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About the Journal

CIET, NCERT has been a premier institution for development and dissemination of resources and techniques related to Educational Technology (ET) for better understanding of teaching-learning at school level. With renewed thrust on educational technology using digital platforms, need for a quality journal on educational technology in India is felt more than ever. Keeping this in regard, Indian Journal of Educational Technology will be a medium for scholarly presentation and exchange of information between researchers, professionals and practitioners of technology related field of education. The journal aims at covering disciplinary areas of educational technology (ET) for school education and teachers' education. The specific objectives of this journal are: i) to provide an open access journal for sharing updated and peer reviewed research on Educational Technology for easy access and ii) to promote research on the integration of technology in school and teacher education, promote innovative practice, and inform policy debates on educational technology. This bi-annual open access online peer reviewed journal will be a platform for exchange of ideas and would also become a basis for further innovation in ET in school and teachers' education.

Notes to Contributors

Indian Journal of Educational Technology is a peer reviewed bi-annual journal especially designed for scholarly discourse of use of various forms of technology in education. Some of the themes encompassed under its broad perview of area are: Education Technology (ET), Information and Communication Technology (ICT) in education, Distance education and technology, Technological integration into pedagogy and content, Open Educational Repositories (OER) and FOSS, Innovation in educational system, Computer-based learning, Audio-video and multimedia in education and issues thereof, Technology cognition and curriculum, Impact of technology in education, Nature of technology and learning, Mobile learning, Learning through social media, Technology assisted evaluation systems, Technology support for differently abled population, Flipped classroom, Virtual and Augmented Reality, Artificial Intelligence, robotics and education, Impact of technology on learning, Social media and children, Economics of technology and its impact on education system, Educational planning administration and technology and Online courses for school and teacher education. We look forward for your contributions in the coming issues. Your feedback and suggestions are also welcome on the following address:
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Editorial

The world celebrated 150th Birth Anniversary of Mahatma Gandhi on 2nd October, 2019. The occasion was used to reflect on Gandhi ji's relevance in the modern world. While a lot can be learnt from the life and works of Mahatma Gandhi, it is in the realm of technology that Mahatma Gandhi appears to us in all his contradictions and dichotomy. By all imaginations Mahatama appears to be far aloof from technology. His frugal lifestyle can be substantiated by minimal artifacts or devices around him in all the pictures or images. The way he led his life appears to be anti-modernist. However, when one gets to understand his views on technology, we get to see a different Gandhi ji. In 1929, he organized an All India Competition for the best machine to spin clothes. The prize money was kept as Rs. one lakh. The terms and conditions of that machine contest were most interesting and revealing. Gandhi ji wanted a machine to be light-weight enough to be carried to the field by anyone in the family and low cost so that, any farmer could buy it. The advertisement further asked innovators to make machine which was durable with usual maintenance of 20 years and efficient enough to spin certain minimum yarns for fabric. The advertisement also said that at the end of any dispute, words of Gandhi ji will be the final. Although many applied, none was found to be suitable to innovate such a machine. This contest revealed Gandhi ji's view on technology and how technology should be used in our society. He wanted technology to be feasible and really contributing to the Indian Economy. He wanted technological solutions to be efficient, durable, light-weight, low cost and sustainable. Gandhiji was equally concerned about the use of technology for employment generation.

While the world grapples with the issues related to technology and innovations, Gandhi ji foresaw its implications. So, in the realm of technology, Gandhi ji appears to be not an anti-modernist but, a pro-modernist and he is not a bridge between traditional and modernity as some claims to be but, he comes to us as someone who transcends time and space. Today, when we face many challenges related to technology, Gandhi ji's views seem to be the most practical & relevant for the people of our country. No wonder, when we decide to use technology in education, we must learn from what Mahatma said about it; which is any technological solution that we offer in the field of education must be for the great majority of people, should be valid for women as well and should help in enhancing the learning of the children.

This issue of the Indian Journal of Educational Technology comprises of ten articles where, six are research articles, one review article, one general article, one communication and one book review. Though all these articles come under the broader umbrella of educational technology but, they vary in their focussed theme ranging from, use of ICT, the attitude of users towards its use to the impact of using ICT.

It is a pleasure to take out the third issue of the journal within the timeframe.

We are thankful to the reviewers and members of the Editorial Board for giving their precious time in deciding appropriate manuscripts for the Journal. The contributions to the journal under various article types have taken a quantum leap from the previous issue. For this, the whole fraternity of academicians; authors, reviewers and readers, all are to be acknowledged. We hope the journal is able to make itself a vibrant platform of discussions related to the theme of educational technology.

(ABHAY KUMAR)
Editor

Research Article

An Exploratory Study on Internet Use and its Application by Underprivileged School Girls

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Abstract

Not knowing how to use the Internet continues to be a significant barrier to digital Inclusion in Developing countries, reports World Wide Web Foundation (2017). Their Digital Gender Gap Audit (2016) reveals that half the world's population is still offline and most of these 3.9 billion people are women in developing countries. Mitigating the digital literacy gap is important to lessen the digital gender gap to ensure inclusive and equitable growth as proposed in the Sustainable Development Goals. The focus now includes - has the access to the internet resulted in potential changes, permeated the social layers and benefitted the Gen Z at the lower social economic strata too? Has it resulted in empowerment, development, and knowledge gaining at the grassroots level? Since the focus is on access, applications, and outcomes of use of the Internet among underprivileged girls, the survey was conducted in Tamil Nadu government schools and Chennai Corporation schools for girls. More than 800 girls were administered the survey questionnaire. The number of filled in questionnaires was 805. The study finds that the underprivileged school girl is aware, ready and motivated to be part of the information society.

Keywords: Internet, access, application, outcome, underprivileged girls.

Introduction

Internet use has recorded a dramatic increase in developing countries with 45.3 per cent of people online in comparison with 7.77 percent 13 years ago, reveals the United Nations. "By the end of 2018, we will surpass the 50/50 milestone for Internet use" declared the ITU (International Telecommunication Union, the UN agency for Information and Communication Technologies) chief Zhou. He added that it represents that we are moving towards a more inclusive global information society, yet "far too many people are still waiting to reap the benefits of the digital economy". The use of computers, Internet and mobile phones are set to hasten the process of making the world a global community but the social, cultural and economic factors determine the uses & values of technology in any society. The evolution of Information and Communication Technologies (ICT) & its rapid adoption is seen as thebackbone of globalisation.

As technological changes set to redefine and reshape societies in fundamental and unexpected ways, technology is believed to be the gateway to accelerate social & economic change in developing nations. According to a government of India Press release (2016), digital literacy refers to the knowledge to handle digital devices such as computers, tablet, PCs and smart phones, and Internet usage. Digital literacy is the usage and comprehension of information in the digital age, describes Gilster (1997) in his book, Digital Literacy. Digital literacy is the set of competencies required for purposes of communication, expression, collaboration & advocacy, thereby ensuring full participation in a knowledge society, according to Wikipedia (2017). A digitally literate person, say Hunt and Miller (2015), will possess a range of digital skills, knowledge of the basic principles of computing devices, skills in using computer networks, an ability to engage in online communities and social networks while adhering to behavioural protocols, be able to find, capture and evaluate information, an understanding of the societal issues raised by digital technologies & possess critical thinking skills. It is increasingly seen as a powerful development tool, used in the global battle to hit child and youth-focused targets in global education, livelihoods and health. According to the UN report, Women 2000 and beyond, (2005), digital divide is often characterized by low levels of access to technologies with poverty, illiteracy, lack of computer literacy and language barriers being the factors impeding access to ICT infrastructure, especially in developing countries. As Castells (1997) observes, the gaps in the Network Society will be defined less and less by geography or by transnational economic structures but rather by a digital divide, those with access to cyber space and others without such access (Melkote, 2001). United Nations Secretary-General Ban Ki- Moon in December 2015 stated that the focus on bridging the digital divide lies in inclusive internet access for all in order to enable the implementation of Agenda 2030 for Sustainable Development & called for intensifying and building an open, reliable, safe, secure, stable and inclusive Internet. The President of the United Nations General Assembly Thomson in July 2017 called for targeted policies and resources to develop the digital skills of today's youth, as well as specific programmes to ensure that women and girls have access to education, health and employment opportunities, at an event held at UN headquarters in New York on the theme 'Skills for the future of work'.

The International Telecommunication Union's (ITU) ICT facts and figures 2017 shows great strides are being made in expanding Internet access through the increased availability of broadband networks. The report finds that 71 % of the world's population of Internet users falls within the 15-24 age category. In developed countries, 94 per cent of the youth population use the Internet, while the proportion is 67 per cent in developing countries and only 30 % in least developed countries. ICTs continue to be a key enabler of establishing an inclusive digital society.

Review of Literature

According to a review on gender digital divide (Antonio and Tuffley, 2014), though women in developing countries have fewer opportunities, they show a great desire and capacity to use ICTs & benefit from doing so. Livingstone & Helsper (2007) in their study among UK 9-19 year olds propose a continuum of digital inclusion. Gradations in frequency of internet use (from non and low users through to weekly and daily users) are found to map onto a progression in the take-up of online opportunities among young people (from basic through moderate to broad and then all-round users), thus indicating why differences in internet use matter, contributing to inclusion and exclusion. Also, demographic, use and expertise variables played a significant role in accounting for variations in the breadth and depth of internet use. Shenglin, Simonelli, Ruidong, Bosc & Wenwei Li (2017) in their policy brief Digital infrastructure: Overcoming Digital Divide in Emerging Economies identify four major challenges - the lack of digital infrastructure and services, the lack of affordable network services, devices and applications, more importantly, the lack of digital skills to create or add value, most importantly, the lack of coordinated efforts to foster social and economic equality. Their recommendations include 1) at the G20 level, general principles should be set for emerging economies, supporting their economic development to close the digital divide globally, thus reducing gaps between poor & rich countries; 2) at the national level, governments should elaborate general policy guidelines and take action to reduce socio-economic inequalities across national populations. These guidelines should also clearly indicate specific measures and strategies to design innovation-friendly policies that every country should follow to sustain their economic growth.

As per a World Bank Report, 1.063 billion people in India are still offline. Manzar (2017) founder of Digital Empowerment Foundation states that in India, 1.4 million government schools, 7-10 million teachers & several millions of children, as per official figures do not have access to the Internet. The article 'What will it take to bring India's children online' (Manzar and Chaturvedi, 2018) reveals that with a computer-student ratio of 1:89 in India (National aggregate), digital inequities are exacerbated. The authors insist on the need to focus on optimal utilization of ICT resources.

