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REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

ACKNOWLEDGMENTS

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APPENDIX/ANNEXURE

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UTILIZING THE POWER OF CLOUD COMPUTING TO PROMOTE GREEN LEARNING

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ABSTRACT

Time, distance and languages are common hurdles for the formal education system. The emergence of IT and the technological solutions like developments in information, communication and computing technologies have made available several powerful tools that support learning to a large sector of the population. Utilizing the information and communication technology in education is referred as e-learning. Emergence of e – learning has led to the availability of higher education to masses. The importance of e-learning like reduced paperwork and manual tasks, saving on the transportation costs, streamlining of processes making it more efficient, automation leading to easy accessibility and ready availability, a collaborative learning mechanism, ease in modification and updation are well-known. The purpose of this research is to explore how cloud computing can be used as a tool for e - learning and hence for the promotion of Green Education. When we use the term green we refer to the methods that help in protecting the environment. Computing technology has put intense pressure on the environment and natural resources and by switching over to green computing we try to reduce, reuse and recycle the resources. E-learning contributes to a greener environment by saving on the fuel to travel for learning purposes and also the resources required to build infrastructure for traditional learning. The reason for suggesting the utilization of cloud computing in this paper is that cloud computing is ultimately the green computing because when we use the cloud, we reduce the hardware usage by individuals and organizations as the data and applications are stored on the cloud and we therefore promote a greener environment.

KEYWORDS
Cloud computing, E-learning, Green Learning, IT Innovations, Web 2.0.

INTRODUCTION

Video Conferencing, Satellite Applications, internet and www has changed the life styles of people around the world. In the education system also, an environment in which, learning is facilitated by Information and Communication Technology (ICT) applications for teaching and learning, has emerged. These tools especially the ones created by web 2.0, which enable the elimination of barriers of the traditional education system leads to setting-up of digital/virtual/e-campuses or e-varsities for E-learning. Global connectivity must mean more than technology and commerce; it must lead to global learning, and the inculcation of values that set apart a civilized human being.

Green: The term "green" is used when we use the minimum resources to carry out a process. The idea is to have sustainable use of resources so that the resources that are used can be recharged by nature on a regular, sustainable and long-term basis. Resources could be energy or material. The activities or tasks carried on should generate the least amount of pollution, and any waste if generated should be recyclable.

Cloud computing: Cloud computing is an emerging technology through which an increasing number of IT services are delivered over the Internet. From personal messages and pictures on Gmail or Facebook, to more professional offerings from Amazon Web Services or Microsoft Online Services, cloud computing makes it possible to run applications without having dedicated hardware, software, and services. Cloud computing, for a great part, is enabled by virtualization, which allows, the decoupling of server hardware from applications and operating system (OS) storage. Cloud computing and virtualization make it possible to sell (or purchase) IT resources, such as CPU time, storage, and network bandwidth, as on-demand and/or metered resources, similar to how public utilities are used. The result is that organizations can reduce costs and be more flexible, more mobile, and scalable while improving their quality of service.

E-Learning: The term e-learning refers to computer based training which incorporates technologies that support interactivity beyond what is normally provided by a single computer. Further, it can refer to an approach that facilitates and enhances learning through the use of computer and communication technology, such as personal computers, Digital Televisions, Mobile Phones, Internet, email, and collaborative software. E-learning continues to be popular because of its ability to provide greater convenience, time flexibility and self-paced learning to students while avoiding travel time and cost. It can also accommodate learning styles not suited to traditional classroom instruction.

REVIEW OF LITERATURE

E-learning has evolved from its predecessor, the distance learning. Distance learning attracted many learners from all over the globe, mainly because of its flexibility. Schank (2002), Roffe (2002), Sambrook (2003) and Tsai & Machado (2002) refer to e-learning as "communication and learning activities through computers and networks (or via electronic means)".The popularity of e-learning is not only limited to working adults who are seeking higher qualifications without leaving their jobs and losing their earning power (Lau, 2003). This trend seems ever increasing as the Internet and computer technology become widespread as a daily necessity of the younger generation. Evan & Hasse (2001) found out that learners are moderately lacking in computer proficiency and, since e-learning is centered around computer technologies, it is a barrier to those learners without good computer skills. In addition, studies of Evan & Hasse (2001), O'Regan (2003) and Rovai & Jordan (2004) found out that learners face limited physical interactions among themselves in e-learning. The main purpose of this paper that is to explore some limitations in this learning method. Students need necessary hardware for e-learning such as desktop or notebook computers and printers (Kathawala, Abdou, Elmulti, 2002; Hiltz, 1997). Therefore, one of the major technological limitations of e-learning is the necessity of computer hardware and relevant resources. Hardware and other ICT resources are necessary for e-learning implementation in institutions. Most of these problems are being addressed by the cloud computing technology. In recent years e-learning has grown into a widely accepted learning model. Innovative changes in e-learning applications have also been witnessed. Also Cloud computing has become one of the hottest buzzwords in the IT area. Many companies and institutions are rushing to define clouds and provide cloud solutions in various ways. Cloud computing allows an e-learning system with the infrastructure which is reliable, flexible, cost efficient, self-regulated, and QoS-guaranteed. In this paper we would establish the link between these two major developments in the IT sector. We would also study the relationship between green computing and education as green computing is considered to be the ultimate outcome of the cloud.

