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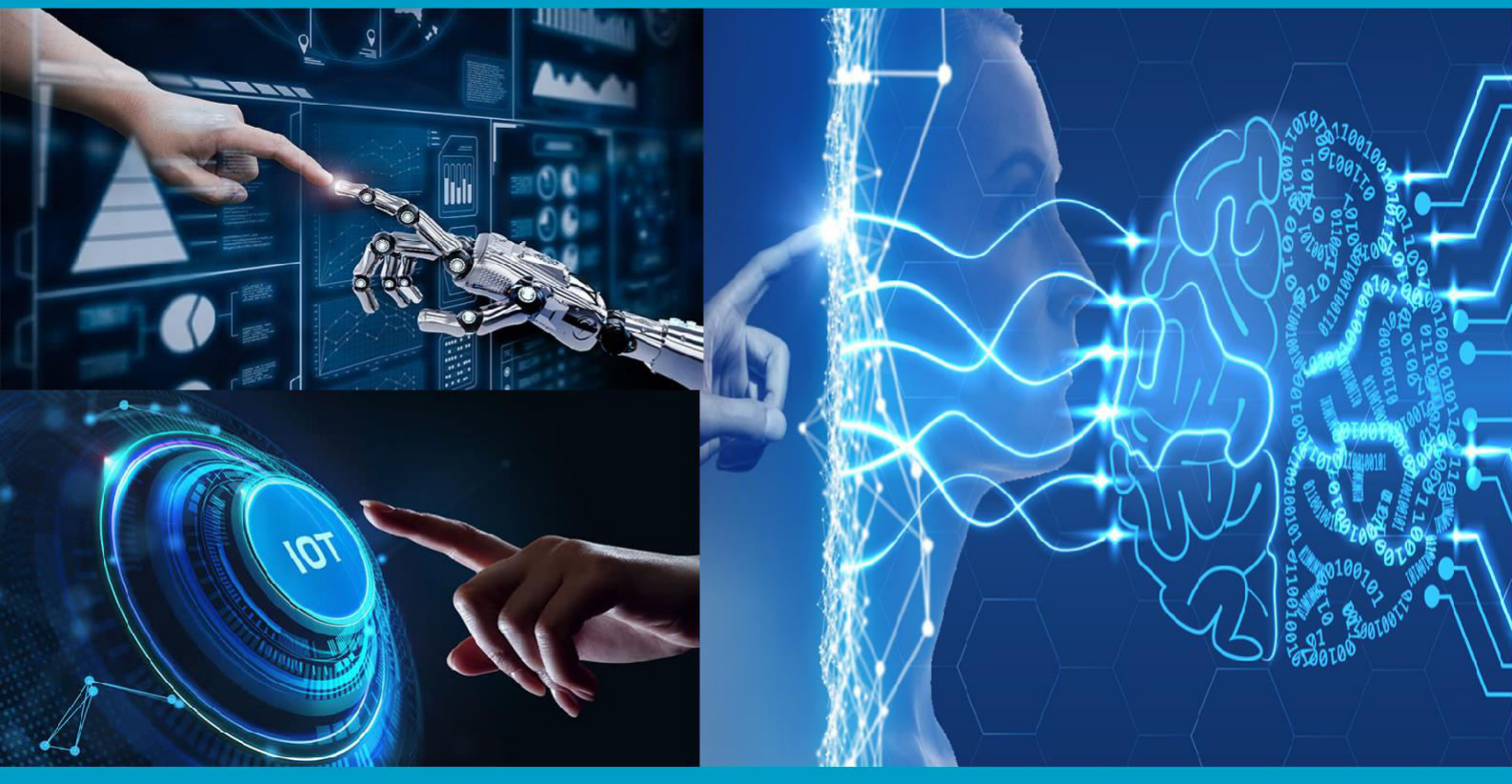

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Education and Teaching in the Information Age

Dr. Tanu Yadav

Assistant Professor, Dept. of EAFM (Commerce), S.S. Jain Subodh P.G. Mahila Mahavidyalaya, Jaipur, Rajasthan, India

ABSTRACT: A recent study suggests that our modern lifestyles are making us "less intelligent" than our ancestors, at least at a genetic level. This research echoes concerns Einstein had when he supposedly said, "I fear the day that technology will surpass our human interaction. The world will have a generation of idiots."The immediate availability of information has created a particular conundrum in our modern society. When it takes a mere few seconds to find information about almost any topic, the value of knowledge and expertise is being devalued as information becomes cheaper and more accessible. This is despite the fact that information, knowledge and expertise are fundamentally different entities. Traditionally, education has been defined by the passing of knowledge from a content expert to a novice learner. The methods of instruction have changed marginally, particularly with the invention of the printing press and a more "industrialised" approach to schooling. But this mechanism of education has remained much the same.Arguments about the inadequacy of traditional models of education in the information age abound, particularly in higher education. Despite the slow adaptation of education to the information age, the rise of the Massive Open Online Course or MOOC and the apparent imminent death of the lecture are just two examples of the changing educational landscape being brought about by our shifting relationship with information and capability for learning with technology.