In today's world, mobile technology, computers and Internet, social media and online communities shape the way the younger generation learn, communicate and develop. The millennial generation is the largest age group to emerge since the baby boomer generation. Buchanan, (2010) in his book Meet the Millennials states that they are masters of digital communication being highly-skilled and savvy in technology and believe in giving back to society and being civically engaged. Their successors, fondly called Gen Z can aptly be called Digital Monarchs. A study conducted by TCS (2013) among Chennai's 12-18 year old students to find out how tech -savvy they were, reveals that 68 per cent of the respondents use the

Internet for finishing assignments, students like to remain connected constantly at home and elsewhere, and they follow celebrities and sports stars on social media. The digital lives of gen Z (children born after 1995) boys revolves around gaming consoles and girls prefer e-book readers. They also enhance and exhibit their ideas innovatively & creatively with the use of digital technology. Research reiterates that access to the Internet at home or access at more locations increases the tendency to benefit out of Internet usage. Internet skills has a positive impact on academic performance overall, finds the study by Pagani, Argentin, Gui, and Stanca (2016) who held performance tests of Internet skills for tenth-grade students with an aim to find out the 'effects of digital literacy on educational outcomes'. The study also revealed that students who showed low academic performance or were from a low family background seemed to have benefitted more; and this was similar for students in technical or vocational schools.

The study on 21st century skills and digital literacy among rural school children in India by Morrin, Huang & Whalen (2014-2015) using qualitative methods in rural government schools in the states of Delhi, Himachal Pradesh and Rajasthan found that, among other things, while students had access to the computer, there was limited access to the Internet. Students did learn to operate the computer, but used them rarely to find, analyse, and use information. Mobile phones were used by some students to access the Internet, though not for educational purposes. Kim, Buckner, Kim, Makany, Taleja, and Parikh (2011) conducted a study among 210 children, aged 6-14 in 6 marginalized communities in India. Their study revealed a highly portable and relatively low cost mobile learning technology is a potential means to ignite self-directed and exploratory learning & a child-centred model may be beneficial for future ICT4D planning.

Considering the socio – economic constraints that any developing nation faces but with the determination to steer forward, the Government of India has launched several Initiatives. The Digital India Programme is a flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy, the vision - Digital India - Power to Empower. Pradhan Mantri Gramin Digital Saksharta Abhiyan with an outlay of Rs. 2,351.38 crore to make 6 crore rural households digitally literate by March 2019 is one of the largest digital literacy programmes in the world reports Hindustan Times, with the objective that digitally literate persons would be able to operate computers and digital access devices like tablets, smartphones etc.), send and receive emails, browse Internet, access government services, search for information, undertaking cashless transactions, etc and hence use IT to actively participate in the process of nation building. National Digital Literacy Mission (NDLM) is a national mission on Education using ICT in Higher Education Institutions, to provide digital literacy to every Indian, aiming to make one person in every family digitally literate it is one of the

integral components of the Prime Minister's vision of Digital India. Also known as The Digital Saksharta Abhiyan (DISHA), the Scheme has been formulated to impart IT training. Online labs (OLabs), SWAYAM, ePathshala are some initiatives to address the dual challenge of reaching out to a diverse clientele and bridging the digital - divide (geographical, socio-cultural and linguistic). The platform offers to its concerned stakeholders (students/ teachers/ educators/parents) access to e-resources through multiple technology platforms, mobile phones, tablets, computers. National Career Service Portal, a national ICT-based portal has been developed primarily to connect opportunities with the aspirations of the youth. The efforts of Rashtriya Madhyamik Shiksha Abhiyan (RMSA) is commendable in organising professional development workshops for teachers of government and corporation schools to implement better teaching methodologies using ICT and have greater engagement with students in classrooms.

With the Government focused on ushering in digital literacy, the non-governmental organizations are doing their bit towards inclusive digital literacy through multitude of projects. For example, a trendsetter & a major contributor, the Digital Empowerment Foundation aims to connect unreached and underserved communities of India in an effort to bring them out of digital darkness and empower them with information access through last mile connectivity, digital literacy and digital interventions. DEF has its presence in 150 locations spread across 80 districts of 22 states in India. It has digitally empowered 50,00,000 people including 25,00,000 women, and through its 345 Digital Resource Centres it has also trained more than 15000 people in digital content creation and dissemination.

A survey conducted across 200 districts of India by Local Circles, a social media platform in which 20,000 parents participated, 8 out of 10 respondents felt that the current school curriculum needs to be upgraded focussing on hands on learning life skills, technology - based learning and inclusion of real issues. Self-awareness, digital fluency and good communication skills are imperative to remain relevant for the future workplace, reveals the white paper by Quest Alliance, an NGO which is working with students in various States.

Tamil Nadu has emerged as one of the States at the forefront of providing digital content to students & teachers. In a revolutionary measure, the curriculum framework committee while revising the syllabus for State Board schools in Tamil Nadu (for the year 2018-19) has given a special focus to ICT in the draft syllabus in a way that it is embedded into the subjects and used in everyday classroom learning. The draft State Board syllabus, within a week of its release saw 1.6 lakh downloads from 17 countries, highlighting the imminent role of ICT based teaching and learning. Tamil Nadu for the fiscal year 2018-19 allocated Rs. 333 crore towards high tech laboratories in 3090 high schools and 2939 higher secondary schools with 10-20 computers each, the

proposed cost being Rs. 462.60 crore, set aside Rs. 758 crore for providing laptops to school students and sought Rs.200 crores from Centre to provide tabs (computers) to the children in government schools. According to the syllabi of classes I, VI, IX and XI, all textbooks have QR codes that link to the digital resources and the audio and video resources to be hosted on MHRD's digital platform DIKSHA. Every lesson has an ICT corner which will link students to portals to understand concepts better through maps and simulations. The initiative received massive response with 9.38 lakh views in the initial ten days of the schools' reopening. A senior official from the Education department attributes this to the fact that basic parameters like reasonable e-literacy, exposure to online content amongst students and teachers, network connectivity etc. are quite strong in the State The recent data from June 2018 to end of February 2019 reveals over 2.1 crore QR code scans, 1.79 crore content downloads & over 6 lakh plus hours spent so far on digital content. The numbers lesson from the class VI mathematics textbook has received over 41 lakh scans and is the most popular online resource as per the data.

To ensure effective implementation of the new syllabus, hi-tech labs with printers, tablets, projectors and computers with Internet connectivity along with a command control centre to monitor and manage the labs and training for five teachers from each school under the auspices of the centrally sponsored ICT scheme have been initiated by Tamil Nadu government across 3090 high schools and 2939 higher secondary schools. To strengthen the Teachers' abilities with ICTs, under the Tamil Nadu Innovation Initiative, the State Council of Educational Research (SCERT) has been conducting workshops on the use of Free and Open Source Software (FOSS) to encourage teachers to adapt and use technology. 2880 teachers have been trained to use several tools and applications to make their classrooms more interactive and learner-centric.

Equity in digital literacy still remains a challenge. The Annual Status of Education Report (ASER), 2017, that studied 1000 young adolescents aged 14-18 in 60 villages in rural Tamil Nadu indicates that while students have access to laptops because the State government has provide them to higher secondary school students, the young adults used it to watch movies rather than for education. Oliver, state head of the Pratham Education Foundation states that while infrastructure in the schools in the State had been steadily improving over the last few years, learning outcomes in both students of government and private schools were found to be nearly the same. ASER Rural survey, 2018 carried in 750 schools in 31 districts finds only a little increase in the number of computers available in the schools, 58.4 per cent in 2016 to 58.9 per cent in 2018. With the importance for ICT in the revised syllabus and the plan for hitech labs in the implementation phase, it will have to be a wait and watch situation.

While all efforts to usher in a digitally literate and digitally secure young

India are being made, it is imperative to assess if we are doing enough in terms of reach and scope. Equipped with knowledge and resources, the information elite have better access to new technologies and have in fact been overwhelmed by its dynamic nature. The focus now includes - has the access to the internet resulted in potential changes, permeated the social layers and benefitted the Gen Z at the lower social economic strata too? Has it resulted in empowerment, development, and knowledge gain in at the grassroots level?

Methodology

The policy brief on Digital Literacy in Education (2011) states, "digital literacy has become much more than the ability to handle computers – just like traditional literacy and numeracy, it comprises a set of basic skills which include the use & production of digital media, information processing and retrieval, participation in social networks for creation and sharing of knowledge, and a wide range of professional computing skills". (Karpati, 2011). The present study will focus on Internet and online media access, competency of use, its applications and outcomes among underprivileged school girls.

Definitions

Access: For the study, access was studied in terms of availability and use of computer and the Internet on the computer & or Smartphone. Frequency of access and place of access is also considered.

Competency: Competency will be studied using the constructs Manage, Integrate and Evaluate (CETF ICT Digital Literacy Initiative – Consensus Document, 2008). These include degree of comfort and assessing capability in performing Internet activities like search, surfing websites, selecting relevant information, verifying reliability of information, uploading and downloading information, using email, social media and other.

Application: The California ICT Digital Literacy Assessments and Curriculum Framework- using the constructs Create and Communicate (2008)- forms the basis for defining application which is studied in terms of digital skills like identifying, creating & communicating information- for example, to complete projects, create documents or a presentation; here, it will be done in terms of using the Internet and online media.

Outcomes: This is studied in terms of the benefits of using the Internet and other online media; specifically, acquiring knowledge, networking, entertainment & personal enrichment.

Objectives

The objectives of the study are:

- To find out access to Internet among underprivileged girl students
- To identify competency levels of use of Internet among underprivileged girl students
- To find out the application of Internet by underprivileged girl students
- To understand outcomes of the use of the Internet and online media among underprivileged girl students

Design and Sampling

Methodology used is survey among girls aged 13- 18 in Chennai. Since the focus is on underprivileged girls, the survey was conducted in Tamil Nadu government schools and Chennai Corporation schools for girls. More than 800 questions were administered the survey questionnaire. The number of filled in questionnaires was 805 (Table-1.1).

Part one of the questionnaire dealt with demographics that was considered relevant for the study.

Age was considered important because this could mean more opportunities to go online using the mobile phone or / and the computer as age increased. Class in which the student is studying is equally important because most schools have a computer lab with at least 2-3 computers which can be accessed more frequently by girl studying in higher classes.

Girls of the age group13 to 18 years, studying in classes ranging from VIII to XI were respondents of the study.

Part two comprised questions that helped answer research objectives.

To understand applications, competencies and outcomes of use of the Internet among underprivileged girls, the California ICT Digital Literacy Assessments & Curriculum Framework (CETF ICT Digital Literacy Initiative - Consensus Document-November 2008) was used.

Analysis and Findings

Underprivileged girls from the lower socio-economic strata studying in Tamil Nadu government and Chennai Corporation schools, studying in classes VIII to XI, in the age group of 16 to 18 were administered the questionnaires in their respective class rooms. The total number of completed questionnaires was 805.

The response to the survey was extremely positive- whether they had access to the Internet or not, all of them were aware of the Internet, and were excited to be part of the survey.

