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Learning Technologies and Developing Countries

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ABSTRACT

Information technology has contributed in improving the learning process topics which were difficult for teachers to explain are now taught easily with the help of multimedia, smart boards and simulations. Gaming concept became more popular for k-12 students where they learn by playing computer games. Web 2.0 features changed the concept of class boundary.

Social media services have it possible to interact with teacher and classmates at anytime from anywhere. However, one of the main issues in developing countries is unawareness of educationist with the use of appropriate technology. We present a study of different learning theories, learning styles and supported technologies currently used by educationists to bridge this gap. We also present how research has been conducted to fulfill the need of pedagogic evidence base for different aspects of the technology/media in educational use. We identify important factors that impact selection of appropriate learning strategies. Based on these factors, we relate learning theories and learning styles with technology so that maximum utilization of technology could be achieved. This would be helpful for educationists to become familiar with various available resources and use these resources so that the effectiveness of learning process may be improved.

KEYWORDS: Information technology, Educational media, e-learning, Multiple Intelligence

INTRODUCTION

Information technology has emerged as a significant instrument of teaching. It has provided a potentially valuable teaching aid across the curriculum. It has brought a revolution in the field of education. We need to know the effectiveness of various educational media for its effective use in learning process. If proper method is applied to make use of particular medium, the result is improved to learner's advantage [1]. Internet services are proving a useful aide for information dissemination and education since it helps in improving student-teacher interaction than the traditional learning environment. Horn et al., advised that blended learning is also supporting the rural area students where the teachers are not willing to go and teach [2].

E-learning is modernizing trend of traditional face to face learning process by web-based educational cyber-worlds. In ttaro et al.,[3] view point, students learn available educational material from online without the physical presence of the teacher. Lin B.S et al.,[4] pointed the main advantage of this online system is that a earner has flexibility of time and choice to read the topic according to his need. Similarly, Kayssi A et al.[5] opines that studying individually, a student has flexibility in the choice that they can adjust their time also(how long to view and how much time he wants to give a specific topic). Computers and mobiles are replacing textbooks with e-books and computer based games are replacing physical games. The technology is replacing the paper and pencil and so improving the learning outcomes. Interactive learning process has evolved the digital technology and many schools are using social networks as integral part of education. By the use of information technology teacher uploads the lecture online and class time is used for practical work.

In order to bridge the gap between technological advancements, in the education sector, of the developed world and lack of awareness in the developing or underdeveloped countries, this study presents a brief overview of current e-learning educational technologies. We also present research has been conducted to fulfill the need of pedagogic evidence base for different aspects of educational technology/media i.e. its usage, cost effectiveness and benefits of these branches of technology follows herewith, extracted from the present literature. These aspects have been explored both from instructors' and the learners' perspectives.

2. Types of Educational Media/Technology

Technology can be referred as hardware and software whereas educational technology can be defined as tools that are helpful in learning process. There are many such tools and technology which should be used in class to aid teaching and learning process. The terms computer assisted learning, computer aided learning, technology enabled learning are most frequently used in literature and all these are related to information technology. Technology helps students to learn by using other than traditional resources which increases their interest. The role of technology is not only limited to formal classes as many tools, simulation and other resources are available online. In this section, we present a selection of educational media and highlight their main features so that efficient utilization of these resources could be discussed in the later sections.

2.1 Blogs

Blogs are amongst the variety of Web 2.0 implemented tools. Word blog which is derived from "weblog" is basically a website dedicated for sharing the information and discussions. The most recently shared information appears first and

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people participate in discussions by giving their remarks. These are multi-author blogs may be used by university students to share info about lectures or may be discussion group created by think-tank. No such technicality is required to comment and share in a blog and now GUI widgets and other tools are now used to comment and share rather than HTML and FTP [6].

In recent years, blogs are being used at large scale in educational services like information sharing and collaboration because of their easiness and rapid development. Inocencio Maramba and Steve wheeler [7] recommended that the blogs offer rich multimedia environment, so the audio and video media can be downloaded in portable devices for "anytime and "anywhere" learning experience.