According to Wikipedia, Sustainable development (SD) is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. E-learning promotes sustainable learning practices by providing ways to save resources. Another technology that makes e-learning simple, widespread and sustainable is the development of tablet computers and laptops. The smart phones

also are a part of this set of portable devices which serve the purpose of e-learning very well without the need for an elaborate infrastructure. These devices are wireless and that is the major advantage. Being wireless, they do not need a wired network infrastructure and hence save a lot of resources. Another benefit is that they are portable devices so people do not have to buy multiple devices to work at multiple places. This saves a huge amount of computing resources and ultimately contributes to saving the environment to some extent from the problem of electronic waste disposal because the more devices we use, the more we dispose.

NEED FOR E- LEARNING

Teaching students in classrooms is the traditional way of teaching around the world. Shifting to the modern approach of E-learning is a challenge but it remains an interesting and promising area of research. In some regions there are barriers to accessing traditional forms of higher education, particularly in areas with a large rural hinterland, or where mobility is restricted such as in developing countries like India. Even in urban areas e-learning plays an important role as the students are becoming more technically savvy, and want to access their course materials from the Web. E-learning systems usually require many hardware and software resources. There are many educational institutions that cannot afford such investments, and cloud computing is the best solution. Learning is not limited to university students but we see the emergence of lifelong learning.

The gap between globalization and sustainable growth continues to widen. One strategy to fill this gap is the delivery of higher education globally by using the power of ICT. The inefficient use of fossil fuel energy in commuting to and from campus, coupled with the high-energy content associated with production and delivery of printed books, suggests an expanded role for e- learning. More specifically, rising fuel prices throughout the world has generated increased interest in using the Internet to support higher education. Going green is an integral part of sustainable development. Achieving sustainable development is a challenge necessary to ensure the well being of our world and its people. Therefore switching to e-learning not only enables spreading of knowledge around the world but it also contributes to sustainable development.

HOW IS E LEARNING THE "GREEN LEARNING"

Green Learning can be described as the type of learning that supports the environment. Whenever we refer to the phrase Green, it implies the protection of environment from the harmful impacts of technology and development and ultimately the concept of reduce, reuse and recycle. A move to eLearning will not only reduce overall costs of learning but also contribute to environmental sustainability through energy conservation. By switching to online learning, we instantly reduce the largest contributor to our carbon footprint, travel. Online learning options using learning management systems and web/videoconferencing can cut back on the need for traditional physical classrooms (and other infrastructure) while also reducing travel costs and associated energy use.

In a traditional teaching set up, the students and the teachers and all other supporting staff has to travel to the campus which significantly increase the carbon footprint of everyone involved. Then there is a huge infrastructure set up for the academic institute which again leads to usage of more resources and energy.

Another aspect of classroom training that is particularly harmful to the environment is the printing out of classroom materials. This leads to consumption of huge amounts of paper. With technologies like Adobe PDF and other collaborative services for document sharing, there is no reason to continue with this model. Making these resources available online has many benefits. First of all, learners can access them on demand from any PC, so if they are at home or away on travel, they can still have access to the information. Secondly, the resources become searchable, so if you are looking for a specific content that you vaguely remember from the training, you don't have to flip through pages to try to find it, but you can just type in a keyword and the PDF returns the page number instantly to you. Finally, if a learner does want a print out of a set of steps to achieve a specific workflow for example, they can print out that single page and save on the other pages that they would have otherwise. The reductions in printing costs as well as the positive impact to the environment are obvious here. Based on this criterion, e-learning can be described as green learning because it saves tremendous resources, mainly petroleum and energy used in transportation of people from their place of dwelling to the place of learning. E-learning enables learning to be delivered on your desktop or even your mobile thus avoiding a whole lot of logistics exercise associated with classroom learning. E-learning is an approach to facilitate and enhance learning based on computer and communication technologies.

BARRIERS TO E-LEARNING

E-Learning emerged in late 1990's and has grown significantly since then. However the success of E-learning has been mostly limited to the developed countries. In rest of the world E-learning is yet to succeed. The barriers to success of e-learning are as follows:

Language barriers: Most of E-learning content is developed for a particular audience, hence the language & accent is usually in English. E-learning content has to be localized to account for local languages. Mindset barriers: For many people, learning has to be face-to-face – i.e., person to person contact is essential. E-learning is seen as too synthetic and impersonal. The general perception is that e-learning is not true learning. Lack of awareness of available online courses also hampers success of e learning.