Table - 1: Profile of the Respondent

Categorisations		Levels of Education					
		VIII std.	IX std.	X std.	XI std.	XII std.	Total
		No.	No.	No.	No.	No.	No.
Age group	13 years to 15 years	128	117	169	24	20	458
	16 years to 18 years	0	0	108	123	116	347
Total		**128**	**117**	**277**	**147**	**136**	**805**
Family size	1 - 3 members	12	17	57	23	25	134
	4 - 6 members	109	92	213	118	101	633
	7 and above members	7	8	7	6	10	38
Total		**128**	**117**	**277**	**147**	**136**	**805**

Family Income	Less than Rs. 15000	102	81	161	73	83	500
	Rs. 15001 to Rs. 30000	21	23	51	42	36	173
	Rs. 30001 to Rs. 45000	2	5	12	7	3	29
	Rs. 45001 to Rs. 60000	3	5	30	17	8	63
	Above Rs. 60000	0	3	23	8	6	40
Total		**128**	**117**	**277**	**147**	**136**	**805**

N = 805

Respondents were from public schools run by the Tamil Nadu state government or the Chennai city corporation. Most were from low income families- 62.11 per cent of the girls were from families with less than an earning capacity of 15000 Rupees per month, and only 8.9 per cent were from a high income background (Table - 1). 56.8 per cent were girls from the age group 13-15 years, and the remaining 43.10 percent were from the age group 16 to 18 years, studying in the tenth, eleventh and twelfth classes. Smaller families were only 16.64 per cent of the respondents; very few, that is, just 4.2 per cent were from large families of 7 and more members.

Table - 2: Devices Used by Respondents to Access the Internet

Device	Always	Sometimes	Rarely	Never
Laptop/Tablet	66	141	99	499
Desktop	87	69	68	581
Smartphone	326	213	70	196

N = 805, Figures are in numbers

The Smartphone is a great leveller - a whopping 75 per cent of the respondents use the Smartphone to access the Internet (Table - 2). 326 of them claim to use the Smartphone always, to access the Internet (Table - 2). Not owning a computer was the reason why 45 per cent of respondents accessed the Internet rarely, or never.

Table – 3: Place and Frequency of Internet Use

Device	Every day	4-5days a week	2-3 days a week	Once a week	Fortnightly	Rarely	Never
School	13	22	20	33	4	77	636
Home	184	51	54	127	9	158	222
Internet Café	11	8	20	51	11	122	582

N=805, Figures are in numbers

Seventy nine per cent have never used the Internet at school-most schools do not encourage the use of Internet at school time. 72 per cent of them accessed the Internet at home either at least once a week, fortnightly or rarely (Table - 3). 184 of them accessed the Internet every day at home. The computer centre was also a less popular place for accessing the Internet. While all were curious and excited to use the computer and the Internet, lack of access to computers, not having enough time in school and lack of Wifi at home, were main reasons for accessing the Internet rarely, or never.

Table – 4: Online Platforms Used by Respondents

3.1 Search Engines and Websites					
	Platforms	Often	Sometimes	Rarely	Never
1	Use search engines like Google	172	281	73	279
2	Go on websites and download information for project and school work	211	276	100	218
3	Go on websites for information other than school needs	131	178	109	387
4	Access e-learning sites	39	76	134	556
3.2 Interactive Platforms					
1	Use the Mail (like Gmail, yahoo mail, Rediff)	46	109	97	553
2	Chat online	152	103	126	424
3	Use Internet call apps like Skype	86	98	138	483
3.3 Social Media Platforms					
1	Access/use sites like Facebook, twitter	124	132	89	460
2	Videos on You Tube	157	223	92	333
3	Follow blogs	42	92	99	572
4	Write your blog	38	75	117	575
3.4 Other Platforms					
1	Apps for uploading photos	136	179	94	396
2	Apps for downloading photos	151	199	92	363

N=805, Figures are in numbers

More than half the respondents (56.27 percent) use search engines like Google either often or sometimes and a few more, that is, 60.49 percent access websites online, for school work either often or sometimes (Table – 4). Also, more than half the number of respondents have never used interactive platform like the email, chat or Internet call apps. Using social media platforms like facebook, twitter and blogs is also rarely or never done by

more than half the number of respondents. The least popular activity on the Internet is blogging. Other popular uses are accessing videos on YouTube (47.20 per cent), downloading photos (43.47 per cent) and uploading photos (39.13 per cent), either always or sometimes.

Table – 5: Degree of Competency in Using the Internet to Perform Different Online Activities

Sr. No.	Online activities	Good	Somewhat good	Average	Somewhat poor	Poor
1	Using appropriate words to search for information using search engines	257	190	99	23	236
2	Opening websites by keying in the URL	121	158	154	32	340
3	Selecting relevant information on websites or in search engine results	115	88	213	37	352
4	Verifying reliability of information	157	83	151	57	357
5	Surfing websites or multiple pages	93	68	155	55	434
6	Downloading/copy pasting text files	302	130	105	15	253
7	Uploading text files	159	96	144	57	349
8	Downloading photos/ audio visual files	326	93	134	19	233
9	Uploading photos/ audio visual files	242	96	133	26	308
10	Bookmarking websites	91	84	162	53	415
11	Using words that are hyperlinked	47	65	151	99	443
12	Completing and submitting online forms	91	83	101	110	420
13	Using email	104	48	103	91	459
14	Registering & accessing social media sites	105	46	91	108	455
15	Accessing and writing blogs	42	50	106	91	516
16	Using the help option	111	52	107	83	452
17	Using the troubleshoot option	44	31	78	117	535

N-805, Figures are in numbers

The number of students who are poor at performing Internet activities increases with the complexity of the process. Comfort areas are downloading text files, photos and audio visual files. An almost equal number feel that they are good (31.92 per cent) or that they are poor (29.31 per cent) at using appropriate words to search for information using search engines (Table - 5). Competency levels in sending emails, following or writing blogs, are low. 64 per cent of the girls felt they were poor at blogging or accessing blogs, and 56 per cent did not know to register and access social media sites. More than 50 per cent of the girls lacked the competency to make use of offline options like bookmarking, troubleshooting and using help. Lack of practice, either because they could not access the computers or Internet often were given as reasons by the respondents for the poor competency, which means that it is a case of lost opportunities for the underprivileged girls.

Table – 6: Application of the Use of Internet

Sr. No.	Application	Number
1	You have used the Internet to gather, evaluate and use information	265
2	You have used the Internet to complete a project using digital tools and resources	313
3	You have identified and mentioned your sources	112
4	You know about the safe use of the Internet	337
5	You are aware of your privacy options on the Internet	187
6	Offline, you have put together different file types to create a document or a presentation	164
7	You have sorted small software and hardware problems	145

N=805, Figures are in numbers

While 41.8 per cent of the respondents were confident of the safe use of the Internet, a little less than a quarter of them (23.22 per cent) were aware of the privacy options of the Internet (Table - 6). About 40 per cent of them have used the Internet to gather, evaluate & use information, to complete projects. But, only 13.91 % of them identify and mention sources.

Table – 7: Outcomes of Using the Internet

Sr. No.	Outcomes	No.
	6.1 Knowledge Outcomes	
1	Helped improve the quality of assignments	298
2	Helped submit better projects	359

3	Helped perform better in examinations	259
4	Helped gain instant information and updates on news/ events	261
5	Educated through online education portals like tutorials, so that I learn more	152
6	Helped acquire skills like fitness, baking, hairstyling, make-up etc.	256
6.2 Networking Outcomes		
1	Helped to express and maintain relationships on social networking sites	246
2	Helped keep in touch with teachers to clarify doubts, seek advice or submit assignments	269
3	Helped coordinate and work on group assignments and projects	247
4	Helps in participating with likeminded social or cultural groups/communities	202
5	Helps to keep posted on what others are doing with their lives	142
6.3 Entertainment Outcomes		
1	Spend leisure time	265
2	Use the Internet play games by oneself/with others	367
3	Access free downloading audio/visual sites on the Internet	379
4	Listen to music/watch videos/archives at no cost	350
5	Access free do-it-yourself videos/tutorials on YouTube etc.	222
6. 4 Personal Enrichment Outcomes		
1	Helped improve self-confidence and personal esteem	292
2	Identify how to use the Internet safely, legally and responsibly	209
3	Keen to get updated with new digital technologies	132
4	Given opportunities to take part in social causes/campaigns/ events/public forums	183
5	Helped discover inner capabilities, skills and talents	275
6	Helped showcase talent/skills	243
7	Created an awareness of various opportunities in education and occupation	186
8	Sharpened goals for the future	194
9	Given confidence to aspire for higher socio-economic levels	178
10	Widened understanding of different cultures and people	140

N=805, Figures are in numbers

The true success of digital and Internet literacy among the underprivileged is the kind of impact it has on their overall growth. While entertainment-based use was the most popular with 47.08 % going online to access free audio-visual sites for downloading, 45.59 per cent playing games on the Internet, and 43.47 per cent going online to listen to music or watch videos at no cost (Table - 7).

The other most important outcome was knowledge based- 44.59 per ent of the respondents said that the use and application of the Internet helped them submit better projects in school, 37.001 per cent felt that it helped improved the quality of assignments and 32.17 per cent even claimed that it helped them perform better in their examinations.

36.27 per cent of the respondents felt that accessing the Internet helped improve self-confidence and personal esteem, and an almost equal number (34.16 percent) were able to discover their inner capabilities, skills and talents. 13.39 per cent found that it helped widen their understanding of different cultures and peoples.

Conclusion

Four important observations can be made from this study:

1. The mobile phone or the Smartphone is the most important device used to access the Internet, making it an important tool in education.
2. The Internet is being used for study purposes- to make better projects, to submit better quality assignments and to some, to do better in examinations, to network with teachers for school related information.
3. The Internet is used for entertainment on YouTube, gaming sites, and photography apps.
4. Social media participation is low, this could be due to the lack of access to computer, lack of time spent on the Internet and also, importantly, lack of linguistic competency.

What was unmistakable was the awareness and excitement about computers, Smartphone, the Internet and its immense possibilities.

Internet Access

The Smartphone has replaced the computer as the preferred device used to access the Internet, with 75 per cent of the underprivileged girls surveyed using it for this purpose. The revolutionary growth of the mobile phone technology, easy access to people across all classes to the mobile phone at reasonable prices has made it a ubiquitous device that is used to go online anywhere, anytime, helping narrow down the digital divide. Mobile phone technology in developing countries now accounts for four out of every five connections worldwide. In a recent report by the GSMA (Mobile for Development Programs) into m-learning, more than half of all young people surveyed in Ghana, India, Uganda & Morocco who had accessed the Internet, had done so on a mobile device (https://www.theguardian.com/sustainable-business/technology-empower-children-developing-countries).

Most students were not allowed to go online while using computers in school, and a large number of the younger respondents were not allowed by their parents to go to cyber cafes, thus reducing their opportunities to use the Internet. Even among those who use the Internet, almost 64 per cent of the respondents used the Internet less than ten hours a week.

Online platform use among respondents

Popular platforms were search engines, websites for information, YouTube and photo downloading and uploading platforms. Interactive platforms and social media were least accessed or used- less time spent on the Internet or lack of competency in language could well be the reasons for this.

Internet Competence

Competency decreased with an increase in the complexity of the application. Most respondents were good or somewhat good at using search engines, downloading text and audio visual files. Most respondents were not comfortable networking online through social media. However, respondents insisted that poor competency was because of lack of access to the computer or the Internet, and not because they found the applications difficult to use.

