

Research Trends for Implementing Adaptivity In E-learning Systems

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Abstract— The need of outcome based education has tremendously affected Learning Technology Market. The vendors of Learning Management Systems are looking the every possible alternatives and services required to meet the customer and learners requirements. Evolution of eLearning systems that are targeted towards implementation of adaptiveness in terms of personalized learning, learning contents, learning styles to ensure efficiency of learning is discussed in this article. Also different types of adaption in eLearning environment and independent eLearning systems which implemented the adaptivity at various levels are analyzed thoroughly on the parameters like learning style, mode of operation, learner's interaction as well various methods used for implementation are studied and we have tried to sum up the important researches that are helpful to improve and provide better services adaptable in eLearning systems. The proposed hybrid adaptive model for eLearning Systems will further add a new dimension in adaptive eLearning Systems.

General Terms: Learning Environment, eLearning, Learning Style.

Keywords: Adaptive eLearnig Systems, Learning Style, Learning Models

I INTRODUCTION

Traditional teaching and learning environments such as class room teaching with the use of black boards and chalk has evolved with the evolution of technology from white board and markers to power point presentations and internet based learning. In most of the corporate industries and educational universities the rapid evolution of technology is demanding new courses to be introduced and learned for surviving in the competition. Industries are not interested to invest on employee training as the class room based training imposes not only cost constraints but also time consumable and it does not guarantee achievement of effective outcomes.

eLearning systems in the form of learning management systems and web based learning systems are gaining importance and becoming the first choice for delivering the training to employees of an organizations and similarly to the students of a university.

The term adaptive is applicable to varied range of systems. An eLearning system is said to be adaptive if it is capable to monitor and interpret the user activities on the domain specific models, deducing requirements and preferences of user out of these interpretations, representing them in appropriate models and acting on the available

knowledge on its user and the subject matter at hand, to dynamically facilitate the learning process. When we talk about adaptively in eLearning environment then it can be implemented at various levels mostly at either course level or system level. In this paper we studied and analyzed the adaptively implemented various levels and learning models and systems that implements adaptively.

II ADAPTATION CATEGORIES IN LEARNING ENVIRONMENT

Alexandros Paramythis and Susanne Loidl-Reisinger have given four broad categories as: a) adaptive interaction b) adaptive course delivery c) content discovery and assembly, and d) adaptive collaboration support [1].

Adaptive Interaction:

In this category the adaptation to support user's interaction with system is implemented at system's interface level. This category of adaptation does not require to modify the content. The user interface is designed in such a way that it adopts as per the users learning delivery tool eg. Color, font size etc is adapted [1].

Adaptive Course Delivery:

In this category the course or series of courses are designed and delivered in such a way that it fits to learner's requirement in terms of learning style, capacity, and goals etc. to obtain the desired results. A personalized touch is provided to the learner through adaptations in dynamic course restructuring, adaptive navigational support; and, adaptive selection of alternative segments of course material (Brusilovsky, 2001) [1].

Content Discovery and Assembly:

In this category adaptation is implemented to discover and assemble course material using adaptation oriented models and knowledge about user. In this case the adaptation is either implemented on learners wish to discover material and authors control on content repository creation and delivery [1].

Adaptive Collaboration Support:

It aims to implement adaptation in supporting learning in a group heading towards a common goal or objectives. Adaptive techniques can be used in this direction to facilitate the communication / collaboration process, ensure a good match between collaborators, etc. Researchers are trying to utilize social media for collaborative learning [1].

III ADAPTIVE LEARNING ENVIRONMENT MODELS

The adaptive models which can be incorporated in learning environments are as follows these models are elaborated in [1].

The domain model:

In this model general learning activities are modeled. This model is based on relationship between learning objects presented in the course. It may also use information such as workflows, participants, roles etc. to implement adaptively [1].

The learner model:

In this model the learner's behaviour or interactions with the learning environment are used to implement the adaptively. The specific parameters or characteristics such as e.g., demographics, previous achievements, etc are not considered to implement the adaptivity in this model. Although the learning patterns, learning style etc can be utilized in this model [1].

Group Models:

Group model uses common characteristics shared by a group of learners. Group model considers various factors such as common objectives / goals, likes or dislikes, education interest, sport interest etc. [1].

The adaptation model:

This model is based on adaptive theory of an Adaptive learning environment and makes use of various levels of abstraction at which adaptation can be implemented. Run time behavior, logical relationship etc. are determined at different levels to implement adaptivity [1].

IV RESEARCHES IN ADAPTIVE E-LEARNING ENVIRONMENT

Stephen Marshall & Geoff Mitchell has suggested that a process model; Capability Maturity Model (CMM) can be used for system level adaptation as it encourages the development of educational resources which are platform independent, and supports organized structures with pedagogical framework[2].

Owen Conlan and Vincent Wade evaluated adaptive solutions that are content and domain independent using the multi-model and metadata-driven approach. The authors discovered advantages to learners by adopting the multimodal approach and evaluated students' performance for a period of four years. Their system provide a personalized service on a generic adaptive engine [3].

Peter Brusilovsky has presented an architecture based on distributed and reusable learning activities called "Knowledge Tree". The authors aimed "Knowledge Tree"

for bridging the gap between internet based education learning systems and intelligent tutoring system. This integrated approach addresses course level adaptability and teacher level usability of course contents [4].

Petroc Gracia and etl... evaluated Bayesian model to deliver a web based course on an Artificial Intelligence. The authors detected the learning styles of student to deliver the course content. For different learning styles they found different levels of precision in adaptivity through Bayesian model [5].