2.2 Wikis

Wikis are also from the same Web 2.0 variety of implemented tools. Wikis are free online articles which can be edited by anyone. They are like free online encyclopaedia, so any author can add the article and contents can also be changed by using the wiki software. As a result there is lack of reliability because the information may be biased or ambiguous. One of the main advantages of wiki is easy and free access of information as compared to printed encyclopaedia. Another main advantage of wiki is parallel sharing of information as anyone from anywhere can work with you on same document.

The two main pros of wikis and blogs are their simplicity of use and the availability of many Open Source/free or low-cost software and hosting options to run them. Wikis and blogs use RSS, which helps users to set up/subscribe easily to 'feeds' to automatically obtain content updates from their favorite services. These are considered as a serious quality issues, as a reason of their free form nature and be deficient control over their content. But according to another opinion it can also be their extreme strength.

2.3 Class website

Class websites are specifically designed to share the class materials. The controlled access in given after login, so that student can access the data which is related to his class or section. We can post assignments and reply the queries regarding that. Website can also be managed in a way that students can submit their assignments electronically. The discussion forums facility can also be provided to help the students discussing any topic with class fellows and teacher. One of the example of class website is CALcampus [8] which provides distance learning support.

2.4 Simulations/Models:

Digital Models and Simulations can assist the teachers in explaining concepts that are too enormous or too minute, or processes that occur too rapidly or too slowly to demonstrate in a physical classroom. According to Eric klopfer et.al., [8] point of view the difference between digital games and simulation is lack of no "win-state". One of their most widespread projects is the Molecular Workbench. This workbench offers to science teachers the simulations about topics like fluid mechanics, chemical bonding and gas laws etc. Skilled Teachers can create activities with text, models and interactive controls in the system. Certain other simulations by the organization are helping students to experiment with virtual greenhouses to understand evolution, software helping to understand the physics of energy efficiency by scheming a model house and simulations of electrons interaction with matter.

2.5 Online Stream Videos:

Teachers and students all over the globe are finding that videos chosen carefully help both to study the subject matter more deeply and also to recall the information they have learned longer. Many students anticipate information to be accessible in a flashy and an entertaining way. Videos help to draw them in. There are many valuable videos that could provide additional learning. Cisco report [9] have stated that, "the pedagogical impact of video can be summarized by three key concepts which are:

- Interactivity with content (the learner relates to visual content, whether verbally, by note taking or thinking, or by applying concepts)
- Engagement (the learner connects to the visual content, becoming drawn in by video, whether on-demand or real-time)
- Knowledge transfer and memory (the learner may remember and retain concepts better than with other instructional media)".

There are many online streaming video websites where one can watch and share any video of one's choice. Some universities have their own websites and others use DailyMotion, vimeo and YouTube etc. YouTube is an opt-in agenda that allows educational institutions to access thousands of educational videos from vetted YouTube channels like PBS, TED, and Khan Academy in a safe and controlled environment. The teachers and administrators choose what videos are accessible to their students. There are also many other sites working for this purpose.

2.6 Online Forums

An online forum or a message board is also called online discussion group, bulletin board or web forum. It is different from a blog. It is a discussion area on a website where members can post discussions, read and respond to posts by other forum members. The online discussion forums let the students to work collectively on projects in small groups. It helps to contribute in on-going discussions focused on course content and to present group project products to other classes. All this work is independent of student location and time of actual participation in the discussion forum. It is synchronized

with a separate web site for the readings and assignments of online course. It is not a situation for few primed students to act in response to a lecturer while the rest of the class sits back. Contribution in the virtual conference demands that students become energetically engaged with the course content and through the communication with their peers, negotiate significance of the content. They gain knowledge through the shared experience that each participant brings to the collaborative discussions. It is expansion of the knowledge base as skills, experiences, intellectual exchange and learning are shared and compared relating to teaching issues.