Internet Application

Almost half the numbers of respondents (41.08 per cent) are aware of the safe use of Internet, but most have to be taught about the privacy options available on the Internet. According to an article on technology empowering children in developing countries in the Guardian (https://www.theguardian.com/sustainable-business/technology-empower-children-developing-countries) a UNICEF study in developing countries found that up to a quarter of children in urban areas and one in every five children in rural areas surveyed in Vietnam had shared personal information such as their phone number or name of their school with someone online. In South Africa, more than 70 per cent of users on an online social networking site talked to strangers at least once a week. In Vietnam 49 per cent of urban children had been exposed to indecent content online, while 20 per cent of rural children reported having been bullied, threatened or embarrassed online.

Internet usage Outcomes

The most important gratification seems to be in the area of entertainment, followed by positive educational outcomes from submitting better projects and homework to doing better in examinations. Networking outcomes are mentioned mainly for schoolwork with 33 per cent getting in touch with teachers, and 30 per cent networking with classmates for group assignments and projects. Using the Internet has personally enriched 36 per cent of the girls- it has helped discover their inner capabilities, skills and talents. 20 per cent of them feel that the Internet has sharpened their goals for the future.

To conclude, it was found that the underprivileged girl is aware, ready and

motivated to be part of this information society. Lack of regular access - which a significant number of them are facing - may result in stunted personal growth and enrichment. In the information age where the Millennial and Generation Z are considered digital natives, inclusiveness is the need of the hour for the underprivileged girls.

Recommendations for further Research

The study focused on underprivileged girls in Chennai government/ corporation schools. The study could be made more complete by including focus groups with underprivileged girls, in-depth interviews with teachers of government/corporation schools, and some case studies of underprivileged girls especially in the higher classes, who made an efficient and effective use of Internet to improve their performance and achieve higher goals.

A survey among underprivileged boys is also recommended. Also recommended is a study among the urban middle and upper classes, who have a clear advantage of better access to the Internet, as a comparison group.

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Research Article

Impact of ICT based tools on Teaching - Learning System - a case study

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Abstract

Information and Communication (ICT) based teaching and learning technologies including simulations, animations, Physics cinema classic videos and virtual lab etc. along with the traditional learning methodologies have been relatively new concepts in current scenario. In this concept, the tasks of the educators and the students both are manifold as the educators have to make sure that the concept is clarified in many ways and the students have to practice not only inside the class but outside the class as well. Self-motivation and responsibility of both the students and the teachers are equally important. In this paper we have studied the impact of technology initiated learning in the courses of Physics-1 and Physics-2 along with traditional learning methodologies on the development of interest, performance and result of same group of students in sem-1 and sem-2 respectively of B. Tech first year. We found that technology initiated learning tools are substantially effective in improving the clarity of concept and subsequently the result of the students.

Keywords: ICT, technology enabled learning, traditional learning, simulation and animation etc.

Introduction

Educational technology is becoming an additional tool of interaction between educators and learners along with traditional teaching-learning system in improving the quality of education. Additional tools can make fair teaching superior and fine teaching excellent but it can't make awful teaching outstanding. Technology assisted teachers cannot be the drivers of improved education until they themselves are primarily very well learned (Roblyer & Hughes, 2018). Modernization and globalization are mostly accepted to impose challenges to individuals and societies (Schleicher, 2012). Teachers are expected to enable citizens, workers to acquire those functional and critical thinking skills. This indicates that teachers have to be competent to use information and communications technology (ICT). They need to be prepared to provide their students with technology supported learning opportunities to enrich student learning. Pedagogies within

technologically rich environments are linked to teacher's pedagogical knowledge, technological knowledge and content knowledge (Chai et. al., 2011). The task of teacher as instructive, collective, decision-making and technological measures, building a broad assessment for public communication base, is to comprehend the add-on learning, teaching process (Maor, 2003). We have to consider the strength and weakness together of technology enabled teaching & learning techniques. In conventional classroom education, teacher and students gather at a meticulous time & teacher delivers the lecture using traditional methods while technology enabled learning allows teacher and student to integrate themselves with additional tools. Technology enabled learning education entail endurance, enthusiasm, confidence, keenness & understanding of computer in general and various softwares like java, flv and qtm etc as well. Furthermore, the success of technology enabled education is based on individual's learning approach and activities type (Katrina, 2003).

For this study, Physics-1 and Physics-2 courses were offered to one particular group of students in sem-1 and sem-2 respectively during two consecutive semesters by the same teacher to the same students. We investigated the effects of ICT based learning on variety of students. It presents mathematical information on students who had studied in conventional classroom and other from technology enabled classroom. The accomplishment of the group of students using technology enabled education depends on different aspects as shown in Table 1. A comparison between these two education methodologies is made and discussed in analysis and results section. Though ICT based education seems to have a number of advantages when used along with conventional classroom for enhancing the teaching and learning process.

Comparisons between ICT based education and conventional Learning

Table - 1 sums up various opinions to make a comparison between conventional learning and ICT-based education.

Table -1: Comparison between conventional education and add on Learning based on the pattern of Jha et al, 2012

Categories	Traditional Education	Technology Initiated Learning
Education Process	It is not group or individual study as learning is conducted with the entire class	The learning process takes place with whole class as well as in group or by individuals
Classroom Discussions	Students are generally mum and teacher talks most of the time	The students & teacher both talk equally

Subject Matter	The course structure is fixed and The teacher delivers the lesson plan	Numerous sources of information are needed
Inspiration	The learners are passive and their motivation is less.	The students participate and their motivation is high
Educators' Role	The role of an educator is authoritative.	The students are directed for expected results in the simulation
Location of Learning	Education is within the classroom and the college	Education is within the classroom as well as outside the classroom on java simulations.
Time of Learning	Education happens within the given time-frame	Education happens within the class as well as out of the class on java, qtm.

Expectation and fulfilment of students from technology initiated education are high when compared with conventional learning, which seems to be true based on the performance of the students in final exam result. Technology initiated learning includes lots of merits over traditional education such as : instants for grabbing the information and answering, better communication between the learners, knowledge being obtained and transferred amongst the learners themselves (Can, et. al., 2007).

Review of Literature

Information and communication technologies (ICTs) are a diverse set of hi-tech apparatus and assets used to correspond and to generate, dispense, stockpile and supervise information as these actions largely used at the spirit of education.

The research model & its components as shown in Figure -1(Aslan & Zhu 2018) has been used to study add on ICT based Learning system. The representation illustrates the contents that give ICT base-education background and the items can be stirred among this mechanism.

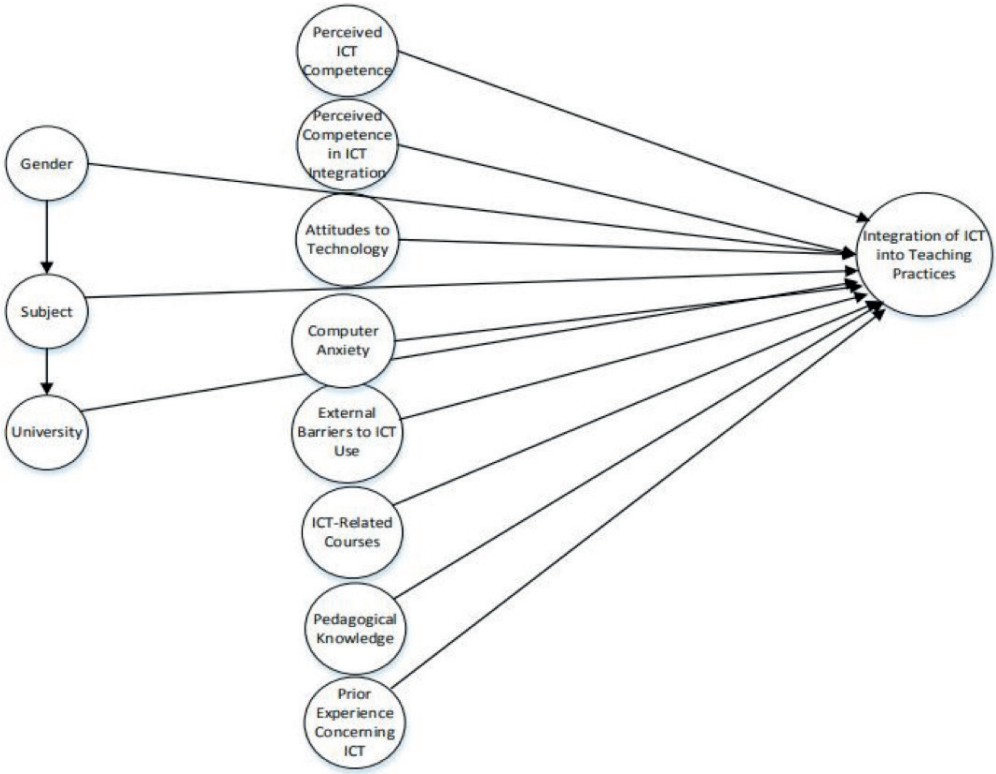

Figure - 1: Research Model of add on based ICT Learning system

In this study, both quantitative and qualitative research was used to investigate the participants' integration of ICT into their teaching practices as the research questions aimed at investigating the different dimensions of ICT integration into education. In this respect, the quantitative and qualitative research was conducted respectively to comprehensively understand the issue in multiple dimensions.

Number of students preferred to take classes in the Active learning classroom (ALC) rather than conventional classroom are more (Gordy et al, 2019). The analysis of student's grades suggested that GPA was one of the strongest predictors for both courses. Final grades in the Traditional Class rooms was better but had weaker predicting significance in the ALC setting. Overall, the majority of students enjoyed taking classes in the ALC due to its physical charm and dynamic collaboration.

Amorphous nature of technology is shown in Figure - 2 (Mishra & Koehler, 2006) and concluded that there is no single best way to make educational design for technological integration but that design should consider subject and classroom contexts.