Cultural barriers: They arise due to the differences in Learning style or preferences. Cultural problems concerning credibility of e-learning. Different people have different attitude towards e-learning and some fear lack of credit or certification after completion

Time barrier: Time management problems occur due to different time zones across the globe.

Interactivity barriers: They arise because there is lack of communication between the participants of an e-learning group. Interpersonal barriers also arise as the e-learning content not always audience-specific

Other technical problems include Limited online course availability, Registration system problems, Connectivity problems, Navigation problems, Limitations of technical support.

Bandwidth problems: They arise due to limited bandwidth availability in certain areas. It may also lead to loss of data and inability to save or transfer data

RESOLUTION OF BARRIERS TO E- LEARNING

Advances in hardware technologies, open source software and ease of communication have made it possible for a wide range of people to own a computer system at reasonable price. Most of the computer users have a high speed Internet access that keeps them connected to the world. The availability of both computer and communication technology has enabled the shift to e-learning for both formal and informal education across the world as a way to provide higher education for a wide range of people at an affordable cost.

E-learning offers a mechanism to overcome these barriers of access and mobility by providing convenient and safe access to education. The real impact that E-Learning on education and training has been achieved through use of online technologies especially the ones promoted by Web 2.0 over the cloud platforms to support both asynchronous (self-paced) and synchronous (collaborative) learning.

Asynchronous learning is the self-paced learning occurring at different times as per the convenience of the learner. Self-managing learning environments are preferred by adult learners as they offer the facility of making curriculum available 24/7. The learning content is in the form of recorded live events and online documents.

Though this mode of learning does not provide direct interaction between the teacher and the student, the technologies like person-to-person contact through email, threaded discussion, phone and video make the scenario better and more interactive.

Synchronous learning is the real-time learning that brings the instructor and student together at the same time in a live event. Synchronous learning involves social learning principles and dynamics, whether the interaction is one-one, one-to-many, or many-to-many. The synchronous learning uses the tools provided by Web 2.0 such as the virtual classrooms, teleconferencing, chat rooms and instant messaging.

The concept of the "classroom" has been expanded and transformed by new modes of e learning. Today a classroom can be physical, virtual or both. E-Learning makes possible new modes of learning that overcome distance barriers and logistical costs — providing dramatic economic savings. Because the internet is global, our classrooms can now be global.

ROLE OF CLOUD COMPUTING

By creatively pushing the limits of cloud computing, we can create highly engaging e-learning environments that enhance the learning experience of the users. The potential and efficiency of using Cloud Computing in higher education has been recognized by many universities throughout the world. Cloud Computing offers to universities the possibility of concentrating more on teaching and research activities rather than on complex IT configuration and software systems. In addition, cloud solutions can be used to support cooperative learning and socially oriented theories of learning, using computer technologies to support collaborative methods of instruction. Cloud computing offers many benefits to e-learning solutions by providing the infrastructure, platform and educational services directly through cloud providers and by using virtualization, centralized data storage and facilities for data access monitoring.

Cloud computing provides much more than the services and infrastructure. It makes the hard disk of client machines almost redundant as all the data storage occurs on the servers. The client machine only needs the processor, RAM and Internet connection. Reducing the hard disk usage provides multiple advantages. It reduces the cost of production of the client system and increases the lifespan of the computer as the processor and RAM can be used for a much longer time. It's only the hard disk that needs constant replacement, thus adding to the wastes produced. Since the number of clients is much larger than the number of servers, reducing the hard disks in clients helps in reducing the impact of computer hardware wastes on the environment. Also the systems without hard disks that use the services of cloud computing consume much less power and emit much lesser heat, and this directly helps in greener environments and sustainable development.

The role that cloud computing can play in making e-learning successful can be seen by various tools for learning supported by cloud computing in the next section. One specific strategy called blended learning combines the best features of the traditional classroom with the power of the Internet and e-learning. Providing enhanced blended learning opportunities throughout higher education can contribute to the goal of achieving sustainable growth in a globalized economy.

WEB 2.0 TOOLS THAT SUPPORT GREEN LEARNING

Cloud computing has given birth to Web 2.0. 'Web 2.0' is an umbrella term for a host of recent internet applications such as social networking, wikis, folksonomies, virtual societies, blogging, multiplayer online gaming and 'mash-ups'. Whilst differing in form and function, all these applications share a common characteristic of supporting internet-based interaction between and within groups, which is why the term 'social software' is often used to describe web 2.0 tools and services.

