INDUSTRIAL REVOLUTION (IR) 4.0 IMPACT ON E-LEARNING TO PROMOTE EDUCATION FOR ALL (EFA): A PARADIGM SHIFT FROM TRADITIONAL TEACHING TO E-LEARNING

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ABSTRACT

Industrial revolution 4.0 and latest Information technologies have affected every aspect of human activity and have a potential role to play in the field of education and training, specially, in e-learning to transform it into an innovative form of learning and experience. The need of new technologies in teaching learning process grows stronger and faster. Today's information age becomes an era of knowledge providing sound and unmatched feasibility for discovery, exchange of information, communication and exploration to strengthen the teaching learning process more convenient after IR 4.0. IR 4.0 helps in promoting opportunities of knowledge sharing and fast communication throughout the world. These can help the teachers and learners having up-to-date live information, knowledge and smart classes. Accurate and right information is necessary for effective teaching and learning; and IR 4.0 has "set of tools that can help provide the right people with the right information at the right time." Learners are independent and they can make best decisions possible about their studies, learning time, place and resources. Learners are able to work in collaborative and interactive live learning environments, effective communication, sharing information and exchanging ideas and learning experiences with all in the environment[1]. IR 4.0 helps in promoting EFA.

Keywords: IR 4.0, Information technologies; teaching learning process; e-learning; knowledge explosion, Education 4.0.

I. INTRODUCTION

One of the basic functions of education is preparation of learners for life. This function in 21st century may be participation in an information rich society, where knowledge is regarded as the main source for socio-cultural and politico-economical development of countries and/or nations. Information rich societies are developed and dominating and they are controlling the information throughout the world. Information encompasses and relies on the use of different channels of communication, presently called information and communication technologies and would be incorporating better pedagogical methods to cope with such emerging situations[2]. These have changed the scenario of education particularly, pedagogy and instruction making teaching learning process more productive creating collaborative, learner centered and interactive global learning environments. Therefore, information technologies are assumed to play a constructive role in education to make the teaching and learning process more productive through collaboration in an information rich society.[3]

First of all, what is Industrial Revolution 4.0 or IR 4.0? IR 4.0 refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. IR 4.0, also sometimes referred to as smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management.[4]

Education in the fourth industrial revolution is a complex, dialectical and exciting opportunity which can potentially transform society for the better. The fourth industrial revolution or IR 4.0 is powered by artificial intelligence and it will transform the workplace from tasks based characteristics to the human centered characteristics. Because of the convergence of man and machine, it will reduce the subject distance between humanities and social science as well as science and technology.[5]

Certainly, the curriculum content would have to be updated to educate learners on the nature and benefits of Industry 4.0 as well as model within the educational context how some of the characteristics of the IR 4.0 have been applied to offering services at the University. Where the expertise does not exist for IR 4.0, guest speakers online or F2F can be invited to deliver guest lectures so that learners are aware and prepared to enter a workforce impacted by IR 4.0.[6]

Therefore, the education system should be improved in such a way as to create as much synergy and correlation as possible between the current technological revolution of Industry IR 4.0 and the reformed systems of new education 4.0.

At present, in the age of the technological revolution known as the IR 4.0, new teaching concepts are being defined as education 4.0.

Information rich society promotes new practices and paradigms for education where the teacher has to play new role of mentoring, coaching and helping learners in their studies rather to play the conventional role of spoon feeding in the classrooms. Learners can learn independently having a wide choice of program selection and access to information[1]. Learners can be involved in skill oriented activities in group e-learning environments for accumulated knowledge. They can interact and share learning experiences with their teachers and fellow learners in knowledge construction and dissemination process. They can receive and use information of all kinds in more constructive and productive profession rather depending upon the teacher. Branson (1991) stated that students learn not only by the teacher but they also learn along with the teacher and by interacting with one another. Indeed, now learners can learn much more than that the teacher teaches in conventional learning environments. For productive e-learning process teachers and learners have to use information technologies according to their requirements and availability.[7][1]

