Effective professional training through adaptive e-learning and decision making systems

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Abstract - Traditional classroom learning is slowly undergoing a change into a form called   blended learning. The mix of human tutors with pedagogical electronic devices producing high quality education and in the recent past e-learning technology has grown to certain level and still growing, but at the same time the issues are also cropping up. This paper elaborates the concept of e-learning and its issues cognate to content management. The integration of e-learning and the knowledge management would bring out solutions to these issues. The adaptation process of knowledge management in e-learning is adaptive e-learning. The paper discusses all these to show that the learning would be very effective with the introduction of adaptive e-learning with the aid of decision support system. The paper will also discuss some of the important concepts of e-learning and the models of adaptive e-learning in general and application of these concepts and technologies in professional training programmes, in particular.

Key words: Adaptive e-learning, content management, knowledge management, decision support systems, blended learning, LMS & CMS.
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1 INTRODUCTION

Even though, e-learning has been part and parcel of education and training, learners are not getting appropriate content at right time. In traditional learning, teacher understands the knowledge level and behaviour of any particular student at a fast rate and that is missing in e-learning.

Most e-learning systems provide Web-based learning so that students can access the same online courses via the Internet without adaptation, based on each student's profile and behaviour. In an e-learning system, one size does not fit all. Therefore, it is a challenge to make e-learning systems that are suitably "adaptive" or "dynamic".

The aim of adaptive e-learning is to provide the students the appropriate content at the right time, means that the system is able to determine the knowledge level, keep track of usage, and arrange content automatically for each student for the best learning result. Therefore, there is a need for decision making systems / intelligent learning systems (usage of Knowledge Management in E-learning systems) in the field of e-learning to find solutions for the issues.

2 Introduction teacher-centred learning or face-to-face learning

India has long history of organized education. The gurukul system of education is one of the oldest on earth but before that the guru shishya system was exist, in which students were taught orally and the information would be passed from one generation to the next.

In Guru Shishya parampara Guru means "Teacher". The letter "gu" stands for darkness and the "ru" stands for that which removes darkness. "Guru" implies one who removes darkness of ignorance. Sishya is from the root instruct or discipline. One who has desire for knowledge and should have trust and devotion towards the teacher.

Certainly, there are advantages in traditional learning because human tutors are always available during the learning time. The attitude and the learning skills are different for different students. The human tutor can grasp easily the level of understanding of each and every student; accordingly he/she can guide the students.

Moreover, the student can interact with the tutor directly or face-to-face for any doubts clarification. Another important point is belongingness or good relationship between tutor and the students and a sort of discipline from both the ends would be there while learning.

In traditional learning there is always a tendency that the student dependency on teacher is more. Thus they might become inactive in classes and not being able to assimilate much knowledge.

3 Crossing the Class-room limits

Learning is facilitated and supported through the use of information and communication technology. E-learning is the single word that describes the various fields of online learning, web-based training (WBT), and technology-delivered in-

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struction. E-learning makes use of the network capabilities to create or deliver and to facilitate learning contents. E-learning is a power that gives the stake holders a competitive edge to enable them to keep ahead of the rapidly changing global economy. E-learning is the use of technology to make students possible to learn anytime and anywhere. The "e" in e-learning refers to electronic, but the meaning goes in many ways i.e." evolving" or "everywhere" or "enhanced" or "extended". The major advantage of e-learning is more cost effective when compare to traditional learning, less time required to access learning material, learner would be flexible enough to learn things at will anytime and anywhere.

The technologies such as Internet protocols and Multimedia are facilitating the learning environments through the electronic media to access the resources and the services. Many educational institutions are moving towards e-Learning technology in order to attract the student community to impart better education but still a lot of scope is there for research.

4 E-learning framework

To build a successful e-learning system that necessitates an organized function of planning, design, development, evaluation and implementation (Badrul Khan, 2003). Above all the promotion and the growth of learning are equally important. Such an e-learning system is more significant when it is easily accessible, learner-centred, affordable, and flexible. Like every technology has framework the e-learning too having structural basis that helps the stakeholders to learn, to design, to develop and to implement e-learning contents, modules, and courses.