The following tools of the Web 2.0 could be used in an educational context.

Wikis: "A wiki is a website constructed in such a way as to allow users to change content on the site". They enable every user to actively manipulate the content of a web page. When using sites like Wikipedia to convey learning content, the interaction of the user with the material can foster the learners' motivation. In an ideal situation the community behind the wiki tries to make it as top-quality as possible. Wikis are used in Education to support collaborative work, to produce a course or study material in cooperation with all academic stakeholders such as lecturers and students and to distribute information to students.

Blogs: The wiki is a way of constructing knowledge; a blog is a way of distributing news. There are one or several authors that produce entries about a topic and visitors can add comments. It is possible to subscribe in order to receive news via email or through RSS readers. A more recent development uses the blog as a way to deliver learning materials to a community. What make them interesting for learning purposes are the simple and approachable design as well as the possibility for the users to comment on every blog post. Some professors already maintain their own educational blogs and post new content as well as respond to the users' comments. Teachers have used blogs as an easy way to produce dynamic learning environments without previous knowledge of html. Students have used blogs as an alternative digital portfolio or as a learning log. Ultimately, blogs have been used as support for collaborative work.

Video repositories: To share video clips at YouTube or some of the several sites that offer this service has become a welcome way to introduce audiovisual material in eLearning courses. Some specific web sites focus on instructional or educational videos, such as Teachertube, Our media, Sclipo, Expert village, Ubu films and EngageMedia. This has helped to solve technical or size-related problems in the distribution of audiovisual products for eLearning courses. While some eLearning institutions have included online video as a resource on their websites, some professors prefer to access public open resources via Stickam or UStream to distribute videos to their students in their distance lectures or coaching sessions.

Shared documents and podcasts: Video clips are not the only kind of documents to share. Professors and students are used to accessing multimedia presentation, written documents and images, for example. As for the audiovisual perspective, podcasting is a different way of sharing audiovisual material. As opposed to YouTube or similar sites, in podcasting documents are downloaded on the client computer for a free use. There are also quality differences. Podcasts are audio files which are distributed to an audio enabled RSS reader like Apple's iTunes. Similar to blogs they started as personal diaries and are now being used for different purposes: from conveying news, to promotional uses and most recently education. There are foreign language tutorials and workshops for many different topics available. Apple started in 2007 to aggregate educational podcasts of American Universities under the name iTunes U. These include course lectures, language lessons and lab demonstrations. Podcasts share some characteristics with audio books as they make it possible to learn even while driving a car or cooking a meal. They have however the additional benefit of being free and often more up-to-date.

For educational purposes, digital reusable learning objects repositories as well as the Open Courseware consortium or the Open Educational Resources initiative have become available. The methods of E-Learning 2.0 are promising but have not realized their full potential yet.

Social networks: A social network is a collection of Web 2.0 technologies combined in such a way to help focus on the building of communities of people who share interests and activities, or who are interested in exploring the interests and activities of others. Participants in a social network usually engage in a variety of forms of communication and information sharing, which can include personal Web pages, blogs, and discussion groups. The current interest and popularity in Web 2.0 applications has led to the phenomenal popularity of social networking sites, such as MySpace and Facebook. Research shows that students these days spend at least some time on social networking sites in a week. Social networking places its focus on the learner and the interactions and provides a relatively informal space that allows learners to exercise their own thoughts, reflections, make their own connections.

CONCLUSION

If we go the green way for learning, we can make a huge contribution to sustainable development. Universities and Corporations benefit from learning through cloud by reduced infrastructure costs, lower software installation and training costs and increased speeds of analyzing and presenting data. Apart from being green through energy savings, it minimizes overhead costs (as courses are delivered 'on-demand'), increases scalability across global branches (as courses are replicated on secure servers closest to the learner), and eliminates downtime during heavy usage (as learners are transferred seamlessly to a free server closest to them). Green Cloud Data Centers can be promoted to reduce data center energy consumption by locating them in cold regions, utilizing wind and solar power, employing low-loss direct current, and using tunnels and other underground sites with strong earthquake resistance and stable temperatures.

Development is a process fueled by resources and it is imperative that much more be done to make certain that these can equitably meet present needs and also remain available for the development needs of generations to come. There are no easy solutions. There is, however, a considerable amount of consensus that the most successful approach will involve two key elements. The first of these is education. More people at all levels must be empowered to develop the values, attitudes and skills necessary to change behavior in regard to natural resource management. The second component is greater collaboration among key entities working to make a difference. Technology plays a vital role in achieving both these goals. Change cannot be brought about by any single organization - no matter how large or well resourced. Every person has to understand and contribute their bit towards making a greener planet. In this research we found that we can utilize the services of the cloud computing for promoting green IT specifically the green learning.

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