II. INFORMATION TECHNOLOGIES

The history of information storage and dissemination indicates that human being used different things for information storage, its display and transmission. In different ages people used different materials and methods for communication such as rocks and stones, papyrus, palm leaves, animal leather and handcrafted manuscripts for storing and transmitting the information from one place to another and to the next generation. [8]These means of information were limited and confined to the elites but "the advent of printing enabled information to be truly widespread throughout the world to move to a more equitable level in terms of access to knowledge". At present,

knowledge may be regarded as power and it comes from having information. Information encompasses and relies upon the use of different communication channels or technologies –called information technologies, for its effectiveness and equal access. Information technologies may extend knowledge beyond the geographical boundaries of a state or country providing relevant information to the relevant people round the clock.[9][10] Information Technology "is any computer-based tool that people use to work with information and support the information and information processing needs of an organization". It includes computers and its related technologies; WWW, Internet and Videoconferencing etc. Information technology can be used to promote the opportunities of knowledge dissemination. It can help the teachers and learners having up-to-date information and knowledge. Accurate and right information is necessary for effective teaching and learning; and information technology is a "set of tools that can help provide the right people with the right information at the right time."In this sense, information technologies may the result of knowledge explosion, where according to Merriam, "computer technology (software) extends the mental ability." Therefore, information technologies may include computer and its related technologies of high tech and low touch nature. Chape, (1994) called them emerging technologies and stated that these are the products coming out of laboratory and into the hands of educational community. These include wireless communications, the information highway, asynchronous mode, integrated services digital networks (ISDN), multimedia applications, personal digital assistants, artificial intelligence and virtual reality.[11] These technologies would be big of brain and small of mass, depending upon computer technology for their effectiveness and increased capabilities. Similarly, Rashid, M. (2001) discussed the interactive video , CD-ROM, compact video disc, Internet, WWW, teleconferencing, computers, satellites and e-mail as emerging information technologies, and according to him these are "current technologies incorporating into the e-learning environment"[12]

III. INFORMATION TECHNOLOGIES AND E-LEARNING

Making Learners Independent in their Studies:

In the era of IR 4.0 and using information technologies learners can decide about their studies, learning time (24X7), place and resources in a better way. Learners can work in more supportive environments, seek help from teachers and fellows, and share their learning Experiences and ideas in romantic and productive fashion. Deed stated that the development of high performance computing and Communication is creating new media such as the www and virtual learning environment. In turn these new media enable new type of messages and experiences, such as interpersonal interactions in immersive synthetic environments lead to the formation of virtual communities. [13]

Figure 1 Source - Internet

The innovative kinds of pedagogy empowered by these emerging media and experiences promoted the opportunities of distance education and at present virtual education and eliminated the barriers of distance and time. New and innovative learning experiences would be enhanced and encouraged by these technologies, as by virtual communities, which exist by interactions across the globe through global network of computers round the clock. [14]The global sharing of experiences would make possible the group presentation form of instruction in e-education. E-education encompasses and relies on the use of information technologies to make learning more productive and more individualized, to give instruction a more scientific base and make it appropriate & more effective, learning more immediate and access to resources more equal. These remarkable aspects can expand the quality and quantity of instructional resources. They can serve learners at their ease in terms of time and place. Rashid stated that, both teachers and learners can work with others at remote sites. The community of learners can expand to include virtually anyone who wishes to obtain information and who is not excluded by policy or cost[15]. They can provide real access to experts in universities, research laboratories, the business community, government agencies and political offices. Information technologies can promote the opportunities of restructuring the teaching learning process. These can transform teaching and learning by offering alternatives to the teacher provided information, access to virtually unlimited resources and opportunities for real world communication, collaboration and competition. The phases of this process as described by Merriam et al are, "developing awareness – recognizing that something is wrong or different; exploring alternative–researching for new ideas from other institutions and acknowledging that change is needed; making a transition–leaving the old approaches behind (or dramatically changed); achieving integration-putting the pieces from the transition phase back together; and taking action-putting new ideas into operation". The process can work at instructional programme or institutional level and one or more phases work simultaneously. Traditional lectures and demonstrations can become web based multimedia learning experiences for e-learners. Web can enrich the learning resources and institutions refocus from teaching to learning, from teacher to learner. It can create learning environment throughout the world by networked learning communities. Networks may create educative environments embedded in democratic philosophy of instruction and helping learners learn.[16][1] The characteristics of which are: "respect for personality; participation in decision-making; freedom of expression and availability of information; and mutuality of responsibility in defining goals, planning and conducting activities and evaluating". E-learning may take place more effectively and dynamically in educative environments where teacher and learners are open to each other to interact and exchange information and