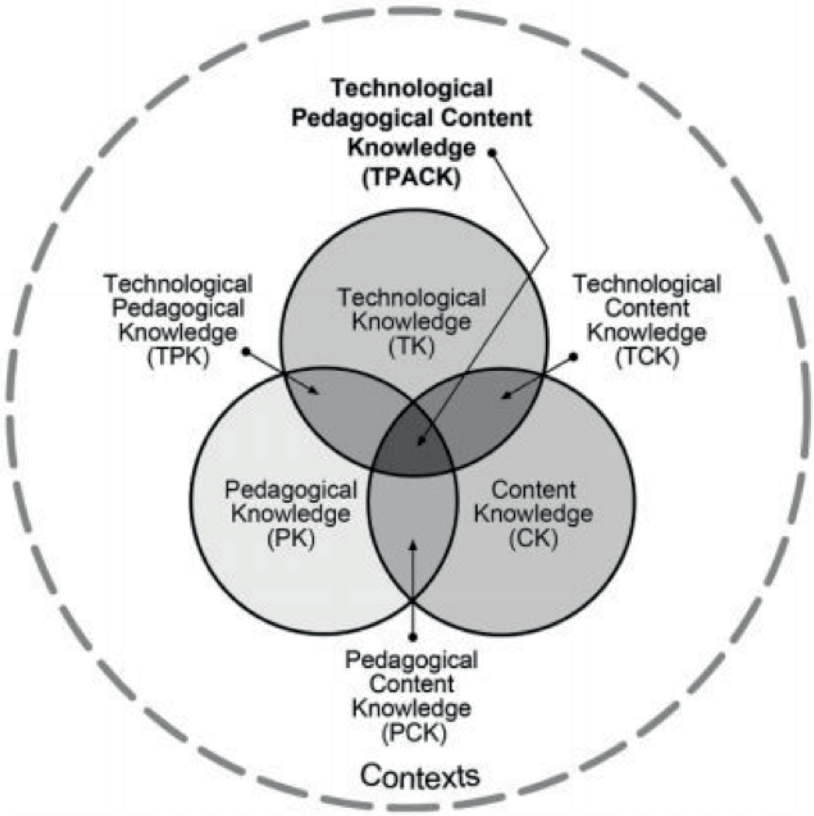

Figure - 2: Technological pedagogical content knowledge model

This means that unlike content and pedagogy that may be largely stable over extended periods of time, technology is continually changing and evolving, creating a shifting landscape that is challenging for teachers to master.

Traditional Learning system motivated by knowledge is a variety of all things of information flow involving learners and teachers including content of knowledge, its path & its compactness (Jha et al., 2012). Flow of knowledge is generally divided into an organization of three components educators, knowledge and students. The interacting structure of e-Learning system and the knowledge flow has been used (Jha et al., 2012).

Materials and Methods

This research is carried out at Faculty of Science & Technology, ICFAI University, Dehradun for teaching the Physics-1 (PH-111) & Physics-2 (PH-121) courses at the time when the main author was working as a faculty in charge of Physics there. These courses are for the sem.-1 and sem.-2 respectively of first year students of B.Tech. program. The task students taken for this research work belong to sem-1 & sem-2. For this study, Physics-1 and Physics-2 courses are offered in two different semesters by one professor using identical syllabi based on the books of Physics, vol. 1 & 2, 5th Edition authored by Resnick, Halliday and Krane of Wiley publication and same assessment instruments

have been employed except utilizing technology enabled learning in sem-2. Two examples taken from world press (2019) and physics classroom (2019), are been shown here; the reflected wave at the soft boundary does not get phase change while there has been a change of 180 degree phase of reflected and no change of phase in transmitted wave as shown in Figure - 3 at hard boundary when a wave passes through a medium of low density to a medium of high density;

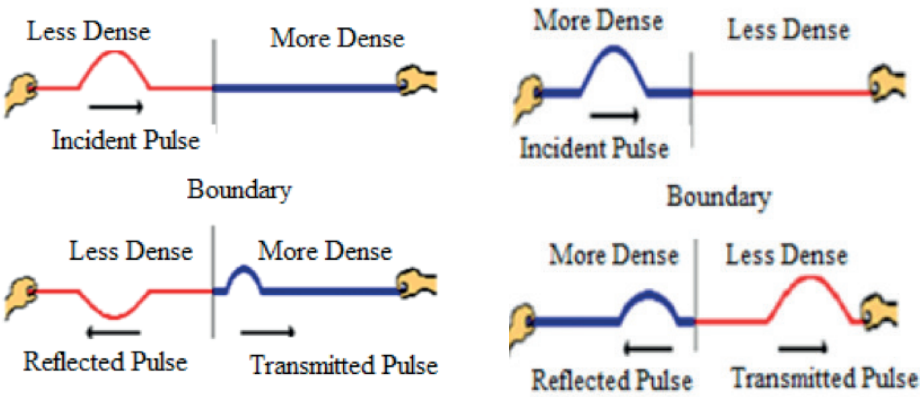

Figure - 3: Wave behaviour at soft and hard boundary

Second one is to make understand the concept of Gauss law as shown in Figure - 4 as it will be difficult to understand it but when seen in Fig. 4 of Pearsonhighered (2019) in which the angles between electric field lines with different surfaces, the law becomes quite clear and understandable.

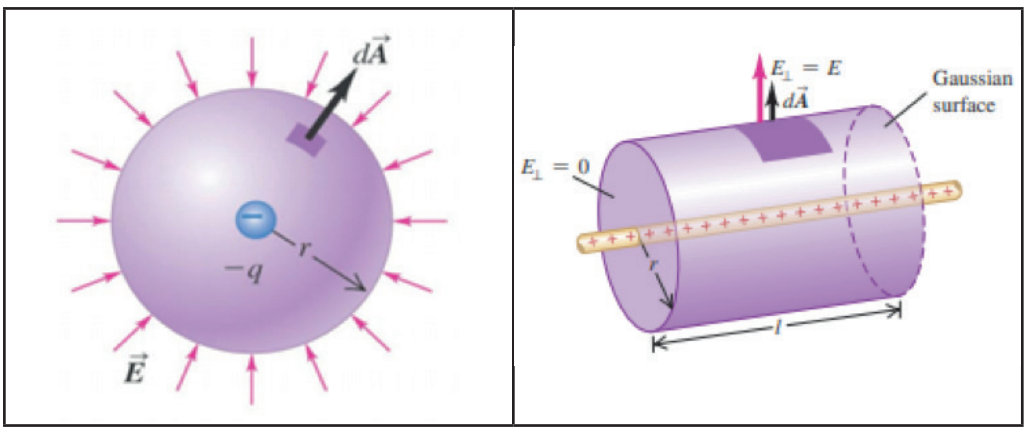

Figure - 4: Integrable surfaces in Gauss law

Similarly the following Figure - 5, taken from Colorado University (2019) shows the production of travelling waves in which students can vary the parameters such as amplitude, frequency and string thickness also. Rarefactions and compressions and the production of sound by a tuning fork is demonstrated in Figure - 6 taken from Amrita university (2019).

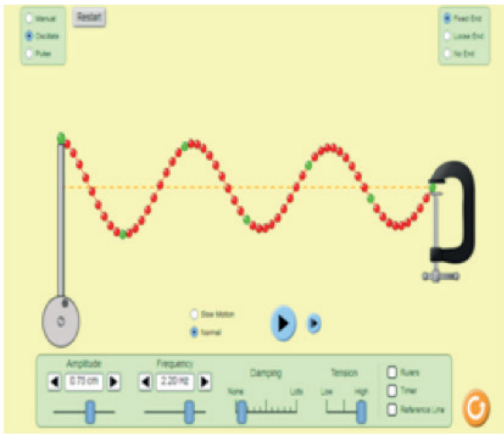

Figure - 5: Travelling Wave

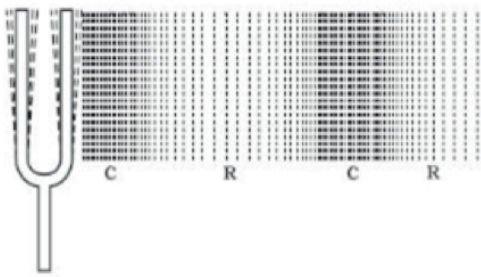

Figure - 6: Production of sound by tuning fork

The two courses of Physics-1 (Resnick, Halliday and Krane,5th Ed. Vol.1) and Physics-2 (Resnick, Halliday and Krane, 5th Ed. Vol.2) in sem-1 and sem-2 respectively are differentiated only in the presentation format: one was a conventional classroom employing chalk duster method with exercises in sem-1 while the other was delivered with additional tools of videos on Physics cinema classics, simulations and animations in sem-2 as shown by few similar examples given above, however the assessment methodology remains the same. Here, videos on Physics cinema classics are primarily obtained from American Physical society and ZTek Company, USA while simulations and animations used by us are mostly from Wiley and Thomson publication. Various aspects of handling the simulations and animations during the course were familiarized in the very first class of the semester. In both the semesters student sample is same that is 63. All the students were generally usual, residential B. Tech first year college students. The details of the sex and age of the students are shown in Table - 2.

Table - 2: Gender and age of participating B.Tech. first year students, ICFAI University, Dehradun

Categories	Number	Percent (%)
Gender		
Female	05	7.93
Male	58	92.07
Total	63	100
Age		
16 - 18	30	47.61
18 - 20	25	39.69
20 - 22	08	12.70
Total	63	100

Animations are shown in qtm and flv player while java is used to run the simulations. Animations are straight forward and do not provide variation in physical parameters while in simulations the physical parameters can be controlled. The students are allowed to play the various parameters of simulations & rerun the animations as per their choices.

Evaluation Methodology, Results and Analysis

The results of students are measured by grades obtained by them. The grading formulae adopted here is same in both the semesters. Students were accessed constantly during both semesters. The continuous evaluation was done by giving tests in which 2 tests were of 15 marks each while mid sem. test was of 20 marks and one quiz of 10 marks making a total of 60% weightage. Final evaluation was done by taking the comprehensive examination which was given 40 percent credence. The weighted final marks are calculated as below;

Weighted final marks = 0.50 × Class Test + 0.10 × Quiz Test + 0.40 × Comprehensive Exam

The weighted final marks of all the students in both the semesters were calculated after the comprehensive examination. A range of mathematical values like mean, standard deviation, maximum and minimum marks for both the sections are calculated and shown in the table - 3.

Table - 3: Descriptive statistics of weighted final marks

Semester	Teaching Methodology adopted	Maximum marks	Minimum marks	Average	Standard deviation
SEM-1	Traditional Classroom	62	10	29.07	8.1
SEM-2	ICT based Learning	62	12	31.86	9.6

Comparison of marks and grades obtained by the students has been done in table - 4 and it is found from the mathematical analysis that average and minimum marks for the students of conventional classroom teaching learning system (sem-1) are little lower than the students of add on Learning environment of system (sem-2).

Table - 4: Explanatory information of weighted final grades

Grades	Sem-2	Sem-1
A (≥60)	2	0
B(50-59)	12	10
C (25-49)	30	28

D (15-24)	10	12
E- (10-15)	4	6
F(≤9)	5	7

Therefore, it is quite clear that modern addition tools involved with traditional tools in teaching learning environment are impressive in creating the interest of the students in the subject and improving their results and grades.

Conclusion

In this student oriented study, we analyzed and compared how additional technical tools like videos, simulations and animations in teaching learning environment along with traditional teaching learning impact on the understanding of the students. It has been established from our results and analysis that add on tools when involved with traditional class room teaching procedures can make a significant contribution in manifold development of the students. Knowledge flow with the support of computer technologies not only clears the concepts in a better way but also give a chance to the student to use his or her intellect in performing and understanding the concept. From this Analysis, it appears that students of sem-2 gain more amount of information and knowledge by using add on learning tools as compared to students of sem-1 who had been delivered with conventional class room methodologies. Most of the students of sem-2 were much comfortable and enjoyed moreover due to their understanding or their changed study habits. Therefore, new ICT based techniques and old teaching systems must be used together for improving the teaching -learning process.