2.7 Email

Email correspondence in the educational environment provides many advantages like speedy delivery, improved and more instant communication, freedom from the limitations of location and time, decreased social isolation, potential for increased interaction, improvement of writing skills and increased internet experience. The omnipresent use of email for response and feedback in the classroom is providing the medium a new level of credibility as an educational tool. Email is a superb tool for delivery of feedback to learners. Once a basic indulgent of feedback's role in learning is established, one can start to focus on how best to take advantage of the educational functions of the communication medium. There is a bit hesitation that email is altering how we communicate and learn. In a study of the effectiveness of email as a communication and instructional aid between instructors and learners, Yu and Yu [10] found "empirical evidence supporting the usefulness of email as a promising aid to promote student cognitive growth pertaining to computer knowledge and skills". Tao and Boulware [11] suggest that email communication facilitates teachers by "identifying instructional focus and taking advantage of instructional moments to fit the developmental needs of their students in authentic situations". They also noted that email inspires learners, give confidence authentic communication and builds new learning opportunities. But some dark aspects exist regarding Email communication. Woods and Keeler [24] cite research highlighting the potential social negatives of email use such as user isolation, user depression and loneliness, and the potential lack of the learning community.

2.8 Virtual classroom

Virtual education is instruction in a learning environment in which Instructor and Learner are alienated by time or space, or both, and the Instructor endows with course content through the use of methods such as course management applications, the Internet, multimedia resources, and videoconferencing. According to Kurbel[12] students receive the content and communicate with the teacher via the same technologies. This technique has many advantages. In this environment student develop their critical thought skills and language. 24/7 assistance is available to the seeker. Although every institution does not have enough financial resources to make its virtual classroom, yet those who can afford to establish their virtual class room by the use of modern technologies like ESL/EFL need not go to a real classroom.

2.9 Digital Library

Digital libraries are eye-catching as a vital part of digital learning environment. The notion of "digital library" is focused on a wide range of definitions. Different viewers associated with a digital library have different interpretations; they appraise a digital library in a various ways and use different terminologies. Digital Libraries are also thought to be related to physical libraries performing similar functions, making a hybrid library (combining traditional and electronic resources). According to IITE Training Materials[13], Digital Libraries are considered knowledge repositories and services, organized as intricate information systems. Its advantages include Management of documents in all formats in a unified way is at top – texts, video streams, e-books interactive exercises, animations, audio files, e-journals and online tests can be stored, described and distributed through internet. It is independent of the type of information. For sharing purpose, it is also independent of human intervention, making the whole process faster and cheaper. Access control can also be implemented easily. Content sharing, like metadata, Interactivity, Customization, Reuse and Cross-institution cooperation is also part of its pros. According to Ana M.B. Pavani [14], students cram in different hours in any day of the week this is considerable when distance learning is considered.

2.10 Epistemic Games:

Game base learning is the process of learning by playing the games. These computer based games are used to teach an educational content. The impact of game based learning has been in discussion since long but without conclusion so for. According to Klingberg T et al., [15], one of the benefits of game based learning is promotion of cognitive abilities like memory retention and analytical skills.

Students play their role as engineers, architects and planners to solve the real world problems and they learn many important concepts by playing the games. There are different games which are designed to fight the diseases like cancer and give the physiological strength to help in fast recovery of patient.

2.11 Wireless classroom microphones:

In noisy classrooms with the facility of microphones, students are able to hear their teachers more clearly. Students learn better when they listen to the instructor clearly. Using wireless class microphone teacher can teach in normal tone and is helpful for teachers in the ways that no longer drop down of their voice. The microphone creates where last benchers can also hear what the teacher says; so everyone concentrates which improves the teaching efficiency.

2.12 LCD projectors:

LCD projectors enable educators to attract students by multiple approaches. Students benefit from watching, listening and interacting with technology instead of simply reading a textbook or listening to a lecture. Integration of text with audio, video helps to make topics of discussion in a classroom lively. Digital imaging-based presentations, web jaunts and interactive simulations also become possible with an LCD projector.

2.13 Interactive Whiteboards/Smartboards:

An interactive whiteboard provides touch control of computer applications. It enhances the experience by screening in the classroom everything that can be put across a computer screen. It helps not only in visual learning, but also in writing, influencing images on the interactive whiteboard and providing the opportunity of interaction to the students. SMART Technologies provide guidance in classroom communication linking students and teachers using computers. SMART-boards are a way for students to keep on engaged in lessons. It is an interactive white board that permits the teacher to project an image from a laptop to the screen. The teacher can even digitally draw on that image. Graphs and tables are available templates in them. These can pile up lessons and digitally improve simple templates into customized learning tools. A wide range of applications are possible with this technology, and students are gaining to a great extent from it.

