

A STUDY AND ANALYSIS OF PARADIGM SHIFTS IN EDUCATION TRIGGERED BY TECHNOLOGY

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ABSTRACT

The immense impact of information and communication technology on education can be considered as one of the achievement of 21st century. Technology in fresh years has been amalgamated not only as tools to support learning, but also considered as one of the chief constraint for reforming education paradigm and pattern. Invention and fruition of technology have been improved education learning by adding various augmentations, substitutions, or blending of new pedagogical approaches and technologies that have improved education and learning. This paper focuses on the impressive transformation which has taken place in paradigm shift of education in recent years, owing to use of technology.

Keywords: *Education, Information and Communication Technology (ICT), Learning Paradigm*

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1. INTRODUCTION

From Mahatma Gandhi to Swami Vivekanand and Tagore the word education has been defined differently by them all. Their definition of education is viewed as the process of unfolding or developing what is innate in the child. Mahatma Gandhi defined education as all round drawing out of the best in the child and man – body, mind and spirit. According to Swami Vivekananda, education is the manifestation of divine perfection already existing in man and lastly Tagore defines education as, which makes one's life in harmony with all existence and thus enables the mind to find the ultimate truth which gives us the wealth of inner light and significance of life. Even today education means the same to us, but the only difference is the change in paradigm of education due to epistemology of technology which provided us with a new learning paradigm which caused a radical reform in education.

Research findings over the past 20 years provide some evidence as to the positive effects of the use of information and communications technology (ICT) on pupils' learning [1]. Technologies for education classically use a transmission rather than constructivist model of instruction. As the twenty-first century begins to unfold, it is becoming increasingly evident that change is defining the nature of literacy. The impact of the information age has produced enormous impetus for rapid and continuous change in literacy, driven predominately by the appearance of new technologies designed to address the ever-changing needs for information and communication. These new technologies produce new kinds of literacy that in turn produce new applications of the technology [2].

Technology has played a significant role in education and in most successful educational reform movements of the past four decades: charter schools and home schooling; standards, testing, and accountability; best practice; outcome-based learning; professional teacher qualifications, and so forth. It remains a catalyst for changing what we teach—the essence of a personal philosophy of technology.

Technology is available in our classrooms, and it is changing the way educators think about teaching and the way students think about learning. The aspirations of using information technology (IT) in education are to enhance teaching and learning, and to increase the efficiency and effectiveness of the educational organization. IT is increasingly used to complement or substitute conventional teaching methods.

1.1 Perspectives on Technology for Education

Over the last two decades there have been fundamental shifts in the way teaching and learning are perceived and conducted within the education sector. One is a move from

teacher-centred to student-centred education, and another is a move from the traditional to the virtual classroom. Technology can help facilitate the knowledge-constructed views technology as having an influential effect on the teaching and learning processes. They state that with the use of technology in education sector, would become more student-centred and that more individualized learning would take place than ever before. There are many ways of using technology to support instruction. Before computers, a number of other forms of technology—film, radio, and television—had been introduced into the classroom with varying degrees of success. It was not until the advent of computers, however, that instructional technology came into its own as a broad area of study.

Technology based instructional are, The National Programme on Technology Enhanced Learning (NPTEL) is a Government of India sponsored collaborative educational programme. By developing curriculum-based video and web courses the programme aims to improve the quality of engineering education in India. It is being jointly carried out by 7 IITs and IISc Bangalore, and is funded by the Ministry of Human Resources Development of the Government of India. Another best example is National Mission on Education through Information and Communication Technology (NMEICT) is ICT based mission and is working for scaling up of the existing Education Help line - 'One Stop Education Portal'- "SAKSHAT". The helpline shall take care of all the needs of the entire learning community including the students enrolled in various educational institutions and lifelong learners by extensively utilizing e-learning concepts and the ICT based methodology. Gujarat Technological University has started the Video Lecture Telecasting series known as ALCOM. This venture of GTU is supported with the help of technical facility through BISAG – Bhaskaracharya Institute for Space Applications and Geo-Informatics. Vision, facilitating students of GTU affiliated colleges to have an access to video lectures from distinguished faculties all over Gujarat and thus creating a platform of knowledge sharing.

Computer-Assisted Instruction--Some of the first computer-assisted instruction (CAI), developed by Patrick Suppes at Stanford University during the 1960s, set standards for subsequent instructional software. After systematically analyzing courses in arithmetic and other subjects, Suppes designed highly structured computer systems featuring learner feedback, lesson branching, and student record keeping. During the 1970s, a particularly widespread and influential source of computer-assisted instruction was the University of Illinois PLATO system. This system included hundreds of tutorial and drill-and-practice programs. Like other systems of the time, PLATO's resources were available through timesharing on a mainframe computer.