India has a huge budding market of add-on educational tools such as videos, animations, simulations and virtual lab. Only few universities and industries have started it. ICT based add- on educational projects have bright business scenario but it has been growing as a subject rather than an industry. Therefore, industrialization of ICT based add-on learning projects are required to be promoted.

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Research Article

Assessment of e-Learning Readiness of Academic Staff & Students of Higher Education Institutions in Gujarat, India

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Abstract

Gujarat has many prestigious higher education institutions which are inclined towards using e-learning platform. The present cross-sectional study is an attempt to assess the eLearning readiness of the stakeholders of these institutions. For this, data was collected (physical/e-form) through a self-developed questionnaire from a sample of 12 lab administrators, 83 teaching staff and 153 students belonging to 35 colleges of Gujarat which are using the e-learning practices. Frequency, percentage and intensity index were used to analyze the data. Majority of the stakeholders have a positive perception towards concept of e-learning and believe that it has many benefits. However, they feel that e-learning helps to a lesser extent in maintaining transparency, face to face contact and interactivity. These factors may hinder their readiness towards e-learning. Also unreliable technology and lack of faculty members' confidence and expertise to use this platform in teaching environment are seen as biggest barriers in e-learning. Hence, there is an immediate need to plan for training programmes which will help in improving the confidence of faculty members in using this platform and would increase their e-learning readiness.

Keywords: e-learning readiness, e-learning, Higher Education

Introduction

Indian higher education is one of the world's largest educational system which faces many challenges despite making significant progress. Educational technologies especially e-learning is proving to be a good solution and of highest priority in addressing some of the challenges in higher education. E-learning is opening new opportunities of transforming the educational

process. If well designed and managed, e-learning can overcome many barriers associated with traditional learning (Hijazi et al., 2003). It is a concept which encompasses students, faculty members, and e-learning managers (Persico et al., 2014). The challenges posed by e-learning are better understood and addressed when there is an understanding about its stakeholder's readiness towards it (Kaur & Abas, 2004). However, the increasing trend of adoption of e-learning in higher education institutions is raising questions like: What is the opinion of the students, faculty members towards e-learning, its advantages, disadvantages and challenges? How far the faculty members are ready in terms of their skills to ensure that the powers of these growing technologies are harnessed?

The evaluation of e-learning readiness can be done from (a) the point of view of its various stakeholders (students, teachers, e-learning experts/lab administrators etc. (Agboola, 2006; Persico et al., 2014) (b) the point of view of various factors like technological, organizational, environmental, nature of course offered etc. (Kaur & Abas, 2004). From the perspective of stakeholders, most of the times faculty members perceive e-learning to be positive and useful. However, they also had many issues which reduced their readiness towards e-learning (Siphamandla et al., 2014; Fathimath. T, 2016). On the other hand, majority of the students also perceived that e-learning is useful and effective (Fageeh, 2011). However, studies also showed that student's satisfaction was less in e-learning platform than in traditional system or they were still not ready for e-learning (Fathimath. T, 2016; Kaur & Abas, 2004; Keller & Cernerud, 2002). Studies also suggested that institutions, policy makers and regulatory bodies have to play a more concrete role in enhancing the e-learning facilities and programmes (Kaur & Abas, 2004).

In India, a fair amount of literature on e-learning studies dealt with aspects like e-learning quality (Agariya & Singh, 2012), perceptions, readiness, attitude towards e-learning (Azimi, 2013). However, majority of these studies are focused to study the readiness or perceptions from a single point of view like that of teachers or students or administrators. Moreover, these studies confine to very micro level with single university or an institution (Azimi, 2013). Gujarat state is witnessing a tremendous growth in higher education and many of them are moving towards harnessing the benefits of e-learning. Hence, there is a strong need for doing this study.

Theoretical Framework

E-learning readiness is the level of mental & physical preparedness of an organization in terms of technological skills, online learning style, equipment/ infrastructure, attitude, human resources, financial etc. (Mutiaradevi.R, 2009; Parlakkiliç, Alaattin, 2015).The critical success factors for e-learning identified by various researchers include: instructor; student; information technology; university support, financial, infrastructure, human resources, content, environment, psychological,

social etc. (Hasan, 2007; Khan, 2012; Tubaishat and Lansari, 2011). From the perspective of stakeholders, most of the times faculties perceive e-learning to be positive and useful. However, they also had many issues which reduced their readiness towards e-learning (Siphamandla et.al, 2014; Fathimath .T, 2016). On the other hand, majority of the students also perceived that e-learning is useful and effective (Fageeh, 2010; Wattakiecharoen & Nilsook, 2013; Ngampornchai & Adams, 2016) however, studies also showed that students satisfaction was less in e-learning platform than in traditional system or they were still not ready for e-learning (Keller & Cernerud, 2002; Kaur & Abas, 2004; Fathimath.T, 2016). Studies also suggested that institutions, policy makers and regulatory bodies have to play a more concrete role in enhancing the e-learning facilities and programmes (Kaur & Abas, 2004; Darab and Montazer, 2011; Nasrudin Md Rahim et.al, 2014; Edumadze, J.K.E et.al, 2014).

Objectives

The following are the objectives of the present study:

- To study the infrastructure available in the institutions adopting e-learning practices
- To study the opinion of stakeholders regarding e-learning, its benefits, disadvantages and challenges.
- To study the familiarity of faculty members and lab administrators with respect to use of various e-learning tools.

Operational Definition of terms

In the present study stakeholders refer to faculty members, students and lab administrators of the higher education institutions and e-learning is defined as an electronic medium which is manifested in form of a. Digitalized course outline\lecture notes outline b. Official use of e-mail c. Official use of online discussions/blogs etc. e. Digitalized assessment f. Digitalized projects announcements & submissions g. Virtual classrooms (VCR) h. Video conference i. Web based trainings (WBT) j. Fully online courses and used in teaching-learning, training, skill enhancement, evaluation etc. either through internet or intranet.

Research design and Methodology

Sample

All those higher education institutions which have their website listed on commissionerate of Higher Education, Government of Gujarat database (website) were contacted through email. A mail clarifying them the definition of e-learning was sent and was asked if their institutions were adopting e-learning practices or not. To respect the rights, values, and sentiments of the research participants, we informed them about the purpose of the study and confidentiality and assured them of maintaining the anonymity regarding their institutions names. 35 colleges responded that they were using e-learning practices. Out of these, investigators personally visited and collected data from 22 colleges which

did not show acceptance to respond to e-tool. The stakeholders of remaining 13 colleges who showed positive response to fill the e-tool were sent the same. Thus, in all 12 lab administrators, 83 teaching staff & 153 students from various programmes like, Medicines, Engineering, Management, Education etc. of 35 colleges participated in the study (Figure - 1). Therefore, the sample for the present study is based on accessible population rather than on target population.

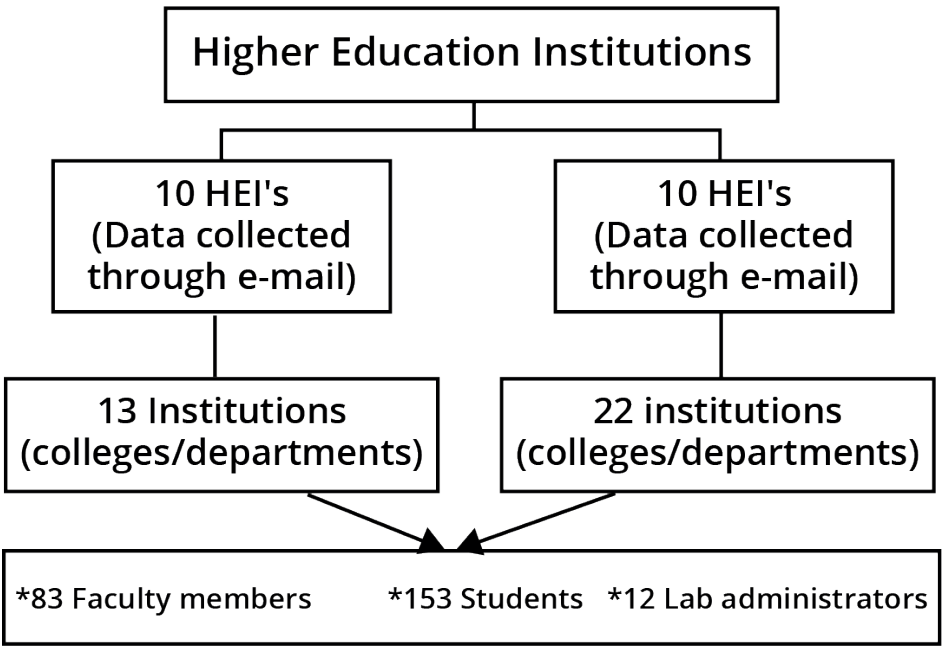

Figure - 1: Participants in the study

Instrument

This cross-sectional study involved a random sample of faculty members, students and lab administrators from above mentioned 35 colleges. Data was gathered with the use of self-made questionnaire consisting of a combination of items like Yes/No and rating scale items which was developed by the investigators after going through extensive literature (Agboola. A.K, 2006; Aydin & Tasci, 2005; Hasan, 2007; Khan, 2012; Mutiaradevi. R, 2009; Tubaishat and Lansari, 2011). The tools included items related to aspects like infrastructure readiness; opinion regarding e-learning, its benefits, disadvantages, barriers etc.; familiarity with e-learning tools etc. Separate questionnaire for students, teachers and lab administrators was developed to collect data in both e-form and hard copy.

Data Analysis

Intensive care was taken to ensure that the participants respond to all the questions of the tool. The collected data was analyzed using percentages, frequencies, intensity index (here after, II). II indicates exact point of intensity

preferred by the sample for each item in a likert scale.

By transforming the data into a single number, it is easy to make a decision about the response of the participants to the given statement (Chaudhari, Pinkal, 2016; Khirwadkar.A and Chaudhari.P, 2019; Kothari.C.R, 2004; Lakhera Himangani, 2017; Sunil Kumar, 2016). In the present study, II was calculated using the following formula for an item in a five point scale arranging from higher intensity to lower intensity.

II = ((f1*5)+ (f2*4)+ (f3*3)+ (f4*2)+(f5*1)) /(f1+f2+f3+f4+f5)

Where, f1, f2, f3, f4 and f5 are the frequencies from higher intensity to lower intensity (Chaudhari, Pinkal, 2016; Khirwadkar.A and Chaudhari.P, 2019; Kothari.C.R, 2004; Lakhera Himangani, 2017; Sunil Kumar, 2016). The analyzed data was then synthesized & presented.

Results and Discussion

Findings related to Facilities/Resources Available for Adopting e-Learning Practices

Connectivity & physical communication infrastructure is the foundation of electronic-readiness for a country (Aydin & Tasci, 2005; Eze et al., 2013). From the findings it was observed that, many of the higher educational institutions have Wi-Fi connectivity in their campus and the institutions which did not have Wi-Fi connectivity in the campus had a minimum 2 & maximum of 4 computer labs. The ratio of computers to students in all the institutions is around 1:2 and around in 80 percent of the computer labs, all the systems have internet connection.