Figure 1

Several researchers and authors have put forth e-learning framework of key practices. In this paper one of such practice is adhered (Bryn Holmes, John Gardner 2006). The entire e-learning would look like a flower having petals and leaves attached and wandering bees, as shown in Figure 1. Searching and selecting are referred as locating sources of information and choosing the appropriate relevant sources based on some criteria. Explore to discover information of learners choice. Test would help the learner to gain knowledge not only by studying something of interesting topic but can also experiment with that.

With collaborate and discuss learner seeking to share the information and new knowledge with others. Analyse is a process in which a learner studies complex issues and turns into simple ones. Create to new knowledge. Understanding models, case studies etc. Synthesizing is process of rebuilding the data into a knowledge set. Promoting or enhance learners with e-learning programs that are delivered through e-learning technology.

5 Learning and content management systems

As we all know that there is a great amount of web data around us called contents. The contents are the core component of the e-learning. Internet provides this information from resources around the world in to our reach. Such information are not in the proper order and most of the time unrelated. For example think of a library with lots of lots of books with no proper setup it would be impossible to select a particular book when it was needed. This is the concern of content management. E-learning provides the solution by managing contents. The main objective of content management is to facilitate the learners with digital contents (web page content) through Content Management Systems [CMS]. There are plenty of such systems through which digital contents are created, processed and managed according to the needs of the learner. Knowledge management plays an important role in selecting appropriate contents based on the certain parameters studied and drawn from a particular learner.

Learning Management system [LMS] is a sort of learning event management system. This covers high-level, critical solution for planning, delivering, and managing the learning events of an organization, including online, virtual classroom, online collaboration, and instructor-led courses. LMS helps organizations in terms of global certification, performance, competency, and learning initiatives with goals. It also performs heavy-duty administrative tasks, such as reporting to human resource and other enterprise resource planning systems.

Learning content management system [LCMS], here the focus is on learning content (Leonard Greenberg, 2007), which is used to create a meaningful content by authors, Instructional designers, course developers and subject experts. The system facilitates to create learning contents just in time to meet the needs of individual learners or groups of learners. Instructional designers create reusable content and make them available for the course developers. This feature eliminates redundant content as well as redundant development efforts and which allows rapid assembly of customized content.

6 Issues of e-learning

There are different areas of e-learning in which issues have been addressed and enormous amount of research is going on to find the answers to these issues.

Content issue – There is an abundance of contents available all over but not in proper order and there is a lack of proper adaptive techniques to segregate or arrange these contents according to learners demand. The learner needs the educational contents on time and online. The educational contents could be of any format like lesson notes, an assignment, a question paper, a quiz, a discussion, case study, expert opinions, video or audio content about any debate, guest lecture, seminar etc.

There are research's in this context is going on but still certain issues like defining proper structures of educational contents taking its own time. In order to be flexible these structures should always be format independent and engage the learner in a good learning experience.

There is a lot of scope for the research in the area of reusability of digital learning materials in particular creating or re-using learning objects. The learning materials are developed or prepared by putting these learning objects in a proper sequence. Also, there is a need of storing these learning objects in a database or repository for future use.

There is a dearth of e-learning standards one being "Sharable Content Object Reference Model" [SCORM], a standard format for e-learning content, and other standards are still at infant stage.

The other content issue of e-learning is the integration of Knowledge Management and e-learning technology. The culmination of both might yield good results in developing decision making systems for e-Learning issues.

In this paper we have limited our discussions only to the extent of content issues.

7 State of blended learning

The classroom learning is powered by online learning becomes a blended learning. The online learning adds handiness and availability to classroom learning. Learner avails a quality education. The positive note of a blended learning is a face-to-face human tutor interaction with the utility of online learning. Most of the present days higher educational institutions are composed of learning devices such as touch screens, LCD's, smart boards etc., which are adopted to a classroom to impart distinctive education. There are several variants to blended learning such as 'web-based learning', 'asynchronous learning', 'hybrid learning', and 'mixed-mode instruction'. All these names indicate the same concept and thereby one can understand that there is no proper model developed so for and there is a scope of research. The advantage part of blended learning is; it enhances reciprocal action between student and instructor, student and student, student and content, and student and outside resources. Blended learning also benefits the institution by improving the efficiency of classroom use and reducing on-campus traffic and the associated need for parking space (Charles D.Dziuban).