Ana Lidia Franzoni , Said Assar described personalized teaching method based on Felder Silverman Learning style model which helps teacher to identify teaching style suited to learner style. With this approach the teacher is able to provide the electronic learning contents suitable to learning style of the student. With this approach student learning efficiency has drastically improved [6].

Sabine Graf, Kinshuk and Tzu-Chien Liu implemented and automated tool that helps teacher to identify learning style of students which supports teacher to deliver effective learning contents. The authors deduced learning styles of students by analyzing their behavior in an online course. The authors carried out the experiment on 127 students and compare with the automatic approach with questionnaire approach and results were found more suitable to detect learning style through the automated approach [7]. Vatcharaporn Esichaikul, Supaporn Lamnoi , Clemens Bechter presented a system in which students prior knowledge level is recorded when he / she registers for the course. During the course of instruction at various check points knowledge level is identified through tests. This personalized data is used to make the system adaptive. The author tried this model for delivering a course on "Introduction to Java Programming Language" through LearnSquare Software. Their results showed positive feedback towards adaptivity capability of the model [8].

Herman Dwi Surjono discussed design of adaptive elearning system based on VAK and Felder Silverman Learning Style model. This system combined learning styles of both model and alternatively course is presented to individual student [9].

Nouran Radwan presented a system of an adaptive elearning course including introduction, contents, assignments, Exercises. The system is implemented using an open source learning management system LAMS (Learning Activity Management System) to present course materials in different ways according to learner's learning styles. Several patterns discovered where learners with different learning style showed significantly different preferences in e-learning environment. These results seem to be important in order to provide courses that include features which fit to different learning styles [10].

Dror Ben-Naim, Nadine Marcus, Mike Bain described research that utilized data visualization and data mining techniques for an Adaptive Exploratory eLearning Environment. The visualization tool Solution Trace Graph and

Virtual Apparatus Framework used to model student interactions and develop the eLearning contents that gave insights for the implementation of adaptivity [11].

Erica Melis, Eric Andrès, Jochen Büdenbender etl proposed a system called Active Math which is internet based learning system that automatically generates interactive (mathematical) courses adapted to the student’s goals, preferences, capabilities, and knowledge. The content presented in xml format. The system is able to retrieve appropriate contents for each user from the knowledge base according to the rule base created. Active Maths provided integrated standalone feature to deliver the course content. This system is useful for learning complex, realistic and exploratory mathematical concepts [12].

V HYBRID MODEL FOR IMPLEMENTING ADAPTIVITY

To implement an adaptive eLearning system that can address the problems of identification of learning style and content delivery we propose a model that can detect the learning style of a learner and accordingly deliver the learning content to the learner.

In this model three main important components of eLearning Systems are considered which are listed below:

1. Learner and Learning Style.
2. Interactivity in Learning Content.
3. Implementing adaptivity

The following figure shows the basic blocks and flow of eLearning system using hybrid model.

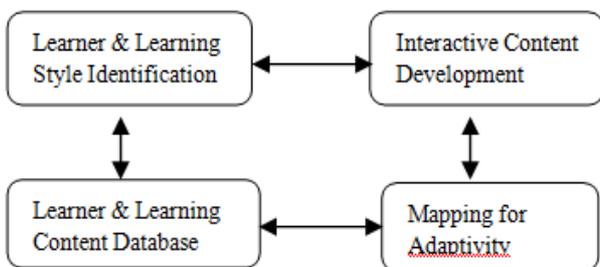


Figure 1: Hybrid Model for Adaptive eLearning System.

Learner and Learning Style:

Every individual has a different learning style and pace of learning. Learning style plays important role to understand the learning material. If a learner is presented learning material suited to his / her learning style effectiveness of achieving expected learning outcome increases. In literature there exists various learning styles and models. In the hybrid learning model only the visual and verbal dimensions of learning style are considered. The visual learners likes to learn through images, videos, animations, graphics etc. Reading text and listening to a voice tape or voice embedded textual course is more suitable to verbal learners. In this

phase of model the learners style whether visual or verbal will identified.

During this phase learner style is identified by two methods the first method employs a style specific questionnaire and second method is implemented in learning contents. In second method to identify learning style of a learner two style test courses can be developed. These courses will have learning content on same topic which are implemented in two formats. The first format will have explanation in the form of visuals, graphics, animations, static images, videos along with less text with voice embedded. The second format of same learning content can be implemented in textual representation with voice over embedded in the course. The analysis of both type of course will help to identify the learner style.

Interactivity in Learning Contents:

Presentation of learning content in terms of accuracy, adequacy, and topic relevancy are important parameters which needs attention during the content development for delivery through eLearning Course. Interactivity is also one of the parameter which needs attention. There are various levels of interactivity which can help the learner in best way and achieve the expected outcome. In this phase the interactive learning contents will be developed. These contents are developed in such a way that they will help visual learners to explore the contents in an interesting ways. The audio embedded in the textual course will help the verbal learner and will motivate them to learn and achieve the expected outcome.

Implementing adaptivity:

Once the learner style is identified and interactive learning content database is created. This phase maps the individual’s learning style to the courses and learning content available in database. This phase suggest the learner which he / she can take up for further learning during the learning process. For implementing adaptivity various parameters can be considered such as the time spent on the learning content, grades scored on the type of learning contents.

VI CONCLUSION

The adaptive eLearning systems are gaining more importance day by day and study suggest that implementing adaptivity will help in ensuring effective outcome based smart education system. All though various useful researches are available in literature we suggest an integrated approach will help to model a new eLearning systems which will implement services based on personal choice of learners and focused towards achieving desired outcomes. Adaptivity at course content level has much more scope for finding new dimensions that will improve eLearning systems. The proposed hybrid model will be useful for visual and verbal learners. Once the learner and his / her learning style is identified the model will suggest the content suited to individual learner style.

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