KEYWORDS: education, teaching, information, age, industrialized, arguments, online, technology

I.INTRODUCTION

Technology has not only made access to information easier, it has arguably made learning easier by making it less challenging and letting us get away with using system one more often. The answers to many questions are only as far away as the nearest search engine or app, so we can avoid any need for the type of analytical thinking required to solve the problem ourselves[1].Technologies are generally designed to be pleasing, marketable and to make learning easier; they are not often designed to deliberately vex us in ways that improve knowledge retention.Similarly, the quality of learning in higher education in particular is often measured in terms of student satisfaction, not how much students have actually learnt. Technology alone is not making us stupid. [2]We are getting out of having to think too much thanks to a complex set of factors, including the increased availability of information and education systems that have yet to adapt to the new information-rich world we live in.[3]All is not lost, however. What both Kahneman and Bjork's research reveal is that carefully controlled psychological experiments can improve our understanding of how knowledge and expertise develop in the information age. And their findings can give us clues as to what to do about it.[4]Of course, applying the controlled laboratory conditions to the classroom is difficult. It's hard to know what exactly is effective and what influence particular technologies are having on learning outside the lab.In 1899, William James said, "Psychology is a science, and teaching is an art; and sciences never generate arts directly out of themselves. An intermediary inventive mind must make the application, by using its originality."If we are to ensure that we are using technology in the most effective ways to educate the next generation, we need to apply the science of learning to the classroom, just as James was arguing over a century ago.[5] This process will undoubtedly require many "inventive minds" to help translate the science into practice.Ultimately, the future of technology-enabled learning and education is in a synthesis of the science of learning and the art of teaching. Developing expertise in expertise will help us figure out how we can educate future generations of students to become wise and knowledgeable in a world where information is cheap and easy. Education is an essential part of life as it leads to success, happiness and excellence. The developments in technology have enabled more and more people to achieve beyond their potential as there many forms of education which you can access via the computer or mobile phone.[6] The impact which technology has had on our lives is that methods of teaching have been altered in order to fit digital revision tools to enhance the learning of students. The students in today's society face huge daunting tasks which they find difficult to cope with, but the educational help which they receive as a result of technology is truly great.[7]

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Millennials are the most educated generation in US history. 61% of adult millennials attend college compared to 46% of the Baby Boomers. As a society we are investing more in higher education than ever. Yet while college used to hold the promise of a better life, today, only 20% of college students feel "very prepared" to enter the workforce.[8] What we're seeing is a disconnect between what we invest in traditional forms of education and what they deliver – and students are starting to notice.At Flatiron School, we're at the center of a change in how people think about education and careers.[9] We conducted a survey of 768 respondents to better understand the impact of a college education on their careers, their desire to seek out further education to expand their career opportunities – and the barriers that may stand in their way.We found three key shifts in how people think about education in the modern age.[10]

1. Lifelong learning is becoming the new normal

Gone are the days when you go to college for four years straight, get a job, and work at the same company until you retire. With so much of our world now powered by technology, the rate of change in the workplace is rapid, and professionals in every industry need find ways to skill up throughout their careers.The survey found that a college education alone doesn't give grads confidence in their long-term professional growth – 65% of those who finished college believed that they might need or definitely need to obtain additional education in order to advance in their careers.I believe we'll see higher education expanding into more formats, providing shorter and more accessible ways for people to gain new skills throughout their careers. We'll see companies invest more in educating their employees to keep them competitive as their jobs undoubtedly evolve.[11]

2. A one-size-fits-all approach no longer works

To be clear, attending a traditional four-year college isn't just about learning one specific skill. It's an opportunity to explore your interests, develop as a human being, meet new people… maybe even do your own laundry for the first time.But while that ephemeral type of development is important, it may not be worth the tremendous cost for every student. Given the rising tuition costs for higher education, enrolling in college can leave some people worse off; for students in the bottom 25th percentile, a college degree doesn't actually translate into a higher salary.Our survey found cost to be the top barrier preventing people from pursuing additional education – despite recognizing their professional need for more education. When it came to the idea of taking on loans, respondents felt burned by student debt and were hesitant to take on more – of those who previously took on student debt, 62% were negatively impacted in some way.A one-size-fits-all, "college for everyone" approach isn't working, and I believe we'll see more students looking to explore whether high-quality career and technical education might be better for them.[12]