8 Adaptive e-learning

Adaptive learning is an educational method which uses computers as an interactive teaching device. Computers adapt the presentation of educational material according to students' learning needs, as indicated by their responses to questions and tasks. Any adaptive technique tends to adjust itself to the characteristics needs of a user. A user perhaps has different characteristics that include knowledge and skills, understanding abilities, interest, style, behaviour etc. In e-learning adaptive technology is a latest trend in the industry and is being associated with various kinds of attributes and capabilities (Alexandros Paramythis, Susanne). The adaptive systems study these attributes and capabilities by monitoring the activities of the learner and interpret these on the basis of realm oriented models. The learner requirements and selections out of the interpreted activities are transformed into appropriate models and apply these on the available knowledge to facilitate the learning process and environment. All these activities of the system carried out transparently. In other words, the basic view (Valerie Shute, Brendon Towle, 2003) here is improving the learning and performance of learners'. This is possible by studying a particular learner. The system instructs the learner while delivering the contents and picks up learner characteristics to provide needed learner content. The process of study includes embedded assignments and tests to drag the learner attention towards learning.

The effectiveness of e-learning is assessed by the degree to which a learner actually acquires the relevant knowledge or skill presented online. This acquisition is generally being regarded as a constructive activity where the construction can assume many forms. Therefore the e-learning environments should be flexible enough to accommodate various constructive activities.

The requirements of adaptive e-learning can be revealed through both the "learning process" and the "learning content". A learning process is driven by "what to learn" meaning the scope of learning and "how to learn". Adaptive learning presents learner with solutions by filtering a set of course materials against user characteristics. The "how to learn" issue is solved through different interaction such as theory-oriented, exercise-oriented or activity oriented one. The technology also proposes ways to acquire and understand the learning style of a student.

The components of adaptive e-learning are: Adaptive Interaction- The concern hears is adapting the proper user interface in order to facilitate the user with proper input screens, dialogue boxes, font, size etc. Adaptive content delivery- This constitutes the optimization or mapping between the course contents and the user requirements. The features such as dynamic content structuring, adaptive navigation supports and adaptive selection of alternate contents are all the part of this component. Content discovery and Assembly, the application of adaptive techniques to retrieve the content from potentially distributed sources or repositories.

This again based on the adaptation model and the level of knowledge about the learner derived from system monitoring. Adaptive Collaborative support- This is intended to have adaptive support in learning environment that involve communication between learner and the social interaction, which enhances social collaboration, cooperative learning, social negotiation in e-learning.

Many researches are still proceeding to fine tune the frame work of the adaptive e-learning. One such is illustrated by F.W.B. Li, R.W.H. Lau and P.Dharmendran, 2009, the framework consisting of three modules student, course and resource profiles. The student profile formulates the student learning needs. The course profile maintains the course structure according to subject topics and gives an idea on how a student can learn the course regarding a variety of learning, content and interaction styles. The resource profile maintains needs from students, course and external environment regarding the concepts under subject topics to help students identify preferred learning resources.

9 Knowledge management process

Knowledge management demonstrates systematic management of vital knowledge and its associated processes of creation, represent, distribute, organization, diffusion, and enable adoption of insights and experiences.
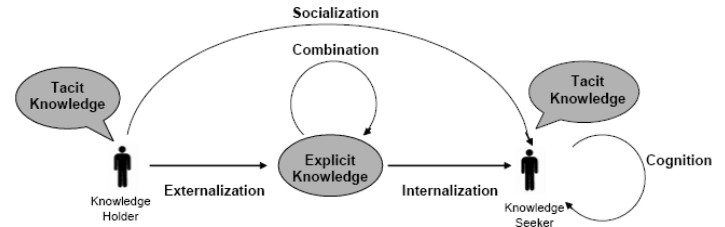

Figure 1. Integration of e-learning & knowledge management.

