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**Innovative technologies in digitalization of higher
education**

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Abstract

Digitalization of education is a powerful trend in terms of reformation and modernization of global education environment. Advances in digital technology have opened up many avenues of learning. Technology has made information accessible / transmittable from anywhere and by / to all groups of people. Education has reached most parts of the world and ICT has become an integral part of human life. This paper describes the process of generation, creation and acquisition of knowledge through the technology. The paper relates how these technologies have been used in education and its impact in general.

Keywords: Digitalization, Modernization, Globalization.

Introduction

“Technology can become the “Wings” that will allow to fly farther and faster than ever before – if we will allow it”.

- Jenny Arledge

“Education is not the learning of facts, but the training of the mind to think.”

Albert Einstein

Digitalization of education is a powerful trend in terms of reformation and modernization of global education environment. Digitalization means transformation of all information types (texts, sounds, visuals, video and other data from various sources) into the digital language.

Discussing the phenomenon of digitalization it should be noted that various analysts and forecast experts (mostly British, including Tim Berners-Lee-one of the inventors of the World Wide Web (Stuart, 2014) consider transition of education process into digital stage as the turning point in the history of education. The United Kingdom is assumed to be the first in the world to introduce compulsory software engineering and IT education in the program for schoolchildren aged 5-16 years in 2015.

The stated approach was adopted by the European Union. EU 2020 education development strategy, adopted in 2014, focuses on digital technologies.

Electronic and digital era

Electronic era commenced with the use of wireless electronic communication over 100 years ago. Transmitting telegraph messages and the radio are among the important applications of this technology. The messages were passed through the air, invisibly, on radio waves. Since then the technology use has moved from radio, to recordings, to movies, to television, to computers, to CDs, CD ROMs & the Internet.

This technology was very useful to convey instant urgent messages and well as to make people be aware current local and international news. This has become an informal but effective form of education.

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Supporting technologies and applications

There are a number of technology components available to built knowledge management systems. Local area networks, Internet and Intranets are the backbones. They provide transparent speedy transfer of knowledge among people and applications. Internet applications built using software and tools allow collaborative intelligent access to knowledge. Appropriate access and authentication layers ensure the security aspect of such systems. Data and document bases act as the repositories to generate the knowledge.

Organization of explicit knowledge

Organization and managing explicit knowledge includes generation, creation or acquisition of knowledge. Such activities could be performed through tools such as RDBMS and EDMS.

RDBMS

One of the most commonly used tools to manage information is a relational database management system (RDBMS). RDBMS have been used by IT applications to manage operational data. The same technology is now been used for knowledge management. RDBMS traditionally managed text and primitive data types such as numbers and date. Knowledge has to be represented using beyond the traditional data types such as character strings and numbers. Thus other forms of representations such as images and videos are required. Multimedia databases have immersed to manage such data.

EDMS

Electronic Document Management System (EDMS) is a rapidly developing technology and is considered as the solution for organizations that needs a way to manage the information efficiently. EDMS applications focus on the control of electronic documents throughout their entire life cycle, from creation to eventual archiving. Its functions include document creation, storage and retrieval, management, version control, workflow and multiple-delivery formats. EDMS allows managing the documentation of an entire process. With respect to education this task is achieved through an enhanced and more effective process called e-learning.

Media for explicit knowledge

Explicit knowledge could be represented using different media. Text, graphics, animation, sound and video are the media to represent them. Unlike the traditional media in forms of books information stored digitally can be preserved without any forms of distortion and they can be accessed easily and quickly from any part of the world.

Text

Text is one of the most effective components of representing knowledge. The words embodied as text, convey a powerful message and this has been widely used in handwritten and print media.

Graphics

Text and graphics are the basic components of multimedia systems. Text without graphics will fail to retain person's attention as well as long-term retention. Bitmaps (paint) graphics and vector (draw) graphics are two basic forms of still graphics. Each type has its own characteristics and

satisfies different needs. Bitmaps stores the graphics as seen on screen while vector graphics stores the instructions of how the graphics is created. Color is an important component of a picture. However when producing graphics colors should be chosen carefully to ensure effective and pleasing displays. Human eye react to light intensity and to the three colors red, green and blue. Like in the case of fonts and sizes of text, the choice of color composition has immediate aesthetic impact.

Animation

Animation adds impact to a presentation. Unlike text and graphics these are dynamic time based media. The visual impact of animation is to harness the learning process. Animations usually take forms like moving an object across the screen, user-controlled movement of an object, bitmap flipping and full animation files. Authoring tools are used to create such objects.

Sound

All forms of verbal communication use sound. Technology has been used to transmit sound across the universe. Teacher's voice has been the primary focus in delivering knowledge. Sound could be represented using computers, and MIDI (Musical Instrument Digital Interface) and digital audio are the two basic file types used in multimedia systems. A multimedia system requires the use of speech, music or special sound effects. When used for education, speech should be short, manageable and integrated with other media. It should be used as a complementary to text.

Video

Video occupies the most disk space and bandwidth when used over the network. Hence video can be integrated with other media only through use of edited segmented video clips each conveying a specific message.

Accessing explicit knowledge

RDBMS and EDMS manage the explicit knowledge. They are accessed using various technologies such as Internet, Intranet, Search Engines and workflow tools.