3. Students are focused on outcomes above all

Again, for many students, college plays an important role in their personal development. But we still see getting a job as the key reason most college freshmen are pursuing a college degree. With the average student spending six years getting a degree and taking on $37,000 in debt – not to mention only 11% of business leaders perceiving college graduates to be ready for work – schools need to do a better job ensuring that students gain the skills necessary to actually launch a career that helps them pay down their debt.Unsurprisingly, of survey respondents who did not attend or finish college, over 68% said they would return to school if it guaranteed a high-paying job upon graduation – one reason we've been obsessed with student outcomes here at Flatiron School from day one.Perhaps the most heartening finding from the survey is that modern workers are hungry to learn – and confident in their ability to do it in pursuit of carers they're passionate about. Over 80% of respondents reported that they feel "confident" or "very confident" in their ability to learn a new skill to advance or change their careers. Now it's our job as an industry to make it easier, more accessible, and more effective for these people to get the education they need to fuel the next generation of companies.[13]

Digital education is an innovative teaching model that uses the technology of computer and network to replace traditional teaching models to achieve efficient paperless classes. In information age, knowledge is updated and iterated quickly. Only by adopting an efficient and innovative education model can learners increase their knowledge

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reserves. Digital education in the information age uses a variety of digital education tools to make education advance with the times and has important significance.[14]

II.DISCUSSION

Digital education tools make it easier to create courses and exams. Various types of course presentations make the class process smoother. At the same time, students will be more interested in courses in the form of videos and pictures, so they will pay more attention to the class. On the other hand, learning materials are digitized, which means that students can learn on smart devices. It is a huge help to promote the paperless process of society.[15]

To do justice to Bernard Poole's, Education for an Information Age: Teaching in the Computerized Classroom, and to determine whether or not this book meets its stated objectives for its audience, it is necessary to locate this text within its genre as a new breed of educational texts. Over the last few years in Noah America, vast financial resources have been allocated to equipping schools with computer hardware and Internet access. This new infusion of internet technology brings with it a new vocabulary invoking new premises and landscapes for learning. The technological revolution, the integration of computers into the curriculum, connectivity and the preparation of our students to flourish in an Information Age -- are new words and concepts for teachers and for those responsible for the professional development of in-service and preservice teachers.Keeping good pedagogy at the core of the technology issue, both in educational research and praxis, is paramount. Computer-assisted educational technology must serve pedagogical goals and, must be understood as but another powerful tool in a teacher's professional kit of methods and tools for creating dynamic and motivating learning scenarios. A new breed of book has emerged to meet these needs, at first in a 'how to' format (how to use technology from a skills and hardware/software perspective) followed by counterpoint texts focussing separately on 'why to' and 'why not to' use educational technology. Is it developmentally-appropriate Is it going to perpetuate strata of inequity? Bernard Poole's text is one of this new breed of book, and, overall, it is a sensitively and meticulously crafted example of this new genre. [16]

Arguments about the role of technology in education go back at least 2,500 years. To understand better the role and influence of technology on teaching, we need a little history, because as always there are lessons to be learned from history. Paul Saettler's 'The Evolution of American Educational Technology' (1990) is one of the most extensive historical accounts, but only goes up to 1989. One of the earliest means of formal teaching was oral – though human speech – although over time, technology has been increasingly used to facilitate or 'back-up' oral communication. In ancient times, stories, folklore, histories and news were transmitted and maintained through oral communication, making accurate memorization a critical skill, and the oral tradition is still the case in many aboriginal cultures. For the ancient Greeks, oratory and speech were the means by which people learned and passed on learning. Homer's Iliad and the Odyssey were recitative poems, intended for public performance. To be learned, they had to be memorized by listening, not by reading, and transmitted by recitation, not by writing.Nevertheless, [17]by the fifth century B.C, written documents existed in considerable numbers in ancient Greece. If we believe Socrates, education has been on a downward spiral ever since. According to Plato, Socrates caught one of his students (Phaedrus) pretending to recite a speech from memory that in fact he had learned from a written version. Socrates then told Phaedrus the story of how the god Theuth offered the King of Egypt the gift of writing, which would be a 'recipe for both memory and wisdom'. The king was not impressed. According to the king, it [writing] will implant forgetfulness in their souls; they will cease to exercise memory because they will rely on what is written, creating memory not from within themselves, but by means of external symbols. What you have discovered is a recipe not for memory, but for reminding. And it is no true wisdom that you offer your disciples, but only its semblance, for by telling them many things without teaching them anything, you will make them seem to know much, while for the most part they will know nothing. And as men filled not with wisdom but the conceit of wisdom, they will be a burden to their fellow men.[18]