experiences in a friendly way. Ennis (1989) concluded in a study "Openness on the part of instructor increased their desire to discuss problems or topics of interest… these discussions expanded their understanding of the content and assisted them in planning the information within a relevant context in their own lives". Educative environments can enhance and shape the teaching learning process to achieve the desired goals. There is a natural tendency for learners to learn and learning can accelerate, in interactive and encouraging environments. Accelerating the encouraging environments may be psychological climates and learners' interactions can create them. Interactions of learners can make learning environment more effective and meaningful and 'much of learning takes place in a meaningful environment'. Learners may get immediate feedback and reinforcement through web-based learning. The psychological fashion of such reinforcement and expectancy also influences the potential for any given behaviour and/or learning to occur. Desired learning always requires access to qualitative and latest information resources and web confirms the increased access to such resources at learners' pace. Moreover, Aggarwal says "there is no denying that web-based courses open new educational access to the non-traditional and geographically dispersed learners. The on-line setting provides a level of flexibility and convenience not provided by traditional classroom courses". Internet and WWW provide learners latest relevant information at their own pace and they can form a virtual community of learners at global level. Teaching organizations are adopting information and communication technologies specially the computers, World Wide Web, teleconferencing and educational television because of their cost effectiveness, access and flexibilities of choices.[17]

Learners Use Information Technologies of IR 4.0 to:

- Participate in education revolution, profoundly affecting the way they think about and use information technologies.
- Improve the ways of learning in new learning fashions
- Extend the ability and skills of applying their learning in real situation.
- Working in groups for cooperative and collaborative learning
- Developing self-learning habits at their own pace and time.
- Learn with the teacher rather by the teacher.
- Develop inquiry-learning habits.
- Use right information at right time to achieve right objective.
- Review and explore qualitative data.
- Exchange learning experiences and information with others learners and teachers living anywhere in the world.

Teachers Use The Information Technologies on IR 4.0 to:

- Present the material in more interesting and attractive way.

- Guide and help learners in searching the qualitative material.

- Make best use of time.

- Coach the learners any time (24X7)**.**

- Provide individualized instruction.

- Direct the learners toward cooperative as well as collaborative learning activities.

- Prepare learning material for learners, rather teaching in conventional situations.

- Diagnose the learning problem of learners and help them to overcome.

- Solve the study problems of learners.

IR 4.0 and information technologies affect the teaching learning process in different ways. These helps the teachers in preparing lecture notes for interesting presentation, on the one hand and facilitates the learners on the other hand. Different technologies help the teachers and learners according to their respective nature and capabilities of storage and presentation. For example computers are used in education for various purposes as they can store and retrieve a huge amount of information.[18] All 20 volumes of the Oxford English Dictionary are contained on one compact disc. The disc provides instant access to 616,500 words and terms, 137,000 pronunciations, 2.4 million illustrative quotations, 577,000 cross references, and 249,000 etymologies. Similarly, American Memory includes Library of Congress collections of primary materials from American history. Available on a combination of computer audio and videodiscs, American Memory contains 25,500 photographs; 500 prints and cartoons about Congress: 60 sound recordings (pre-radio) of early 20th century leaders; 1,610 color photographs taken during World War 2nd, 28 motion pictures of President William McKinley and 350 pamphlets by blank authors from Reconstruction to the First World War. [12]

Provide the opportunities of global interactions. Learners can learn from interactions with the information, interface, teachers and co-learners using global networks. They can interact at their own and get rid of their routine work. They may review and explore the qualitative as well as quantitative data trough computer networks. They can work on group projects participating in peer learning and knowledge building activities. Under the influence of information technologies, teaching and learning occurs in a changed situation.