Streaming video is television content that can be delivered to a computer via the Internet. Streaming video offers immediacy and individual control, while video tapes offer a wider range of content and centralized control. Videotapes only require common classroom technology—a TV/VCR. Used in conjunction with one another, these two technologies can deepen student engagement with lessons, strengthen understanding of the connections between history and current events, and offer a practical way for students to make up missing assignments or review material covered in class. Virtual reality (VR) is a modern technology that gives to its users the illusion of being immersed in a computer-generated virtual world with the ability to interact with it. Virtual reality, connected to the Internet and the World Wide Web, can create virtual spaces that contribute to helping an active learning process. Future evolutions in computer technologies will bring ever more powerful graphics to students' desktops, which will relieve some of the current simulation restrictions. Animated demonstrations are increasingly used for presenting the functionality of various computer applications.

The Technology Enhanced Active Learning (TEAL) project at the Massachusetts Institute of Technology (MIT), created by John Belcher, a professor of physics who was concerned with the low attendance and high attrition rates in his department's electricity and magnetism course. Professor Belcher set out to build a studio for learning about electricity and magnetism—a bold move, considering how theoretical this subject matter tends to be.

The Overhead Projector simplifies Visual Instruction which reduces the problem of discipline in the darkened room, makes the teacher's work easier by permitting him to sit before the class, facing pupils, with all notes and materials for the lesson ready at hand. The Overhead Projector provides for this time-and-saving, over-the teacher's-head projection with an ingenious system of mirrors, solidly mounted and practically indestructible. The instrument is inexpensive. It conserves the teacher's energy, concentrates pupil attention, and eliminates the necessity of an assistant

2. RELATED LITERATURE REVIEW

Deryn [6] has identified three distinct relationships between literacy and technology: (1) transformative change, in which technology regularly and systemically changes literacy through the evolution of literacy-based technological advances; (2) transactional change, where technology and literacy interact and change each other as new technologies generate new potential and implementation initiates variations to the technology; and (3) deictic change, which is a constant state of change of both technology and literacy demonstrated

through human impact with new technologies. This is manifested in most cases by immediate human adjustment to the implementation vision of these new technologies.

There are 3 levels of Information Technology adoption [3]:

- (a) Personal productivity aids
- (b) Enrichment add-ins and
- (c) Paradigm shift

Personal productivity aids are applications, which allow teachers and learners to perform familiar tasks faster and more effectively (such as word processor and spread sheet). Enrichment add-ins injects new materials into the “old” teaching and learning without changing the basic mode of instructions. Examples include e-mail, web pages, the use of video, multimedia, and simulation to enhance classroom presentations and homework assignments. The paradigm shift is where faculty and their institutions reconfigure teaching and learning activities to take full advantage of new technology. The result is a mix of the best of the old and best of the new. Considering the paradigm shift, Graham Hills et al. [10] differentiates between the New Learning Paradigm and the old learning paradigms which are spelt out in greater detail in Table 1.

Table 1: The development of the New Learning Paradigm [10]

Traditional	Future	Anticipated benefits
Static	Dynamic	Cheap methods of producing, transmitting and restoring acceptable quality video and animation will have greatly improved the presentation of a wide range of materials.
Impassive	Supportive	Well-designed computer-based learning support systems will have been made highly supportive in dealing with a learner s difficulties. This will provide great scope for remedial teaching.
Single Medium	Multimedia	The imaginative and skilful use of a wide range of media will provide scope for attractive learning, eg audio, video and animation.
Synchronous	Asynchronous	The space and time constraints of traditional presentation methods using lecture and laboratories will have been removed by a shift to self-paced learning using a variety of support mechanisms.
Passive	Active	Learning will be seen as an active process in which concepts are acquired, incorporated into appropriate schemas, and tested in action.
Unidirectional	Interactive	Interactivity offers scope for benefits in clarification, elaboration and consolidation, and is the key to the production of highly supportive learning environments.
Location	Network	Learning can be supported on a network basis across space, rather than in only one location.
Audience	Person	The possibility of developing learning support systems that

		tailor their response to an individual s needs and performance.
Real	Virtual	The use of virtual objects simulated by computer, and which are interactively accessible, offers considerable scope for linking theory and experiment in teaching and technology.