Slate boards were in use in India in the 12th century AD, and blackboards/chalkboards became used in schools around the turn of the 18th century. At the end of World War Two the U.S. Army started using overhead projectors for training, and their use became common for lecturing, until being largely replaced by electronic projectors and presentational software such as Powerpoint around 1990. This may be the place to point out that most technologies used in education were not developed specifically for education but for other purposes (mainly for the military or business.)[19]

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Although the telephone dates from the late 1870s, the standard telephone system never became a major educational tool, not even in distance education, because of the high cost of analogue telephone calls for multiple users, although audio-conferencing has been used to supplement other media since the 1970s. Video-conferencing using dedicated cable systems and dedicated conferencing rooms have been in use since the 1980s. The development of video compression technology and relatively low cost video servers in the early 2000s led to the introduction of lecture capture systems for recording and streaming classroom lectures in 2008. Webinars now are used largely for delivering lectures over the Internet.[20]

None of these technologies though changes the oral basis of communication for teaching. The role of text or writing in education also has a long history. According to the Bible, Moses used chiseled stone to convey the ten commandments in a form of writing, probably around the 7th century BC. Even though Socrates is reported to have railed against the use of writing, written forms of communication make analytic, lengthy chains of reasoning and argument much more accessible, reproducible without distortion, and thus more open to analysis and critique than the transient nature of speech. The invention of the printing press in Europe in the 15th century was a truly disruptive technology, making written knowledge much more freely available, very much in the same way as the Internet has done today. As a result of the explosion of written documents resulting from the mechanization of printing,[21] many more people in government and business were required to become literate and analytical, which led to a rapid expansion of formal education in Europe. There were many reasons for the development of the Renaissance and the Enlightenment, and the triumph of reason and science over superstition and beliefs in Europe, but the technology of printing was a key agent of change.Improvements in transport infrastructure in the 19th century, and in particular the creation of a cheap and reliable postal system in the 1840s, led to the development of the first formal correspondence education, with the University of London offering an external degree program by correspondence from 1858. This first formal distance degree program still exists today in the form of the University of London International Program. In the 1970s, the Open University transformed the use of print for teaching through specially designed, highly illustrated printed course units that integrated learning activities with the print medium, based on advanced instructional design.With the development of web-based learning management systems in the mid-1990s, textual communication, although digitized[22], became, at least for a brief time, the main communication medium for Internet-based learning, although lecture capture is now changing that. The British Broadcasting Corporation (BBC) began broadcasting educational radio programs for schools in the 1920s. The first adult education radio broadcast from the BBC in 1924 was a talk on Insects in Relation to Man, and in the same year, J.C. Stobart, the new Director of Education at the BBC, mused about 'a broadcasting university' in the journal Radio Times (Robinson, 1982). Television was first used in education in the 1960s, for schools and for general adult education (one of the six purposes in the current BBC's Royal Charter is still 'promoting education and learning').[23]

In 1969, the British government established the Open University (OU), which worked in partnership with the BBC to develop university programs open to all, using a combination originally of printed materials specially designed by OU staff, and television and radio programs made by the BBC but integrated with the courses. Although the radio programs involved mainly oral communication, the television programs did not use lectures as such, but focused more on the common formats of general television, such as documentaries, demonstration of processes, and cases/case studies .In other words, the BBC focused on the unique 'affordances' of television, a topic that will be discussed in much more detail later. Over time, as new technologies such as audio- and video-cassettes were introduced, live broadcasting, especially radio, was cut back for OU programs, although there are still some general educational channels broadcasting around the world (e.g. TVOntario in Canada; PBS, the History Channel, and the Discovery Channel in the USA).[24]

