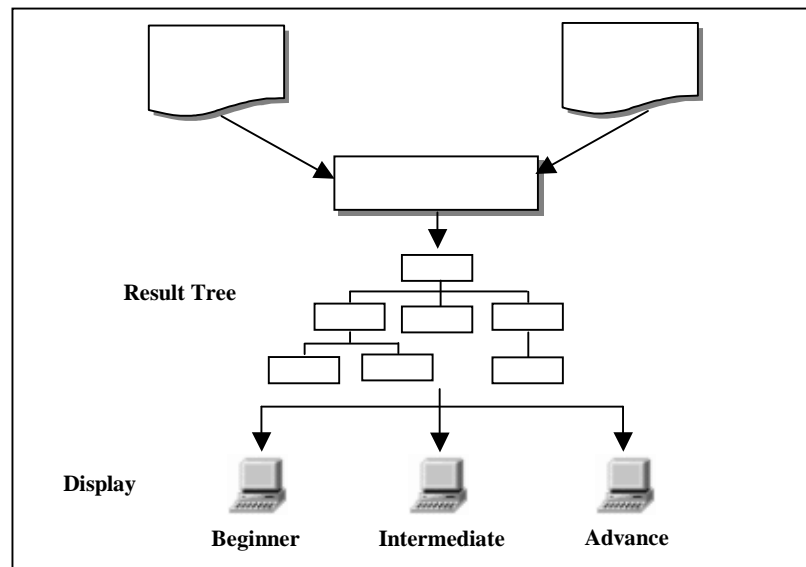

Figure 3: Transformation process in EDUX

The Extensible Stylesheet Language (XSL) is the World Wide Web Consortium's language for manipulating XML data. The XSL specification describes an XML Transformations (XSLT) language that is use to write a stylesheet. When applying the stylesheet to an XML document, the XSL processor transforms the XML source document into a new XML, HTML, or text document. XSLT style sheets are built on structures called templates. A template specifies what to look for in the source tree, and what to put in the result tree (Hunter, D., 2000). It operates by reading a stylesheet, which consists one or more templates, then matching the templates as it visits the nodes of the XML document. The templates can be based on names and patterns. Templates include literal text that is used in the resulting transform, interspersed with directives to include specific data. XSLT is an XML-based language that enables you to transform one class of XML document to another. XSLT can dynamically transform XML documents into HTML documents for a variety of browsers. It also can transform XML data into XML, HTML, or other text formats. Besides that, it can filter information to present information targeted to a specific user or user group. While it is possible to style data by embedding formatting elements into XSLT files, the real purpose of XSLT is not to format data but to transform and manipulate data (Froumentin, M., 2001).

In the EDUX system, this process will be used in classifying the student according to his level and the way notes are displayed for each level of student. The XSLT selects only the field needed to classify the level of students, either he is in the *Beginner*, *Intermediate* or *Advanced* level. This process will also be used for the notes evaluation. By referring to the result in the student level evaluation, the notes are then displayed to each student according to their level. XSLT matched each node in the student profile to meet the requirement for displaying the notes. After this process, the result is passed to the browser for displaying the layout accordingly.

STORAGE AND CONNECTIVITY

XML is very useful for allowing fast and easy interchange of structured non-textual data and it has the potential as a universal transfer format by allowing applications of different types to exchange data smoothly. Databases and XML offer complementary functionality for storing data. Databases store data for efficient retrieval, whereas XML offers an easy information exchange that enables interoperability between applications.

In EDUX, Tamino Information Server is used as the database. Tamino has been optimised for the management of XML data. It has components and functions for the communication over the Internet, the storage of XML and non-XML data, in addition to, access to external systems, maintenance functions and application interfaces. Tamino is used to store XML data, to update external databases, and to integrate with existing applications and data sources for retrieval. Basically, the procedures for working with Tamino for those cases are similar.

i. Firstly, describe the data using an XML schema. Until XML schemas are finalized, Tamino accepts XML Document Type Definitions (DTDs).

ii. Secondly, define a Tamino schema. Tamino provides a schema language that describes the rules according to which data are stored and can be retrieved. XML Authority, Tamino's graphical Schema Editor, or a text editor can be used to write a schema.

iii. Lastly, once a Tamino schema is defined to the Tamino Data Map, the instances of the schema can be stored. Tamino stores and retrieves information according to the rule specified in the schema.

In EDUX, the XML documents that contain the student profile will be entered into the Tamino database. Basically, this is for the newly registered students. For the registered students, their profiles can be entered using non-XML application if the database used is a non-XML database (legacy database). Those profiles can be retrieved and mapped into XML format for data manipulation. The new lecture notes will be stored in the XML database, and those existing lecture notes written in other format and stored in other relational database will be retrieved, converted and stored in native XML database. These processes are clearly shown in Figure 1.

CONCLUSION

EDUX is an e-learning system that uses the intelligent hypertexts language: XML. EDUX is a web-based application using a portal concept. Each student will have his own portal where information displayed is tailored towards his level of acceptance. This portal will also include *push technology* concept that alert users to the availability of new learning modules, in addition to modules that best fit their individual learning histories, preferences, and knowledge. With EDUX, student may access the courses at their own pace, based on their ability.

The idea of EDUX is tailoring the information on certain courses, for a specific student according to his needs. It is actually a concept of *prescriptive learning* where the student is only *prescribe* the information that need to be digested according to his level of acceptance. This approach lets the students to develop knowledge and skills in a hands-on environment.

Web based teaching and learning creates new evolution in the education era. Applications using HTML is interpreted by browsers for presentation. On the other hands, XML enables applications to interpret meaning of data and how the content are being organized. By allowing the separation of content from presentation, XML enables authors to concentrate on creating quality content rather than creating Web pages. Online training materials will be better organized and described more clearly using XML tags. Interactive content enhances the learning experience of students and enable clearer explanation of concepts and ideas. Adopting XML in managing multimedia content in EDUX such as image description, file locations, multimedia objects and etc., simplify multimedia integration into training content and making it easier to develop and maintain.

Content development has always been an expensive task. Creating the content in a reusable format and facilitate maintenance is thus essential. If content are being developed in static HTML pages, maintenance costs over time will exceed content development costs. EDUX using XML allows customizing of content for different audiences with ease by applying XSL (XML style sheets). XML offers the flexibility to deliver content in different ways. This has a far-reaching implication in how e-learning is being conducted. The e-learners can personalize their learning experience by selecting different presentation styles that helps them to learn in the most effective way. Content updates and supplements can be added in an unobtrusive manner and yet be easily accessible. To use XML in training now means planning ahead and avoid developing learning content in proprietary format thereby risking expensive conversion to share content across different learning systems.

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