Touch-screen projectors like Smart Board, Mimio, Pico and Promethean Board are used to manipulate screen by hands rather than through computer or remote. These touchscreen machines are connected to computer sense the board area and submit the signal back to machine. One of the advantages of this process is that the teacher is free to move in the class and visit the board when needed. The students can also use the board and manipulate by themselves. These boards are just like iPads with a size of projector screen. Their performance multiplies when they are connected with different online software tools.

2.14 Document Camera:

Document camera is also called visual presenter and used to display the objects to large audience [16]. A document camera is one of the easiest and quickest ways to integrate technology into the classroom. No special skills are needed to use this piece of equipment. A classroom document camera can be connected to a DLP/LCD projector through a computer or connected directly to a DLP/ LCD projector. This can be used to actively engage the students in the learning process. Visual learners will benefit from the use of a classroom document camera by seeing small items, text, demonstrations in a much bigger way. Hands-on learners can also benefit from the use of a document camera by allowing them to be the ones placing objects or items under the document camera and explaining what they are showing. Another benefit of using a document camera is the decrease in copying expense. Schools are always looking at ways to minimize the expenses in view of the paucity of financial resources.

A classroom document camera can reduce drastically the extent of copying a teacher has to do. Instead of copying 30 quizzes for a class, place 1 copy of the quiz under a document camera and either have students answer the questions on a sheet of paper or use clickers such as the Classroom Performance System (CPS) to have the students answer the quiz questions.

2.15 Podcasts:

Podcasting is sharing of audio and video contents across the internet for free. Ccontents of your interest are automatically downloaded after your subscription [17]. These downloaded files are available to listen anywhere and anytime. You get the notifications when the new content of your interest is available. Like blogging you can also create radio style shows and broadcast them without any cost. It allows the teachers to share the lectures with students and all the subscribe students can listen the lecture by their convenient time.

2.16 Flashcards

Flashcards do not frequently contain a visual element that is added to the learning process. Numerous learning activities and games are centered on visual flashcards. These consist of words as well as images. Generally a flashcard has a problem or concept on one side and the answer on the other. Occasionally, one side has a visual element, which is predictable to help one to memorize the key idea or concept.

2.17 Virtual Reality:

Virtual reality is being applied in education by past many years and is acknowledged as a powerful medium of instruction. Virtual reality is the simulated environment where users interact with avatars/graphical images which represent people [18]. This allows the user to process the tasks which are difficult to implement in real word due to their time, location and cost effects. One of the main advantages of virtual reality is that it doesn't require the physical presence of the environment, person or any other resource. Today in science field many topics are being taught by using 3D models like in forensic pathology for autopsy procedures etc.

2.18 Virtual Manipulatives:

Manipulatives are physical objects used to educate mathematical concepts and virtual manipulatives are online version of these manipulatives. The virtual manipulatives are web-based rather than standalone applications. According to

Moyer, Bolyard, & Spikell [19]: "An interactive, Web-based visual representation of a dynamic object that presents opportunities for constructing mathematical knowledge".

By help of visual representation students can touch and move objects to learn the mathematical concepts which may be numerical or operational. Learning mathematics requires the student's engagement and manipulatives help the student to visualize the relationship and applications.

2.19 Probs and Sensors

Also called as Probeware used to acquire, analyze and display real time data with the help of computer [20]. The way to create the ability of graph motion by taking auto focus sensor from polaroid camera and connecting with computer graph program. Now this concept ultrasonic motion detection is being used in all over the world and the students use it to capture real world data and translate it into graph. This process saves a lot of time because they don't need to translate this data into graph. When we connect the ultrasonic motion detector to a graph, it gives the real time feel to handle fast moving or slow object. Collecting real time data through probes and sensors are widely used in educational applications i.e. to calculate the dew point with a temperature sensor, test pH and its effects etc.

3. Comparison/Features/Summary of existing E-Learning Technologies

Learning styles impact how well one learn in certain circumstances. Some learn unsurpassed by hearing information, while others learn superlative by seeing it. A number of different theories have emerged to describe how students prefer to learn best. Paying attention to "best practices", and innovative teaching methods will make learning strategy more effective.