The use of television for education quickly spread around the world, being seen in the 1970s by some, particularly in international agencies such as the World Bank and UNESCO, as a panacea for education in developing countries, the hopes for which quickly faded when the realities of lack of electricity, cost, security of publicly available equipment, climate, resistance from local teachers, and local language and cultural issues became apparent (see, for instance, Jamison and Klees, 1973). Satellite broadcasting started to become available in the 1980s, and similar hopes were expressed of delivering 'university lectures from the world's leading universities to the world's starving masses', but these hopes too quickly faded for similar reasons. However, India, which had launched its own satellite, INSAT, in 1983, used it initially for delivering locally produced educational television programs throughout the country, in several indigenous languages, using Indian-designed receivers and television sets in local community centres as well as schools (Bates, 1985). India is still using satellites for tele-education into the poorest parts of the country at the time of writing (2015).[25]

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In the 1990s the cost of creating and distributing video dropped dramatically due to digital compression and high-speed Internet access. This reduction in the costs of recording and distributing video also led to the development of lecture capture systems. The technology allows students to view or review lectures at any time and place with an Internet connection. The Massachusetts Institute of Technology (MIT) started making its recorded lectures available to the public, free of charge, via its OpenCourseWare project, in 2002. YouTube started in 2005 and was bought by Google in 2006. YouTube is increasingly being used for short educational clips that can be downloaded and integrated into online courses. The Khan Academy started using YouTube in 2006 for recorded voice-over lectures using a digital blackboard for equations and illustrations. Apple Inc. in 2007 created iTunesU to became a portal or a site where videos and other digital materials on university teaching could be collected and downloaded free of charge by end users.[26]

Until lecture capture arrived, learning management systems had integrated basic educational design features, but this required instructors to redesign their classroom-based teaching to fit the LMS environment. Lecture capture on the other hand required no changes to the standard lecture model, and in a sense reverted back to primarily oral communication supported by Powerpoint or even writing on a chalkboard. Thus oral communication remains as strong today in education as ever, but has been incorporated into or accommodated by new technologies. In essence the development of programmed learning aims to computerize teaching, by structuring information, testing learners' knowledge, and providing immediate feedback to learners, without human intervention other than in the design of the hardware and software and the selection and loading of content and assessment questions. B.F. Skinner started experimenting with teaching machines that made use of programmed learning in 1954, based on the theory of behaviourism .[27]Skinner's teaching machines were one of the first forms of computer-based learning. There has been a recent revival of programmed learning approaches as a result of MOOCs, since machine based testing scales much more easily than human-based assessment.PLATO was a generalized computer assisted instruction system originally developed at the University of Illinois, and, by the late 1970s, comprised several thousand terminals worldwide on nearly a dozen different networked mainframe computers. PLATO was a highly successful system, lasting almost 40 years, and incorporated key on-line concepts: forums, message boards, online testing, e-mail, chat rooms, instant messaging, remote screen sharing, and multi-player games.Attempts to replicate the teaching process through artificial intelligence (AI) began in the mid-1980s, with a focus initially on teaching arithmetic. Despite large investments of research in AI for teaching over the last 30 years, the results generally have been disappointing. It has proved difficult for machines to cope with the extraordinary variety of ways in which students learn (or fail to learn.)[28] Recent developments in cognitive science and neuroscience are being watched closely but at the time of writing the gap is still great between the basic science, and analysing or predicting specific learning behaviours from the science.More recently we have seen the development of adaptive learning, which analyses learners' responses then re-directs them to the most appropriate content area, based on their performance. Learning analytics, which also collects data about learner activities and relates them to other data, such as student performance, is a related development. [29]

Arpanet in the U.S.A was the first network to use the Internet protocol in 1982. In the late 1970s, Murray Turoff and Roxanne Hiltz at the New Jersey Institute of Technology were experimenting with blended learning, using NJIT's internal computer network. They combined classroom teaching with online discussion forums, and termed this 'computer-mediated communication' or CMC .[30]At the University of Guelph in Canada, an off-the-shelf software system called CoSy was developed in the 1980s that allowed for online threaded group discussion forums, a predecessor to today's forums contained in learning management systems. In 1988, the Open University in the United Kingdom offered a course, DT200, that as well as the OU's traditional media of printed texts, television programs and audio-cassettes, also included an online discussion component using CoSy. Since this course had 1,200 registered students, it was one of the earliest 'mass' open online courses. We see then the emerging division between the use of computers for automated or programmed learning, and the use of computer networks to enable students and instructors to communicate with each other.The Word Wide Web was formally launched in 1991. The World Wide Web is basically an application running on the Internet that enables 'end-users' to create and link documents, videos or other digital media, without the need for the end-user to transcribe everything into some form of computer code. The first web browser, Mosaic, was made available in 1993. Before the Web, it required lengthy and time-consuming methods to load text, and to find material on the Internet. Several Internet search engines have been developed since 1993, with Google, created in 1999, emerging as one of the primary search engines. In 1995, the Web enabled the development of the first learning management systems (LMSs), such as WebCT (which later became Blackboard). LMSs provide an online teaching environment, where content can be loaded and organized, as well as

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providing 'spaces' for learning objectives, student activities, assignment questions, and discussion forums[25]. The first fully online courses (for credit) started to appear in 1995, some using LMSs, others just loading text as PDFs or slides. The materials were mainly text and graphics. LMSs became the main means by which online learning was offered until lecture capture systems arrived around 2008.