As high as 73 percent of faculty members responded that they have individual personal computers for them in their staff rooms. Among them, 90percent of participants responded that their personal computers are connected to internet. Around 63.64 percent lab administrators expressed that their institutions have software specialists for the purpose of adopting e-learning practices, and around 54.55 percent of them expressed that they have the authoring tools which are required for the purpose of adopting e-learning practices. 100% of them expressed that their institutions have high bandwidth connectivity & much secured network connectivity. 90 percent of them expressed that they have free and unlimited internet access. With respect to connectivity with digital libraries, around 72.73 percent of them said that their network has connectivity with the digital libraries of their institutions and also other pay and use digital libraries. A higher percentage of i.e. around 72.73percent of them said that latest software were available with them. However, only 36.36percent of lab administrators expressed that they used LMS (Learning Management System) for providing e-learning practices.

Mutiaradevi. R, 2009, Siphamandla Ncube, et al., 2014, Parlakkiliç, Alaattin, 2015 support the point that facilities/ resources available for adopting e-learning practices play an important role in determining the e-learning readiness. The above findings show that majority of institutions are well equipped in terms of network and

connectivity. However, majority of them are using basic e-learning technologies, a very few of them are using features like, LMS/Content Management System (CMS) in their e-learning platform.

Findings related to opinion regarding e-Learning

Individual readiness & positive perception about e-learning significantly improve the effective use of e-learning (Aydin & Tasci, 2005; Sadik, 2007). In our survey, the respondents were asked about their opinion regarding e-learning and it was found that, around 24.1 percent of the faculty members felt that e-learning is very valuable while 71.08 percent of them felt that it is a valuable practice. 83.13 percent of the faculty members felt that gender was not significant for responding to e-learning (Aydin & Tasci, 2005; Parlakkiliç, Alaattin, 2015) which is in contrast to findings of Agboola, A.K, (2006), Proctor & Burnett (2006). Moreover, 50.6percent of the faculty members expressed that academically well prepared students responded more positively to e-learning practices than academically less prepared students. Around 58.3 percent of the lab administrators felt that e-learning is a very valuable practice.

It is clear that stakeholders have positive opinion regarding e-learning which is a good sign for the institutions which are using the e-learning practices and also for the institutions which are planning to use e-learning practices in the near future as attitude toward e-learning directly affects individuals readiness (Akaslan, D.,& Law, E, 2011;Aydin & Tasci, 2005; Sadik, 2007)

Findings related to Benefits of e-learning

Positive culture is created in the institute if all the stakeholders realize the benefits of e-learning (Sadik, 2007). Stakeholder's belief and appreciation towards the benefits of e-learning has a major impact on e-learning readiness.

Faculty members

The II regarding personal benefits of e-learning as perceived by faculty members ranged from 2.26 to 3.23 (Table - 1). Most of them felt that spreading of information becomes easy and faster in the e-learning and it also becomes easy to update the student's records and it helps students to learn at their own pace at any time and in any place. Re-use of the content is also seen as one of the benefits of e-learning. In terms of professional benefits of e-learning, according to them, reaching more students in less time and ease of providing additional information regarding the course to the students are the highest advantages of e-learning.

Table - 1: Percentage wise Distribution of Ranking for the Personal and Professional Benefits of E-Learning as Marked by Faculty Members along with Intensity Index (II)

Personal Benefits					
Particulars	**1st**	**2nd**	**3rd**	**4th**	**II**
Spreading of information related to the content becomes easy and faster.	47.14	34.2	12.86	5.71	3.23
Students can learn at any place, pace, and any time	34.25	17.8	24.66	23.2	2.63
Re-use of content	17.57	21.6	29.73	31.0	2.26
Easy to update the students records	35.62	21.9	21.92	20.5	2.84
Professional Benefits					
Assist in maintaining transparency	19.12	19.1	30.88	30.8	2.26
Re-use of content	26.39	26.3	20.83	26.3	2.38
Easy to provide additional information regarding the course	29.85	40.3	19.40	10.4	2.90
Can reach more students in less time	52.70	25.6	10.81	10.8	3.20

These findings confirms the assertion made by various researchers that e-learning is not limited by time, space and location and many other benefits (Siphamandla Ncube, et al., 2014; Smedley, 2010; Unneberg, 2007). However, "assist in maintaining transparency" benefit of e-learning was rated least. During the process of data collection the investigators could observe that some faculty members were using e-learning platform effectively for academic and administrative purposes.

Lab administrators

Table - 2 shows the II for benefits of e-learning as ranked by lab administrators. Just like faculty members, even they felt that spreading of information becomes easy & faster in the e-learning platform & it enables learning at any place, pace and at any time. The benefit which is ranked 3rd by them is that "e-learning helps in development of professional skills" and thus it enables them to be upto date with professional needs. Ease of communication, flexibility of time, place and pace are the most important benefits of e-learning (Smedley, 2010; Wagner et.al, 2008).

Table - 2: Percentage wise Distribution of Ranking for the Benefits of E-Learning as Expressed by Lab Administrators along with Intensity Index (II)

Particulars	1st	2nd	3rd	4th	II
Spreading information becomes easy and faster	66.67	16.66	16.67	0	2.50
Helps in being upto date with professional needs	33.33	22.22	44.44	0	1.89
Assists in development of professional skills	33.33	44.44	22.22	0	2.11
Enables learning at any place, pace and any time	33.33	50.00	16.67	0	2.17

Students

They felt that the most important benefit of e-learning is that it enables learning at any time and at their own pace (Table - 3). Moreover, just like faculty, even students feel that ability of e-learning in maintaining transparency is less.

Table - 3: Percentage wise Distributions of Ranking for the Benefits of E-Learning as Ranked by Students along with Intensity Index (II)

Particulars	1st	2nd	3rd	4th	5th	II
Ease of access of information related to the course	27.21	17.6	21.3	28.7	5.15	3.33
Students can learn at their own pace	22.56	20.3	35.3	15	6.77	3.37
Enables learning at any time	25.55	38	24.1	10.2	2.19	3.74
Enables learning at any place	22.6	15.1	12.3	26.7	23.3	2.87
Assist in maintaining transparency	8.462	6.92	9.23	18.5	56.9	1.92

Other studies showed that students did not regard access to e-learning as a benefit as compared to personal interaction (Keller & Cernerud, 2002) & preferred hybrid learning to complete online learning (Eldeeb, 2014). In some places where face-to-face mode was not available or it was not according to their convenience, students opted for e-learning only (Huss and Eastep, 2013). All stakeholders felt that access to information related to the course content becomes easy and fast in the e-learning platform and further it is easy to reach more students in less time. Also, they all felt that e-learning platform provides the scope for learning at own pace, at any time.

Findings related to Disadvantages of e-learning

The II for disadvantages of e-learning as expressed by the faculty members ranged from 2.55 to 3.77 (Table - 4). Most of the faculty members perceived that e-learning is not a costly affair (Abu-Hassan-Assari, 2005) which is in contradiction to the study by (Akkoyuklu & Soylu, 2006).

Table - 4: Percentage wise Distribution of the Ranking for the Dis-Advantages of e-Learning as Ranked by Faculty along with Intensity Index (II)

Particulars	1st	2nd	3rd	4th	5th	II
It is a costly affair	21.9	15.07	12.3	16.4	34.25	2.55
Handling and management of content is a technical affair	10.8	24.32	24.3	28.3	12.16	2.93
It reduces face to face contact and interactivity	40.0	22.67	18.6	12.0	6.67	3.77
As the content is available online for a long time, it reduces students interest	16.4	31.51	17.8	20.5	13.70	3.16
In e-mode, it is difficult to trace the students' actual learning.	26.0	20.29	27.5	14.4	11.59	3.35

The biggest disadvantage as perceived by them was that it reduces face to face contact and interactivity (Young, 1997). Faculty members also felt that in e-mode, it is difficult to trace the student's actual learning (Arkorful & Abaidoo, 2014). They also felt that availability of content for long time online reduces student's interest in it. Some faculty members even felt that handling and management of content in the e-learning platform is a technical affair.

Lab Administrators:

Most of them felt that availability of content for long time online reduces student's interest in it. They expressed that e-learning reduces face to face contact and interactivity. The two aspects of e-learning, i.e., 'it increases their workload' and also 'effective\real learning does not happen' were rated the least.

Students

Students also felt that e-learning reduces face to face contact and interactivity and rated it as biggest disadvantage. They expressed that tracing the students' actual learning in the e-mode is very difficult (Table - 5).

Table - 5: Percentage wise Distribution of the Ranking for the Dis-Advantages of E-Learning as Ranked by Students along with Intensity Index (II)

Particulars	1st	2nd	3rd	4th	II
E-learning reduces face to face contact and interactivity	31.75	31.75	14.29	22.22	2.73
As the study modules are available online for a long time, e-learning reduces students interest towards the modules	28.80	16.00	28.80	26.40	2.47
In e-mode, it is difficult to trace the students' actual learning.	21.77	27.42	33.06	17.74	2.53
Often, effective\real learning does not happen	23.02	24.60	23.81	28.57	2.42

All the stakeholders felt that e-learning mode reduces face to face interactivity and it is very difficult to trace the actual performance of the students. They also said that availability of e-learning modules for a longer time reduces students' interest towards it as they develop the tendency of postponing their tasks. Further, a few faculty members felt that handling and management of content in e-learning mode is a technical affair & considered it as one of the disadvantage of e-learning. However, the positive sign came from lab administrators who felt that adopting e-learning practices does not increase the work pressure.

Findings related to Challenges/Barriers to e-learning

Faculty Members

The intensity indices obtained for statements which described the challenges/barriers to e-learning varied from 3.15 to 4.06 (Table - 6). According to faculty, "Lack of knowledge on how to use the e-content on the part of students" is perceived to be the least causing barrier in promoting e-learning practices. Further, faculty members also expressed that adopting e-learning practices would not increase their work load (Lloyd et.al, 2012).

Table - 6: Percentagewise Distribution of the Ranking Given by Faculty Members for the Challenges/Barriers to E-Learning along with Intensity Index (II)

Particulars	1st	2nd	3rd	4th	5th	6th	II
Students lack knowledge about how to use the e-content	10.67	13.33	13.33	28.00	12.00	22.6	3.15
Network access/ Usage problems (unreliable technology)	27.78	15.28	22.22	9.72	19.44	5.56	4.06

Students lack self-motivation in using e-content	27.40	16.44	15.07	19.18	9.59	12.3	3.96
Faculties lack interest and confidence to use this technology in teaching environment	30.14	19.18	12.33	8.22	19.18	10.9	4.00
Increasing work load on the part of faculties	12.70	20.63	22.22	14.29	19.05	11.1	3.60

However, unreliable technology and lack of interest and confidence on the part of faculty members to use the e-learning practices were found to be biggest challenge in adopting e-learning practices (Agboola, 2006; Mutiaradevi, R, 2009; Parlakkiliç, Alaattin, 2015).

Lab administrators

According to them, lack of sufficient infrastructure to promote e-learning, technical nature of handling and managing the content in e-learning platform, lack of pre-training were considered to be the biggest barriers in implementing the e-learning platform. Unreliable technology was considered to be the least barrier in adopting e-learning which is in contrast to the opinion expressed by faculty members.