Internet

Internet provides a cost effective global network backbone. It connects users from anywhere, as long as they have access to the web. This has allowed users to host information on their computers and make them available for others. Such computers need to be dedicated for that purpose as users will be searching for information at different times. These sites are called web sites and they are connected to the web on 7x24. This technology intends to provide unrestricted access to information. An educational institute will publish all information relevant to the public through their web sites. This technology has made information accessible as it happens and people access them at any time they want to do so.

Intranet

Intranet is used only within an organization, thus restrict access to information from outside the organization. The appropriate security measures (e.g. firewalls) implements such requirements. These web sites allow employees and authorized users to access information while protecting the same from others. This technology is used to share

confidential information within an organization. Teachers and administrators could monitor the overall status of a student and hence take appropriate actions promptly. Teachers can also make their learning material and exercises available through them. Some e-learning systems runs on these networks with login accounts created for its users.

Search engines

Search Engines are very effective powerful tools that allow text based information retrieval. Web based search engines deploy different types of navigation strategies. Meta searching, hierarchical searching, attribute searching and content searching are among them. This facility is now widely used by most users of the Internet. This has helped researchers, teachers and students to reach the required information and acquire the knowledge.

Workflow

Workflow Tools allow documents and other forms of information to be routed among individuals and applications according to predefined processes. Workflow tools allow setting up the workflow environment in terms of users, types of information, processes, timing constraints and alternatives. These tools are used in some organizations, but not yet exploited by the education sector. Teachers could use these tools to effectively communicate with their students. We see e-learning systems gradually incorporating some of these characteristics.

Using explicit knowledge

The explicit knowledge that was accessed should be able to use effectively. For this it is necessary to ensure that the information gathered is presented in a useful manner. Tools such as Decision Support Systems (DSS), data mining and data warehousing are available for such purposes. These tools are just lying around for use by most users and education sector is no exception.

Decision support system (DSS)

DSS are software products that transform operational data into useful information such as statistical models and trend analysis for used by the management for decision-making. They summarize internal and external data into graphs, charts and simple reports.

Data mining

Data mining is a process to discover new knowledge from existing databases. Here, sophisticated data searching techniques and statistical algorithms are used to discover patterns and correlations in vast quantities of data.

Data warehousing

Many organizations have several databases existing within their organization. A data warehouse attempts to unify all these databases. The technology aggregates the data from different databases and cleans the data in the process of attempting to increase the quantity of the data. Effective data mining could then be performed.

Sharing knowledge

Knowledge sharing is done among a network of people. Communication among people could be done through paper mail, fax and telephone. However these techniques are synchronous and less effective across geographical

boundaries. IT provides more effective solutions through the use of e-mail, video conferencing, virtual meeting, and document collaboration. Combined use of knowledge sharing techniques will allow reaching them beyond geographical boundaries and performing businesses and services more effectively.

E-mail

E-mail allows sharing knowledge asynchronously. An individual could share knowledge with a community by sending a message to a group of people. Distribution list eliminate the need for everyone to remember the names of the community and also ensure everyone gets the message.

Video conferencing

Telephone allowed voice communication among distant personnel. This has evolved not only to view a live video of the person but also to connect to a number of people. Although the technology is costly it is been used for scheduled meetings involving people internationally. Universities having campuses spread over a larger geographical locations have their staff meetings through such technology. This saves travel time of individual. If the time saved and it is used effectively the organization and society will benefit in the long run. Some universities use this technology for teaching as well. Students ask questions by posting them to the teacher using the technology. Such systems require each student to have their individual computer with the ability receive and interact with the system.

Virtual meeting

Virtual meetings allow people from different locations connect with each other to conduct meetings and share knowledge as if everyone were in the same room. Applications such as presentation graphics, spreadsheets and word processing can be shared in real time. Educational Institutions created to deliver knowledge have yet to adopt technology for this purpose. Universities, technical education centers should use them on regular basis. In developed countries computers has become a day-to-day tool like a radio and a television.

Document collaboration

Document collaboration lets team members' work together with many other participants with documents or information in real time. Everyone can manage and use information in real time. Documents in digitized form can be transmitted to a remote place in the exact form and reproduced any number of times. Digital information leads to tremendous saving of space, time and maintenance, while providing easy access, storage, management and retrieval of information. Chances of non-availability, losing or misplacing of documents is rare and documents that fall under this category are accessible even after many years of isolation.

Changes taken placed

Availability of vast amount of information on the web has provided access to all types of learning material. The teacher's lecture notes are no longer the primary focus of a learning process, and the teacher's role and the student's learning process is changing.

Method	Teacher	Student
Verbal explanations	Dictate	Listen and copy
Writing during class	Blackboard/ whiteboard & Chalk / Pen	Copy notes
Pre-written transparencies	Overhead Projector	Copy notes
Pre-prepared slides	Multimedia projector & computer	Printed material
e- learning	Provide learning material	Learn through participation

- 1) Classroom level
- 2) Teacher's role
- 3) Student's role
- 4) Curriculum
- 5) Assessments
- 6) Language barriers
- 7) Society
- 8) Infrastructure Facilities

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