By 2008, George Siemens, Stephen Downes and Dave Cormier in Canada were using web technology to create the first 'connectivist' Massive Open Online Course (MOOC), a community of practice that linked webinar presentations and/or blog posts by experts to participants' blogs and tweets, with just over 2,000 enrollments. The courses were open to anyone and had no formal assessment. In 2012, two Stanford University professors launched a lecture-capture based MOOC on artificial intelligence, attracting more than 100,000 students, and since then MOOCs have expanded rapidly around the world.Social media are really a sub-category of computer technology, but their development deserves a section of its own in the history of educational technology. Social media cover a wide range of different technologies, including blogs, wikis, You Tube videos, mobile devices such as phones and tablets, Twitter, Skype and Facebook. Andreas Kaplan and Michael Haenlein (2010) define social media as

a group of Internet-based applications that …allow the creation and exchange of user-generated content, based on interactions among people in which they create, share or exchange information and ideas in virtual communities and networks.[22]

Social media are strongly associated with young people and 'millenials' – in other words, many of the students in post-secondary education. At the time of writing social media are only just being integrated into formal education, and to date their main educational value has been in non-formal education, such as fostering online communities of practice, or around the edges of classroom teaching, such as 'tweets' during lectures or rating of instructors. It can be seen that education has adopted and adapted technology over a long period of time. There are some useful lessons to be learned from past developments in the use of technology for education, in particular that many claims made for a newly emerging technology are likely to be neither true nor new. Also new technology rarely completely replaces an older technology. Usually the old technology remains, operating within a more specialised 'niche', such as radio, or integrated as part of a richer technology environment, such as video in the Internet.However, what distinguishes the digital age from all previous ages is the rapid pace of technology development and our immersion in technology-based activities in our daily lives. Thus it is fair to describe the impact of the Internet on education as a paradigm shift, at least in terms of educational technology. We are still in the process of absorbing and applying the implications. The next section attempts to pin down more closely the educational significance of different media and technologies.[24]

III.RESULTS

When students use digital tools such as Online Exam Maker for learning, they can preview the courseware uploaded by the teacher to the learning system before class, which is helpful for breaking through the most difficult knowledge. For the exam, the online exam system Online Exam Maker supports students to repeatedly practice the wrong questions in the exam, which can improve the autonomy of students in learning.[27]

With increasing knowledge and technological progress of society; our country requires learning skills that could help it keep pace with the development of science and technology. Educational systems in a community and consequently education will not be able to separate from other social institutions, national and international interactions widely known in the global village. Education in the twenty-first century is the center from which all changes and developments arise. Information technology in education needs a culture. This culture needs to be learned along with the use of hardware resources. The system needs to be educated to use information technology; otherwise, purchase and transfer of technology and investment will be nothing but wasting resources. Although these technologies are not impartial in any sense they should be used as means for communicating information, in the existing social structures. However since the process of change and transformation is in the nature of human social institutions, the educational system is also prone to some alterations. But the fundamental problem is that what strategies should be adopted so that education systems in developing countries do not only follow developed countries but grow and progress base on their own needs in the path of progress. Most school-age children in the United States interact every day with a variety of information media—television, video

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games, multimedia computer systems, audio- and videotape, compact discs, and print. At the same time, workplaces are retooling with advanced technologies and acquiring access to complex, comprehensive information systems to streamline operations. Our youth have so much exposure to technological gadgets and information resources that one would think the transition from school to workplace would be second nature. Not so. According to recent projections, only about 22 percent of people currently entering the labor market possess the technology skills that will be required for 60 percent of new jobs in the year 2000 .[28]

To eliminate this mismatch between schools and workplace, we need "Information Age" schools. Researchers point to at least six attributes that characterize an Information Age school. The following descriptions of these attributes include examples of exemplary schools, along with contact information. I have "found" each of the schools by making site visits in my former role as an ASCD regional director and by serving as a judge in a variety of technology competitions.[25]

Interactivity. In schools demonstrating interactivity, students communicate with other students through formal presentations, cooperative learning activities, and informal dialogue. Students and teachers talk to one another about their learning tasks in large groups, small groups, and one-to-one. Students have constant access to and know how to use print and electronic information resources to inform their learning activities. They recognize the value of the information in their own communities and interact with various community members, including businesspeople, social service staff, arts professionals, athletes, older adults, and volunteer workers, enhancing their curriculum studies with authentic information from primary sources.