Learning process can be conducted in formal or Informal way. Formal learning is classroom-based, provided by trained teachers and organized, guided by a formal curriculum, leads to a formally recognized credential. Informal learning happens outside the classroom, in after-school programs, community-based organizations, libraries, or at home. The goals of informal and formal teaching methods are often very different. Informal teachers seek a rapport with their students. Both formal and informal education settings offer different strengths learning strategy for a particular project. If your project fits in the classroom, it can have a very long life; teachers will use trust resources for years. After-school programs offer a different kind of environment, where your activities don't need to be as formal and where you can reach a different audience.

One of the major factors that affect the choice of learning strategy is the cost of learning. As some learning theories, styles are supported by latest tools and technologies that increased the cost of learning. In order to select an effective learning strategy it is important to consider whom that the intended learners are. As learning theories, learning styles and supportive technology vary for adults learning and childhood learning.

For making learning process effective it is important to consider individual difference in learning. There are individual difference in acquisition and learning. There are different approaches for dealing with individual differences among learners that improve the learning process. For effective utilization of resource the other factor is training required for use of that resource. Some technologies are not so easy to use and we training is required to use that resource. So to properly utilize the resource there may be need of training for person using that resource.

Information Technology has provided many compelling and promising tools for teaching and learning. An attempt has been made in the present literature to describe the benefits of this technology and efficacy of its use. Media types with required resources are listed in table-1. The said table also contains the benefits of media, efficacy and education level in which level these are mostly used. The table enlists all the required resources other than computer and internet, the latter being the mandatory requirement of every technology.

4. Mapping Multiple Intelligence and E-Learning Technology

Education means learning knowledge, skills, and attitudes. The most important of these is learning how to learn. Teaching, by itself, does not constitute learning; neither does passive listening. Learners must decide to incorporate any knowledge, skill or attitude into their own set of values and behaviors (lifestyle), or the learning is not meaningful. Learning happens outside the classroom as well as within. Some learning results from teachers and some does not. For effective e-learning strategy, there is a need to select appropriate learning and technology. In this research study we have tried to relate learning styles and supportive technology. In table-2 we have shown the relationship between learning styles and supportive technology. The ultimate aim for relating these learning styles and supportive technology is to make learning strategy more effective and enhance learning.

Table 1: Benefits of Media and Technology for Education

S No	Media / Technology	Most effective level	Education Type	Utilization	Efficacy	Concentration
1	Blogs	Andragogy	Informal	Allows to collaborate, share by main stream channels	Share Educational Media	No
2	Wikis	Andragogy	Informal	For collaboration of projects and courses	Easy Collaboration	No
3	Class website	Andragogy	Informal	Share class notes, lectures and tasks for home work	Communication with classmates	No
4	Simulations/ Models	Pedagogy/ Andragogy	Formal/ Informal	Used to model real-life or hypothetical situation	Scientific modeling of natural systems or human systems	Yes
5	Online Streaming Videos	Pedagogy/ Andragogy	Formal/ Informal	Video lecture sharing	Can have video lecture if someone missed	Yes
6	Online Forums	Andragogy	Informal	Online discussion, bulletin boards and web forums	Collaboration in group work	No
7	Email	Andragogy	Informal	Increased interaction and decreased social isolation	One-to-One Communication	Yes
8	Virtual classroom	Andragogy	Informal	Learner are alienated by time and space	24/7 assistance for seekers	No
9	Digital Library	Andragogy	Informal	Knowledge repositories and services organized as intricate information system	Sharing e-journals, e-books and documents in different formats	No
10	Epistemic Games	Pedagogy	Informal	Game based learning	Thinking about problems and justifying solutions	Yes
11	Wireless classroom microphones	Pedagogy/ Andragogy	Formal	Used for digital clarity in voice and room localization	Serves as assisted listening device with headset	No
12	LCD projectors/ Multimedia	Pedagogy/ Andragogy	Formal	Text, videos and simulations can be used during lecture	More interactive learning	No
13	Interactive Whiteboards/ Smart Technology	Pedagogy/ Andragogy	Formal	Like traditional white boards but can be controlled directly by touching special pen or hands	Multimedia lessons, demonstration of projects etc.	No
14	Document cameras	Pedagogy/ Andragogy	Formal	Displaying and capturing graphs, Science experiments, Zoom in small item, Math manipulative, save images, work as scanner	Real time image capture device	Yes
15	Podcasts	Andragogy	Informal	Publish files to internet where individuals can receive by subscription	File sharing	No
16	Flashcards	Pedagogy	Informal	least expensive ways to study material	memorizing vocabulary and math formulas, dates and events for history classes	Yes
17	Virtual Reality	Pedagogy/ Andragogy	Formal/ Informal	Visualization increases the learner's interest and can learn independently, Can learn individually and flexibly	To learn concepts of Earth Science, Medical, space and other sciences	Yes
18	Virtual Manipulative	Pedagogy	Formal/ Informal	Graphical tool to learn Mathematics	Easy to learn Mathematics	Yes
19	Probes and Sensors	Andragogy	Formal/ Informal	To collect real time data	Error free data collection	Yes