Such insights and experiences comprise knowledge, either embodied in individuals or embedded in organizations as processes or practices. Darrell Woelk (2002), proposed a model of Knowledge Management comprising knowledge management phases such as socialization which transfers tacit knowledge from one person to another person, which is diagramattically shown in the Figure 1.

Externalization translates tacit knowledge into explicit knowledge in a repository, Combination combines different bodies of explicit knowledge to create new explicit knowledge, Internalization extracts the explicit knowledge from a repository that is relevant to a particular person's need and deliver it to that person where it is translated into tacit knowledge, Cognition apply tacit knowledge to a business problem.
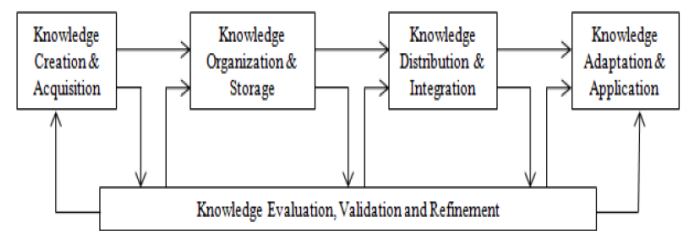
The Knowledge Management Process
Source: Vasilyeva, Pechenizkiy and Puuronen, (2005), p.117

Figure 2.The process of knowledge management.

Accacording to Vasilyeva, Pechenizkiy & Puuronen (2005), Knowledge Management can be viewed as a continuous process and is divided into five main stages: Knowledge creation & acquisition, Knowledge organization and storage, Knowledge distribution and integration, Knowledge adaption and application and knowledge evaluation, validation and refinement.

10   Culmination of e-learning and knowledge management

E-learning technology and knowledge management technologies has been evolving separately, and some of the recent research studies show the culmination of these two technologies would yield better e-learning environments. The objective mainly based on organizational learning analysis. Knowledge management facilitates an e-learning system with organizational learning. The researchers trying to analyze commonality in both the technologies with respect to the goals, assessment methods, knowledge sharing processes. The traditional view point of the e-learning with in knowledge management thought of as a knowledge resource repository, where the knowledge management methods can be implemented to increase the effectiveness of knowledge dissemination [Ponce, 2003]. The learning materials are treated as knowledge in the knowledge concept. Whereas the recent studies show that the adaption in the e-learning system the concept of knowledge has different meaning and it is related to the information on what, how and under which context can be adapted [Ekaterina Vasilyeva, 2005].

11   Adaptive e-learning and Decision making

Decision making is the problem of choice among several alternatives. It is the process of constructing the alternatives, means, given a problem statement, developing a list of choice options. It also includes a search for opportunities for decisions. Decision support systems aim mainly at broadest type of decision making and in addition to supporting choice, they aid in modeling and analyzing systems organizations, identifying decision opportunities and structuring decision problems.   Probability theory and decision theory plays an important role in decision making process.

Decision making under certainty has been addressed by economic and operations research methods, such as cash flow analysis, break-even analysis, scenario analysis, mathematical programming, inventory techniques and a variety of optimization algorithms for scheduling and logistics. Decision making under uncertainty enhances the above methods with statistical approaches such as reliability analysis, simulation and statistical decision making.

Decision making under uncertainty is one of the most inherent and most prevalent properties of knowledge, originating from incompleteness of information, imprecision and model approximations made for the sake of simplicity. Decision making under uncertainty can be viewed as a deliberation, means, determining what action should be taken that will maximize the expected gain. Due to uncertainty there is no guarantee that the result of the action will be the one intended, and the best one can hope for is to maximize the chance of a desirable outcome. The process is on the assumption that a good decision is one that results from a good decision-making process that considers all important factors and is explicit about decision alternatives, preferences, and uncertainty. It is important to distinguish between good decisions and good outcomes. A very good decision can be followed by a bad outcome. Supporting decision means supporting the decision-making process to take better decisions. Better decisions can lead to better outcomes.