At the Sun Valley Elementary School in Winnipeg, Manitoba, 4th grade students regularly participate in "keypals" activities to exchange cultural information with schools around the world. Students in grades 5 and 6 use resources from their school and community to develop "talking books" that provide graphic, textual, and auditory lessons on animals, foods, weather, and other classroom topics for the 1st grade class. The librarymedia specialist helps students develop interactive multimedia projects for their classes and the community. One such project takes citizens on an adventure tour . When students initiate their own learning, they participate in productive questioning, probing for information they can use rather than waiting for the next question on a test or from a teacher. Information resources are central, not peripheral, in day-to-day learning activities. Students gather their own data to learn about topics, using a variety of sources and practicing effective research techniques. They are able to examine the large quantity of information they have gathered, synthesize it, and reduce it to usable quantities for their purposes. They can analyze and interpret information in the context of the problems or questions they have identified, and they can evaluate not only the quality of the information they've gathered but also the processes they've used to gather it.[29]

The most important role for information technology at Taylorsville Elementary School in Taylorsville, Indiana, is to support a commitment to self-paced, individualized learning. Students participate in a program that emphasizes high expectations in core subjects and allows them to work at their own pace. Teachers use instructional strategies like multiage, multiyear groupings and team-based project work. Teachers facilitate, rather than direct, student learning, and they are comfortable using a variety of information technologies. Two days each school year are devoted to ongoing technology training, and a technology coordinator and three part-time aides assist teachers with their technology-related problem solving. To develop self-initiated learners in the Information Age school, the teacher's role must evolve away from dispenser of prefabricated facts to coach and guide. In this continuously changing role, teachers leave fact-finding to the computer, spending their time doing what they were meant to do as content experts: arousing curiosity, asking the right questions at the right time, and stimulating debate and serious discussion around engaging topics. In fact, every adult in the school community communicates the power of knowledge by modeling a love of learning. Pre-service and inservice programs require the use of information resources and technologies as an integrated part of teachers' certification and recertification. Teachers create a community among themselves in which they are willing to plan together, share successes, resolve challenges, and model strategies for one another.[30]

Professional development in information technologies is available daily at Adlai Stevenson High School in Lincolnshire, Illinois, in a specialized lab for teachers staffed by a full-time trainer. Proficiency with technology resources is a hiring requirement for teachers. All teaching staff have a three-year period to demonstrate proficiency

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with voice, data, and video technologies. The rigor of staff training reflects the school's commitment to providing students with an environment that promotes lifelong learning, provides opportunities to access global information and create knowledge, encourages participation from the community, and develops the skills of collaborative problem solving. Teachers and students use information technologies constantly for instruction, assessment, exploration, management, and the school's day-to-day operation. Media and technology specialists are critical in the Information Age school, and their role is twofold. Working with students, they are project facilitators. They can ask the initial questions that help students develop a focus for inquiry. They are thoroughly familiar with the school's and district's information resources and can direct students to multidisciplinary materials suitable for their investigations. With their technology skills, they can expose students to resources in a variety of media as well. They can assist students in their efforts to develop technology-enhanced products and presentations.

Working with teachers, they are instructional designers—partners in curriculum development and unit planning. Their expertise with information resources can inform teachers' exploration of curriculum topics and assist them in locating the materials they need. And, because ongoing professional development is an integral part of the work in an Information Age school, media and technology specialists contribute their expertise to the design and delivery of technology-enhanced inservice programs.[29]

Traditionally, students learned information skills in isolation as part of elementary- and middle-level "library skills" development. Technology "literacy" programs took place in computer labs during pull-out programs or in separately scheduled classes. In the Information Age school, such skills are taught on an as-needed basis, and they are integrated throughout the curriculum.