There seems a shift from traditional teaching to e-learning. Menges (1994) stated that the eight "shifts" of Collins (1991) reflect the effects of IT on teaching and learning process. These shifts put greater emphasis on the activity of the learners than on that of the teacher's[19]. These include:

- *A shift from traditional lecture and narration to e-learning*

Learners learn through interactive IT and teacher guides them on how to use and reflect responses. Learners may be diagnosing learning problems and helping learners to find their solutions. When learners work with IT, teachers reduce the time they spend directing them; they spend more of their time in guiding them to learning more**.**

- *A shift from face-to-face classroom instruction to small group of conferencing*

Each learner's progress at different rates and pace in their individual learning process. Teachers can interact with individual learners and in small batches online. They can become better informed like mentor-mentees of the individual learner's progress and problems in their learning. That's why individual can help and facilitate in more effective way.

- *A shift from working with better one to working with weaker one personally*

Individual differences exist among learners at all levels of learning. IT enable teacher personally to cope with this problem in large classes working with individual learners and in small groups. Even if both teachers and learners are geographically apart. The teacher is then identify and able to aim instruction at one specific target group and to dedicate time to those who mostly need help.

- *A shift from almost all learners learning the same things to different learners learning different things*

Conventionally, all in class have to learn the same what the teacher deliberate to teach them in a class. However, now the pedagogy has changed and the use of IT and due to IR 4.0 has enabled the learners to learn what they required, and what they desire to learn. More focus on individual attainments. Resources and sources for learning are available through IT, AI and Virtual Reality, it becomes possible for learners to recognize, identify, categorizes and use the appropriate information to attain the goals under the guidance of teacher.

- *A shift towards more conventional engaged of learners, majority of learners is passive listener in the classrooms for most of the time.*

Teachers carry on delivering lectures without any concern of learners' participation in the teaching and learning process. Use of IT in classroom situation particularly interactive technologies however; ensure attention and active involvement of learners. Technologically designed instruction is more likely to engage individuals for intense effective learning than simple lectures and book reading a classroom.

- *A shift from evaluation based on test performance to evaluation based on online test using latest technology.*

Competencies, knowledge, information and skills are necessaries to live a successful and productive life. They may result from live, practical, informative and undertaking creative online projects rather than repeating or paraphrasing information from lectures and text books. The best practicals and projects include realistic tasks that generalize the learning and its application in new situations. Information technologies actively involve the learners in different proficiency based activities through talent oriented projects in real situations.

- *A shift from competitive structure to a cooperative goal structure.*

Collaborative and co-operative learning methodology provides learners the opportunities of extensive interaction. Learners have to create and access to extensive databases and share through networked communications to work on collaborative projects. Teachers guides the learners, how to create, share and interact in networked collaborative learning environments.

- *A shift from the predominance of verbal thinking to the integration of visual and verbal thinking.*

With IT and IR 4.0, learners would have broad experience with video than with print, yet instruction is based mostly on print. However, visual literacy is weakly understood and weakly utilized in perceiving instruction. Teachers need to ponder what capacities for visual knowledge and skills learners should possess, and determine how they can ensure progress towards developing these capacities. Information technology can help the teacher

on the one hand and facilitates the learners on the other hand. Both, teachers and learners get rid of their routine work, and have to play their new roles in new situations respectively. Teachers spend much of their time in assisting the learners rather lecturing; and learners access the information of their need, like mentor-mentees.

In the today's era of IR 4.0 and IT teachers indulge in spending more time to facilitating learners rather delivering lectures in the classrooms. They work in groups; searching, preparing and evaluating instructional materials and organizing data into meaningful information and in online manageable forms.[20] Spending their time in preparing and training learners; helping them to learn through read and reviewing the huge information. They will be offering and encouraging to create group presentations. These presentation will be carefully constructed to model and answer existing questions and solve current problems in certain disciplines. They will also be demonstrating the potential of skill development in learners by using information in problematic situations.

The following shifts redefine the new role of teachers in new era:-

- *A Shift From Covering Material to Assisting learners in Sampling Material Teachers decide what is vital and what is optional for learners when the Information is too much to decide by them.*

The vital information can be assigned and learners guided to work in an effective way. In the era of IR 4.0, many options of online media are available. The content should span a variety of online media to ensure that they become adroit in using information sources and that they experience the effects of various media.