According to Felder [21], learning style is "characteristic strengths and preferences in the ways they [learners] take in and process information". Learning styles are different methods of learning or understanding the new information. The way a person easily understands the topic, expresses and remembers the information. According to Prichard [22], learning outcome is improved if the learner is aware of his learning preference and meta-cognition.

Howard Gardner [23] proposed the theory of multiple intelligence, although the theory was not initially for educationist but later on numerously adopted in educational setup. According to Gardner theory every human being possesses nine different intelligences in varying degrees that reflect his learning style. Education can be improved if the lectures are designed considering the multiple intelligence perspective as each student has different intelligence profile. Following are eight different intelligences:

1. Verbal/Linguistic intelligence involves the using of words effectively for spoken and written language. It also involves the ability to learn languages and the capacity to effectively express the idea. These people like reading, writing, poetry and story write up.
2. Interpersonal intelligence involves the interaction with others. These people are more social and like group discussions. They learn through interaction with friends, video conferencing, audio conferencing, blogs etc where they can participate freely.

3. Logical/mathematical intelligence involves analysis, reasoning and calculating. These people analyze the problem logically and resolve the problems scientifically. These students learn the tings while relating the answer logically and like experiments and logic games.
4. Musical intelligence involves composing and recognizing tones and pitches. These people like music and learn better in musical tone and environment. They can be taught better in lyrics and musical tone.
5. Bodily/kinesthetic intelligence involves communication by body language. They can be taught through body movement, hands-on practice and other physical activities.
6. Visual/Spatial intelligence involves the visual/graphical intelligence. They can be taught through graphics, charts, drawings, video and simulations. Intrapersonal intelligence is related to those people who are not social and are shy to participate in social activities. They can be taught independently and like book reading, simulations and one-to-one concentration.
7. Naturalistic intelligence involves recognizing and classifying plants and animals. These people are aware of natural and artificial taxonomies. They learn through relating the things with nature and real life.

Table 2: Mapping intelligence and technology

Intelligence	Strengths	Supportive technology
Verbal/Linguistics	Reading, writing and telling stories	Wikis, blogs, class website, online forums,
Mathematical/Logical	Math and logic related problem solving, Reasoning,	Virtual Manipulative
Visual/Spatial	Visualization and drawing	Modeling/Simulations, Online stream videos
Bodily/Kinesthetic	Using tools and hands on learning	Flash cards
Musical	Singing and listening music	Epistemic Games
Interpersonal	Leading and communication	Online forums
Intrapersonal	Work alone	Email
Naturalistic	Connection with real life	Virtual Reality

5. Related Work

Technology has richly equipped teaching methodologies, in various ways. It has added new dimension to the typical and archetypal teaching methodologies. We have explored assortment of technologies aiding the education in different ways. Simulations have changed the whole facet of a concept elaboration and understanding. These have eased both the instructor and the learner to genuinely involve and engage within the concept to understand it by the use and exercise of real-life modeling or hypothetical situation. Blogs and wikis allow users to collaborate and share by main stream channel. Epistemic Games are wonderful addition to think about problems and justifying solutions in a game based environment. Visualization has increased the learner's interest. These technologies assisted to improve education at different levels and helped to speed up learning. These also open the ways to cross hinders in way of an idea or concept elaboration and understanding. This study reveals that these education aiding equipments have fully changed the educational environment. Benefits of these technologies can be taken by use of very low cost resources.

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