As a result of a districtwide effort to reform curriculum and instruction, the school day at Christopher Columbus Middle School in Union City, New Jersey, is organized into blocks of 90 minutes to two hours. Longer class periods have allowed teachers to create a project-focused, research-based curriculum that integrates the traditional subject areas with access to local and remote information resources through a variety of technologies. In addition to a central computer lab for whole-class instruction and walk-in use, each of the school's 12 classrooms has five computers, a printer, and a video presentation station. Students also have access to multimedia production equipment, computer video editing capabilities, and Internet connectivity from all PCs. Teachers receive three days of paid technology training each year, and a full-time technology coordinator conducts student computer classes, consults with teachers, and handles troubleshooting. Everyone in the Information Age school recognizes the need for continuous evaluation not limited to scheduled standardized assessments. They engage in a high level of introspection, asking questions about the appropriateness of information resources, the efficiency of information searches, and the quality of information selection and evaluation. They also examine the quality of the products and presentations they use to share the results of their inquiries, as well as the communication process itself.[26]

The Maryland Virtual High School of Science and Mathematics is a collaboration of 15 schools. They use information technologies to focus on computational science studies, accessing the Internet for mentoring, sharing projects, and assessing science resources. Students and teachers search and communicate online through local area networks (LANs) attached to each school's Internet hub. They use various software applications to create computational models of processes such as climate phenomena, animal population changes, and planetary motion. Teachers from the participating schools attend several three-day professional development sessions each year, as well as a five-day workshop at the end of each school year. Project staff are available for schoolwide training and outreach efforts in the various school communities. An Information Age school has a different look and feel than a traditional school. Classroom methods link information retrieval, analysis, and application with strategies such as cooperative learning, guided inquiry, and thematic teaching. Information technologies are easily accessible, not locked away in media closets or labs. Student projects and products proliferate—not just as display items but as resources for other students and information for future investigations. Classrooms and hallways are frequently the scene of discussions and debates about substantive issues—topics important to both the curriculum and to the students investigating them. Most important, the most probing questions come from the learners, who are curious about a variety of issues and intent on communicating what they discover.[30]

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The curriculum at Patton Junior High School in Fort Leavenworth, Kansas, is "driven by students' needs to be productive members of an ever-advancing Information Age" (U.S.D. 207 Technology Initiatives brochure 1996). Instruction reflects the district's efforts to maintain high standards of achievement while encouraging learners to investigate a variety of topics in an exploratory environment. Students use technology tools and develop life skills in a 26-module program that includes topics such as robotics, audio broadcasting, maintaining a healthy heart, and becoming a confident consumer. The media center and classroom computers all provide Internet access. Teachers can use a centralized media management system to remotely schedule videotape, laserdisc, and interactive CD presentations without the need to check out and transport bulky equipment.[11]

Students can use smart devices to search and access more information, even students from different places can use smart devices to participate in the same teacher's course. Students can choose more learning methods, and teachers can also search for more educational resources to enrich their learning and educational abilities.[14]

IV.CONCLUSIONS

To transform your school into an Information Age school, begin by using information technologies to encourage experimentation with the school's program. Focus on improving the connections between curriculum content and school process. Lengthen class periods. Consider multiage grouping. Experiment with interdisciplinary, problem-based, or thematic approaches to instruction. Develop individualized instructional plans for every student. Implement ongoing assessment measures that reflect students' continuous learning (portfolios, projects, performances). Encourage community members to regularly contribute their time and expertise throughout the school. Include them as part of decision-making groups for curriculum and technology planning. Provide incentives to teachers and administrators who demonstrate their willingness to try new methods and share what they've learned with their peers. Hire technology support staff with teaching experience to consult with teachers as well as troubleshoot equipment. Pay teachers to participate in professional development activities.[16]

Rather than sitting back (like passive television viewers) marveling at the ever-increasing quantity of information and the rapidity of change, educators must lead students through a careful, cumulative acquisition of information literacy and technology skills. Teams of school professionals can plan integrated activities focusing on important content while encouraging students to practice these skills. Learners should engage from their earliest years in rich, complex, authentic experiences that provide a tension between creativity and utility. These experiences should also offer frequent opportunities for feedback and an environment of trust and open communication. This "orchestrated immersion" (Palmisano et al. 1993) can help ensure that students will leave their school years better prepared to participate actively and flexibly in their communities and the workplace. Digital education integrates a variety of technologies, such as artificial intelligence. It can be combined with the use of learning platforms to recommend suitable learning materials for students according to their current learning conditions and learning habits, thereby improving students' interest and efficiency in learning.The digital education model improves teaching and learning efficiency, enabling teachers and students to cope with challenges well in the information age[28]

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+91 99405 72462 +91 63819 07438 ijmrsetm@gmail.com