- *A Shift from Unilaterally Declaring What Is worth Knowing Negotiating Criteria That Identify What Is Important Instead of providing net packages of content, the teacher plunges into primary sources.*

Together they develop ways to discriminate, distinguish and classify the more important from the less important. Online virtual exercises can help to develop criteria about the importance of data and information and its use for specific purposes. Learners can discuss these criteria for understanding and developing the new one if needed by solving virtual exams. A discipline-specific standard validates the information and enables learners to develop expertise in formulating criteria in other disciplines. They must also medium specific as the characteristics of hardcopy (print) and softcopy (electronic) information significantly differ from each other.

- *A Shift from Ranking Learners Relative to One Another to Negotiating Standards Specific to Individuals.*

IR 4.0 with IT promotes diverse academic opportunities and paths for each learner. They show progress according to their capabilities because some may progress slowly than others. The teacher can't use homogeneous standards of achievement and homogeneous rate of learning to evaluate learners' work. Therefore, it would be necessary to collaborate learning objectives and rates of progress that replicate individual interests, abilities, skills and needs.

- *A Shift from Grading According To Individual Attainments to Grading According To Collaborative Contributions.*

Assessment of individual work is easy. But judging and gratifying individuals' work in group performance is difficult, due to roles and responsibilities of each group member vary. With advanced technologies and available software, IR 4.0 and IT permit almost variability and unevenness in the tasks that group members pursue and judging them individually in a group.

- *A Shift from Merely Verifying Learner Source to Deriving Standards for Fair Use and Credits.*

Plagiarism is an annoyance in academic affairs. For a teacher to verifying is difficult task to verify all the sources to ensure the originality of learners' work. This role of plagiarism detector seems unfeasible when sources are so large, numerous and information can be so easily altered. But with IR 4.0 and IT software has made it possible to detect the plagiarism.

- *A Shift from Requiring Learners to Produce Knowledge to rewarding them for demonstrating Originality.*

A learner should have the skills, knowledge and capabilities of understanding, interpreting and applying knowledge in real situations. Without the application of information and knowledge learners can no longer retain it and soon they forget. In today's era of IT learners should be capable to apply core concepts and generalize principles too significantly in different situations. Exposure to IT leads to this affective principle. Information technologies would develop in learners, the capability of judging the validity and precision of information. Learning by IT, they would evaluate and discover the information to achieve certain objectives of their study.

IV. PREPARATION IN THIS ERA OF IT TO PROMOTE EFA

Certain skills capabilities of using different information technologies developed in IR 4.0 are necessary for learners as well as teachers. Therefore, gradual encounters with the technologies are necessary to prepare themselves for the era of information technology. [20]

Figure 2 Source - Internet

They will anticipate in the age of information technology as:

- Requiring learners to use electronic databases in their searches.
- Encouraging learners to use electronic mail to ask questions, and for submitting assignments.
- Becoming familiar with the advantages and disadvantages of the technologies and exploring the capabilities of compact-disc read-only memory (CD-ROM), audio-video conferencing etc.
- Surveying learners about their familiarity with the current information technologies and asking if they will share their knowledge and skills with the class.
- Using a word processor to develop class notes and editing a version to use as learners' handouts and a version for overhead transparencies.
- Using computer programs for keeping records in large class-enrollment lists, test items and so on and having learners review and update their own record from time to time.

- Using different packages for data analysis
- Encouraging learners to include visual elements as part of their projects.
- Spending learners' time as a multimedia workstation, planning a presentation; assembling projection graphics, video clips, animation, sound and other materials; trying to match particular materials with specific learning objectives; and integrating the materials into a unified presentation.
- Eliminating and/ or minimizing physical problems arising from the use of information technologies.

V. CONCLUSION

Information technologies with IR 4.0 are the result of knowledge explosion. These include hardware & software technologies and facilitate e-learning. Using Information Technologies learners are now able to participate in learning communities throughout the world. They are independent and free in choice of their program of study and access to the resources. They may learn collaboratively, share information, exchange their learning experiences and work through cooperative activities in virtual learning environments due to IR 4.0. Information technologies facilitate e-learning in more productive fashion. Similarly, the role of teacher is also different in new settings than in the conventional system. Teacher facilitates and guides the learners in their study playing the role of a coach or mentor. Now teacher is not at the center of the instruction and sole source of information as in conventional classrooms. He/she decides contents/experiences and/or activities, locates the resources and guides learners how to have access and utilize the information for required outcomes. In nutshell, information technologies are restructuring e-learning to meet the International standards to promote EFA.

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