Kathleen P. King [14] states that technology clearly has the ability to confuse, intimidate, and frustrate learners and users. Learning to cope with these necessary new knowledge bases and skills is a complex process for all. In addition, educators have additional needs in this learning process as they are urged to immediately and proficiently bring the new learning to significant educational application in their classrooms.

Deryn M. Watson [6] and Mary Sellen [20] describes that due to the dynamic nature of technologies , IT is not only perceived as a catalyst for change, but also change in teaching style, change in learning approaches, and change in access to information. Further Deryn M. Watson [6] Technology has revolutionised the way we work and is now set to transform education. Children cannot be effective in tomorrow's world if they are trained in yesterday's skills. Nor should teachers be denied tools that other professionals are trained to take for granted.

S. P. Shinde et al. [29] puts forward with implications of new technologies, which are presented in Table 2. He also represent education scenario in India, by stating that due to impact of technologies on education the scenario of the schools and colleges and other institutions providing education has also been changed. Now these knowledge houses are well equipped with all modern technically sound devices that facilitate the learning environment. The use of projectors, DVDs, smart boards, and other modernized devices is an indication that India is also developing in an equal pace with the whole world. Apart from this, different international schools are also making their appearance in India. India is now being placed among the best education provides country of the world.

Table 2: Implications of New Technologies [29]

Traditional Model of Teaching	New Model of Teaching	Technology Implications
Classroom Lectures	Individual Exploration	Availability of networked Computers with guided access to online information and learning Materials.
Teacher as Deliverer of Information	Teacher as a Guide	Availability of networked Computers with guided access to online information and learning Materials.

Individual Work	Collaborative Learning	Access to email and online 'conferencing' tools
Face-to-face Teaching	Flexible and Distance Learning	Student access to networked computers for materials delivery and support
Consistent Content	Fast-changing Content	Availability of networks, web space and web publishing tools; sharing of computer-based learning materials with other institutions

Philip Molebash [23] elucidates that it is no secret that education is slow to change, especially in incorporating new technologies. This is described by as paradigm paralysis, the delay or limit in our ability to understand and use new technology due to previous experiences. It takes new experiences to replace the old ones, and this simply takes time. Unfortunately, education can no longer take the time it wants. The trends in technology are creating a future that is arriving faster than education is preparing for it. We must therefore ask what these trends are and how education will adapt to them.

Shazia Mumtaz [32] explicates one case study on constructivist classrooms that examined the relationships between professional engagement and teaching practice, including instruction involving computer use. Professional engagement was measured by the frequency that a teacher had informal substantive communications with other teachers at their school, the frequency and breadth of professional interactions with teachers at other schools and the breadth of involvement in specific peer leadership activities, mentoring, and workshop and conference presentations. The study found that teachers who regularly participate in professional interactions and activities beyond their classroom teach in different ways than teachers who have minimal contact with their peers or profession. The more extensively involved teachers were in professional activities, the more likely they were to have teaching philosophies compatible with constructivist learning theory, teach in ways consistent with a constructivist philosophy and use computers more and in exemplary ways. Their use of computers with students was not limited to gaining computer competence, but extended to involvement in cognitively challenging tasks where computers are tools to promote communicating, thinking, producing, and presenting ideas.

Geraldine Blattner [9] and Reginald Nnazor [25] expresses that computer use has become increasingly embedded in everyday life. Today's students rely on technology for information gathering, to stay updated on social concerns and national issues, for inter-personal communication, and as a way to learn. It is not surprising to find a similar trend in the academic world; in the last decade research has illustrated how the Internet and various

communication technologies support meaningful educational experiences. Advances in information and communication technology (ICT) have provided unprecedented opportunities for technology-facilitated synchronous and asynchronous teaching and learning on campus and in distance education environments.

Donna L. Rogers [8] highlights on the effectiveness of technologies by stating that researchers conclude that 60% of American students are visual dominant learners, 37% are auditory dominant learners, and 3% are kinesthetic dominant learners. Moreover, trainees complete courses with multimedia in one-third of the time as those receiving traditional instructions, and reach competency levels up to 50% higher.

3. FINDINGS AND ANALYSIS

In this section we present the findings from the literature reviewed in Table 3 about paradigm shifts in education considering technology as the focal point.