Adaptive systems generates certain volume of results whichmust be used in a better way. Sometimes a particular result may be needed for usage and selected by human judgement.   However, there is a substantial amount of evidence that human intuitive judgement and decision making can be far from optimal, due to the reason that complexity and stress deteriorates the human decision making. [Mark J. Druzdzel, 2002]. The decision support systems can aid human cognitive difficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, and aiding the process of structuring decisions. Therefore, by integrating adaptive systems and decision support systems would expect better results. This may be possible by inputting the results of adaptive system to decision support system.[Zilobaite et. al, 2012].

The concept of decision support system is that it is called as interactive computer-based systems able to make decisions and suggest solutions to the problems; however the final decision in most cases is made by an expert.   Sometimes it also refers to as knowledge-based systems. They provide data storage and retrieval, support for model building and model-based reasoning. They support framing, modeling, and problem solving. Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support systems are typically used for strategic and tactical decisions faced by upper-level management│decisions with a reasonably low frequency and high potential consequences in which the time taken for thinking through and modeling the problem pays o_ generously in the long run.

12   Adaptive models

Student model: The system judges the learning style and preference of the learner and offers content accordingly. Initially the learner interacts with the system through the intelligence module. The intelligence module in order to judge the learning style of the learner puts some questions to the learners. The learner answers these questions based on his preference

and analyzing the answers. The intelligence system suggests a suitable content for the learner. The content delivery system based on the instruction from the intelligence system delivers the content to the learner. After a learning session the feedback and suggestions from the learner are also recorded for future modifications. [Dekson D.E. et. Al,2010].

Learning style model: Gordon Pask's work(1976) is based on the recognition of two different kinds of learning strategy: serialist and holist. Serialists tackle the subject step by step, building from the known to the unknown with the simplest possible connections between the items of knowledge. Holists, on the other hand, seek an overall framework and then explore areas within it in a less haphazard way, until they have filled in the whole.

Honey and Mumford's learning style model developed by Honey and Mumford (1982) includes four stages of learning styles: Activist, Reflector, Theorist and Pragmatist. Activists need interaction between other learners in elearning environment and therefore group works and real-time conversations are recommended for them. Reflectors prefer standing aside and think what is happening. They learn best by observing someone else, collecting information about it and going through what was learned. Theorists prefer analytical and rational thinking over subjectivity and emotions. They like complex problems where they can use their skills and knowledge. Pragmatists are the ones who prefer hands on doing over theory.

David Kolb (1984) found that the four combinations of perceiving and processing determine the four stage learning cycle. The learning cycle stages are:

• Concrete Experience (CE) – feeling
• Reflective Observation (RO) – watching
• Abstract Conceptualization (AC) – thinking
• Active Experimentation (AE) – doing

This process is shown as an idealized learning cycle or spiral where the learner "touches all the bases"—experiencing, reflecting, thinking, and acting—in a recursive process that is responsive to the learning situation and what is being learned.

13   Application of Adaptive learning and decission making technologies in professional training environment.

The Banking financial institutions need periodic training programmes and refresher courses for their staff. These institutions give training for their employees from the time of their recruitment till their retirement, at various stages, on various topics. These training programmes will have their own curriculum contents. The lessons, topics and duration of the programme have to be decided by the training manager. All the lessons, training materials are stored in the database. Depending on the training or course, the relevant mateials have to be picked from the database. The computerized decision making system can pick-up the right material for the right course. These processes will not onlyn reduce the precious time of training department executives but also the overheads of the training department can also be reduced by organizing the programmes with minimum efforts. It needs considerably more efforts at the time of preparing the materials and put the same in to the database. Later, only modifications, additions and updations need to be done. It reduces the costly human resources overheads. The training programmes and other courses can be conducted effectively and efficiently within a short duration of time.

13   Summary & conclusion

The aim of adaptive e-learning is to provide the right information at the right time. There is no barrier of time and place for any learner to gain knowledge. In order to facilitate learner with effective adaptive e-learning the technologies such as e-learning, knowledge management, decision support systems are used collectively to improve the organizational learning.

Implementation of these technologies can definitely make the institutions highly benefited, by reducing the cost and time along with enhancing their training efficiencies.

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