Table 3: Analysis of Literature

Sr No.	Author(s)	Major Contributions
1.	Abdulkafi Albirini [1]	He suggests that, in order to ensure a proper functionality of modern technology, we need to resolve this theoretical inadequacy. A possible solution would be to thoroughly restructure “education” and schools, as remnants of the industrial age, into a new paradigm and institution.
2.	Bob Kemp, Chris Jones [2]	They explored the following themes which include the way disciplinary differences affect the use of digital resources and how academic progression is understood by academic staff in different disciplines, and its role in informing staff choices in deploying digital resources for student use. They also address the issue of changing academic practice and the adoption life cycle in relation to use of digital resources.
3.	David Mioduser, Rafi Nachmias, Dorit Tubin, Alona Forkosh-Baruch [4]	They present an analysis schema for the systematic study of these transformational processes in schools using ICT.
4.	David Riley [5]	David Riley in his work identifies three uses of educational technology and evaluates their potential to change curricula and pedagogic strategies. He categorized the first type of use of educational technologies, called ‘functional substitution’, is associated with typical uses of multimedia, intranets and Internet technologies. The second type of use of educational technologies, called ‘functional delegation’, is commonly associated with word processors, spreadsheets, databases and other generic software. and lastly the third type of use of educational technologies, called ‘functional innovation’, is epitomised by computer modelling.
5.	Deryn M. Watson [6]	Deryn mentions that unquestionably, IT has changed aspects

		of the nature of knowledge and the way we access it. But what knowledge do we need in the 21st century? So much of the debate about technology and education is based on the premise that technology will be the catalyst to create change.
6.	Devon C. Duhaney [7]	In his work he explores the integration of technology in the education process and some of the changes they have generated in classroom activities. He also states that Technology is now being widely used in the classroom to enhance and enrich teaching and learning. The availability of new information technology is contributing to many innovations in classroom activities. Strategies/techniques now used to support technology in teaching and learning enable teachers to work collaboratively with students while the students themselves become more immersed in their own learning.
7.	Donna L. Rogers [8]	Donna indicate that implementing technology competencies may be a mechanism, but effective use of technology in the classroom will require a paradigm shift from “teaching” to “learning”, which will require adequate training in technology and learning styles, as well as technical support.
8.	Graham Hills, David Tedford [10]	Discusses about the ingredients of the effective education and training.
9.	Jo Dugstad Wake, Olga Dysthe, Stig Mjelstad [11]	Their study revealed a complex relationship between the introduction of technology and changes to teacher roles, and the teaching-learning environment in general.
10.	Judy Sheard, Angela Carbone [13]	The student-centred, technology-enhanced paradigm has influenced teaching practice and the ways in which students approach their learning. However, in their study they discussed about the indications that educators and students were having difficulty achieving the ideals of this educational paradigm.
11.	Kathleen P. King [14]	New technology is being introduced at such a rapid rate today that it is difficult for teachers to keep up with it on their own, because of this, professional development of teachers has become more urgent.
12.	Katie McMillan Culp, Margaret Honey, Ellen Mandinach [15]	According to them educational technology has evolved steadily, from the stand-alone computers of the 1980s, to the networked, multimedia workstations of the 1990s, to the highly portable and wireless devices that are beginning to proliferate today. Further, just as technologies themselves have evolved over the past twenty years, so, too, have our goals for student learning, in general, and for the use of technology to support teaching and learning, in particular.
13.	Klarissa Ting-Ting Chang, Carnegie Mellon University [16]	They provided with the study of an updated meta-analysis on the effects of information technology (IT) in education. They conducted Sixty-eight experimental studies on the application of IT in the classrooms were integrated and analyzed. Positive effect sizes were found for learning outcomes, including academic achievement, knowledge retention, task performance, self-reported learning, and self-efficacy.

14.	Larry Cuban [17][18]	Larry articulates that today, computers and telecommunications are a fact of life as basic as electricity. They have altered the daily work of large businesses and industry. Yet why is it that with all the talk of education reform and information technologies over the last decade, computers are used far less on a daily basis in classrooms than in other organizations?
15.	Lawrence A. Tomei, Robert Morris University [19]	They describes that technology fosters better communication, removing barriers that, in the past, have stymied learning. Yet, technology is not a magic potion for resolving all the woes of education. Technology, in and of itself, does not create better teachers, learners, or administrators. However, when technology is used side by side with other school improvement efforts, it can be a very effective vehicle for progress.
16.	Meurig Beynon [21]	The perception of the relationship between technology and learning is been elaborated in his work.
17.	Patricia L. Rogers [22]	According to Patricia newer technologies used to enhance and facilitate learning are a major part of this evolutionary process: "as they adapt to current practice, new technologies become less visible. Yet, simultaneously, by adopting these new technologies, current practice continuously evolves"
18.	Philip Molebash [23]	Philip points out that experts from all fields, including education, business, and government agree that we have moved into the information age. As much as 97% of the world's knowledge will be accumulated over one person's lifetime. The current teaching paradigm of the teacher as the possessor and transferor of information is shifting to a new paradigm of the teacher as a facilitator or coach. This new teacher will provide contextual learning environments that engage students in collaborative activities that will require communications and access to information that only technology can provide.
19.	Qiyun Wang, Huay Lit Woo [24]	They describe ICT integration as a comprehensive process of applying technology to the curriculum to improve teaching and learning. They identify success of ICT integration which depends not only on the availability of technology, but also heavily on the pedagogical design.
20.	Reginald Nnazor [25]	Reginald Nnazor states that advances in information and communication technology (ICT) have provided unprecedented opportunities for technology-facilitated synchronous and asynchronous teaching and learning on campus and in distance education environments.
21.	Robbie McClintock [26]	Educators need power, not purity; technologists need vision, not predictability. Together educators and technologists have the historic opportunity to improve the civic prospect -- that is the message of Power and Pedagogy.
22.	Rose Mary Mautino,	The technologies of literacy in the future will need to function

	Stefan L. Biancaniello [27]	as cognitive tools that guide students in the generation of the concentric circles of lifelong learning.
23.	Rozalind G. Muir-Herzig [28]	The current study results indicated the extremely low means of technology use among the teachers. Technology training is needed for the teachers to apply technology as a tool for their curriculum. Although technology is not a panacea for all educational ills, technology is an essential tool for teaching. To use technology as an effective instructional tool, training and time is needed for teachers to infuse technology into their curriculum.
24.	S. P. Shinde, V. P. Deshmukh [29]	They highlight impact of Technology by stating that a technological change permits new activities and makes new activities superior in many important ways over the previous method of operation and creates long lasting innovations in society. Web-based teaching and learning is rapidly emerging as a predominant paradigm in the delivery of education in society. Internet is the ocean of knowledge. This ocean can be made available to all students as early as possible in their life. So Information Technology & related tools can be introduced in education by using World Wide Web as education delivery medium.
25.	Sanjaya Mishra , Ramesh C. Sharma [30]	Interactive Multimedia in Education and Training emerges out of the need to share information and knowledge on the research and practices of using multimedia in various educational settings.
26.	Sara Price, Martin Oliver [31]	They provide an illustration of the broad nature of research perspectives essential for developing our understanding of the relationship between technology and educational practice and a focus on change in educational practice and perspectives, actual or potential, arising from the existence of technology.
27.	Shazia Mumtaz [32]	According to Shazia, research findings over the past 20 years provide some evidence as to the positive effects of the use of information and communications technology (ICT) on pupils' learning. In spite of such projects, the effects of numerous training programmes and an investment by schools in ICT resources, there has been a disappointingly slow uptake in schools and other education sectors.
28.	Starr Roxanne Hiltz, Murray Turoff [33]	They focuses on, on line learning that have been introduced to improve distance learning by adding various augmentations, substitutions, or blending of new pedagogical approaches and technologies.
29.	Theofanis C. Despotakis, George E. Palaigeorgiou, Ioannis A. Tsoukalas [34]	They proposed on the use Animated Demonstration (AD) to enhance the design of educational applications.
30.	Tzu Chien Liu [36]	He considers wireless and mobile technology as a useful tool for enhancing student-centred learning.

From Table 3, we analysed that, there have been fundamental shifts in the education landscape with the move from teacher-centred to student-centred learning and from the traditional to the technology centred learning environment. The technology-enhanced paradigm has influenced teaching practice and the ways in which students approach their learning. Information and Communication Technology is often perceived as a vehicle for change, change in teaching style, change in learning approaches, and change in access to information.

The availability of new information technology is contributing too many innovations in education system. Yet, technology is not a magic potion for resolving all the woes of education. Technology, in and of itself, does not create better teachers, learners, or administrators. However, due to the use of information and communication technology in the area of education, it is considered to be a very effective vehicle for progress.

4. CONCLUSION

The introduction of new information technology in teaching and learning has impacted the traditional classroom activities. The various technologies produce a greater level of interaction between and among teachers and students. They also help to improve the educational environment while providing enrichment in the learning experience. The infusion and integration of the new information technologies in the teaching and learning have had an immense impact on the educational environment.

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