The findings in this section show a positive point that faculty members believe that students have sufficient knowledge to use the e-learning practices. Data also indicates a need for increasing the technical consistency of the e-learning platform. Also, a point of concern is about lack of confidence and interest of the faculty members in using this platform. This should be addressed immediately.

Findings related to familiarity with e-learning tools

When an institution decides to adopt e-learning, the stakeholders need to be familiar with tasks like development of instructional system, use of software and hardware etc. (Driscoll, 2002).

In terms of working with computers, as high as 69 percent of the students said that they were very comfortable in working with the computers. More than 45 percent of the students work for more than 20 hours in a week on computers and around 19percent of them work between 20 and 10 hours in a week on computers. Around 35 percent of the students use computers between 1 to 9 hours in a week. In terms of using the internet, a majority of students consider themselves as experienced users. Around 23percent of students consider themselves as very experienced users and around 9 percent of the students consider themselves as champions in using internet (Fathimath, T. 2016). Most of the students have medium and advanced expertise in using computer and internet.

When it comes about familiarity of e-learning tools by faculty members and lab administrators, the II obtained for faculty members with respect to Learning Software/Virtual Tutorials, Computer Based Assessment, Virtual Learning Environment (e.g. WebCT,

Blackboard), Video conferencing, Authoring web pages (for specific learning outcomes), Electronic White Boards were 2.51, 2.4, 2.01, 1.98, 1.96, 1.94 respectively. These figures show that, faculty members look familiar with learning software/virtual and they have a very less familiarity regarding all other e-learning tools. The II for these tools reveal that most of the faculty members have not used them at all or have tried these tools hardly once. A very meager percentage of faculty members claimed that they were expert users with reference to their familiarity with the mentioned e-learning tools. This finding is in tune with the studies of Alenezi (2012), Edu madze, J.K.E et.al (2014), Rogers (2000). This scenario is observed to be better with lab administrators because in most of the institutions managing the e-learning platform is considered as a technical task and hence it is mostly handled by them.

Thus, expertise on behalf of students is not an issue in implementing e-learning, however, if the higher education institutions want to reap maximum benefits from the e-learning practices, they should create a platform where their faculty members are trained, exposed & motivated towards e-learning platform.

Directions for future study and conclusion

The use of e-learning platform is still at infancy stage and hence deeper studies to evaluate the objectives/ mission/goal of the institutions in adopting the e-learning practices can be done. Qualitative studies focusing on the pedagogical aspects of e-learning can also be carried out. The number of institutions in India adopting fully online mode of e-learning are increasing and hence research studies in this direction can also be carried out. The present study reveals that stakeholders believe positively in e-learning, however, they have apprehensions that e-learning also has some disadvantages. A point of concern is also about expertise of faculty members in using various e-learning tools. This again puts forward the point that institutions have just begun this initiative of using e-learning practices and have made least efforts in training the faculty members in these e-learning tools. Hence, this should be addressed. Also the government especially department of higher education should develop e-learning quality guidelines to guide higher education institutions. These findings would help the higher education institutions and others who intend to put into practice the e-learning platform.

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Research Article

Effectiveness of Computer Based Instructional Package in Terms of Achievement in Educational Psychology

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Abstract

This is technological era in which every facet of life has been transformed by computer technology. Education too, has not remained untouched by the advent of modern ICT. A whole new spectrum of ICT based technologies have thrown up many new innovations in teaching and learning such as use of open resources, digital lectures, educational software, blogging, social media etc. Learning based on books and lectures by teachers is now being blended with innovative methods of teaching learning based on ICT. Education remains no more confined to black board, chalk, and teachers talk but various new inventions like computer multimedia have become integral part of modern educational system. The use of computers, multimedia, simulation, and audio/video presentations makes education live and vibrant by involvement of learner's multiple senses in the process of learning. Computer based Educational technology has many advantages over the conventional system of instructional delivery in teaching learning process. In the present research, Investigator developed Computer Based Instructional Package in Educational Psychology and assess the effectiveness of package in terms of achievement of pupil teachers in educational psychology. Achievement is also compared on the basis of gender & Intelligence of prospective teachers.

Key Words: CBI package, Achievement, Educational Psychology.

Introduction

Technology is an integral part of our day to day life. Today it affects every part of our life from shoe making to making indigenous aircraft career like Vikrant. The concept of technology in education was dreamt many centuries ago when, Plato prophesised that someday in the distant future our grand children will develop a new equivalent of our class rooms. They will spend many hours in front of boxes with fires glowing within. They may have the wisdom to know the difference between light & knowledge? The dream of Plato comes true with the invention of computers and other related inventions in the field of education. Students now spent hours sitting before electronic device called computer and use it to convert, store,

protect, process, transmit and securely retrieve information. Thus, new era of education through technology has started in which technology and education are going together hand in hand.

Information and communication technologies have become one of the major constituents of contemporary society within a very short time. Understanding ICT, Concept of ICT and mastering over the key skills of ICT is now concerned as a core part of the education, alongside reading, writing and numeracy by many countries (Daniels, 2002). ICT is not generally referred to computer and computer related activities, other systems and technologies also consist of the phenomenon that is commonly regarded as ICTs. Near the end of 1980s, the term computers were replaced by 'IT' (Information Technology), which is followed by the introduction of the term ICT (Information and Communication Technology) around 1992 (Pelgrum & Law, 2003). United Nation Report (1999) stated that ICTs embrace internet service provisions, telecommunication equipment services, libraries and documentation centre, commercial information providers, network-based information services and other information and communication activities. According to UNESCO (2002) ICT may be regarded as the fusion of Information Technology with other related technology, specifically communication technology. The entire fields of education including teaching, learning, and research have been greatly influenced by ICT. On the basis of the use of ICT in education, it has been categorized into two broad categories: ICT in Education and ICT for Education. ICT in education intend teaching- learning process with ICT. It involves the adoption of general components of ICT like hardware, software, data, information procedures and human resources in the teaching learning process. Studies shown (Chaudhary & Sharma, 2012; Ruhee, Wani & Bilal, 2011; Shivkumar & Arunachalam, 2012; Rajasekar, 2009) that integration of ICT in teaching learning process and in curriculum has positive and significant impact on student's achievement in different subjects such as mathematics, science and social sciences specifically in knowledge and understanding domain of objectives, practical's & presentation skills.

The use of ICT in educational context, act as a catalyst for change in this field and because of having the variety in nature, it encourages and support individual and independent learning. As more and more students use ICTs for their learning as information resources and cognitive tools, the impact of the technology on students' learning affect their learning significantly (Reeves and Jonassen, 1996). According to Duffy and Cunningham (1996), contemporary learning theory is based on the notion that learning is an active process of constructing knowledge by individuals rather than acquiring and stored knowledge and that instruction is the process by which the knowledge construction is supported rather than a process of knowledge transmission.

Contemporary learning approaches using ICT as a tool, may provide many opportunities to constructivist learning through active efforts and support for context-related and student-centred learning.

Computer Based Instructional Package may contain graphics, text pictures and animations which can cover a specific part or whole of the lecture or concept with no provision of providing support from any other medium. It consists of a little more than an ordinary class room lecture or notes. In this mode of instruction computers are used as primary means of knowledge exposition. Thus, computer Based Instructional Packages may present any topic in a lively & an interactive mode.

The studies related to ICT are excessively conducted on relative effectiveness of Computer Based Instructions and comparative analysis with traditional and other methods or strategies of teaching. However, researcher found that in India most of the researchers are conducting researches to assess the attitude and awareness of students and teachers towards use of Information and Communication Technology. In this area researchers namely Karen (1990), Collins (1990), Dede (1990), David (1990), Kolderie (1990), Fletcher, Flin, & Gravatt, (1995), Trilling, Bernie, Hood & Paul (1999), Saxena and Gihar (2009), Halverson, Richard, conducted researches and explored this area of study. Chaudhary & Sharma (2012), Ruhee, Wani & Bilal (2011), Shivkumar & Arunachalam, (2012), Rajasekar (2009) conducted studies on Effectiveness of Information and Communication Technology and it has been found that ICT significantly improves effectiveness of teaching learning process. Similarly, Sarangi (1992), Singh (1991), studied effectiveness of Educational Television Programme, Shinde (2002), Singh (2001) studied effectiveness of Computerised Programme on achievement. Patel (2011), Ajmera (2002), Sharma (2014) studied effectiveness of Video Instructional Material and conducted researches and explored this area of study but no study conducted on How ICT and Computer Based Instructional Package improve our teachers effectiveness and students achievement in specific subject like Educational Psychology and no attempt has been made to develop Computer Based Instructional Package on Educational Psychology. From the review of related literature, it has been found that most of the researches related to ICT have been conducted on primary and secondary school students and teachers. But only few researches have been conducted on B.Ed. Pupil Teachers. Investigator explored the area but it is found that no Computer Based Instructional Package on Educational Psychology has been developed at B.Ed. level which may help pupil teachers in enhancing the comprehension of the contents. This Computer Based Instructional Package developed especially for pupil teachers or future teachers to provide insight in to Educational Psychology. It will hopefully be helpful for future teachers to identify, understand and nurturing their abilities with the help of study of Educational Psychology.

Objectives of Study

The present problem endeavours for the realization of the following objectives:

1. To compare adjusted mean scores of Achievement in Educational Psychology of B.Ed. students taught through Computer based Instructional Package and Traditional method of teaching by considering Pre-Achievement in Educational Psychology as covariate.
2. To study the effect of Treatment, Gender and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre-Achievement in Educational Psychology as covariate.
3. To study the effect of Treatment, Intelligence and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre- Achievement in Educational Psychology as covariate.

Hypotheses

The hypotheses of the present study were as follows:

1. There is no significant difference in the adjusted mean scores of Achievement in Educational Psychology of B.Ed. students taught through Computer based instructional package and traditional method of teaching by considering Pre- Achievement in Educational Psychology as covariate.
2. There is no significant effect of Treatment, Gender and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre-Achievement in Educational Psychology as covariate
3. There is no significant effect of Treatment, Intelligence and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre-Achievement in Educational Psychology as covariate.

Methodological Orientation

Sample

As the purpose of this study was to find out the relative effect of the Computer Based Instructional Package in enhancing the comprehension of Educational Psychology by student teachers, therefore researcher selected a total no. of 127 student teacher by the purposive method of sampling, wherein 75 students of B.Ed. and B.Ed.-M.Ed. (Integrated) were selected as an Experimental group and 52 Students of B.Ed. were taken as Control group. Since intact group of students were selected, therefore quasi experimental design was adopted by the researcher. However, the treatment was randomly assigned and both experimental and control group compared on the basis of treatment. Variable wise distribution of sample is given in the Table -1.

Table - 1 Variable Wise Distribution of Sample

Sr. No.	Variable	Groups	N
1	Treatment	Experimental Group	75
		Control Group	52
2	Gender	Male	55
		Female	72
3	Intelligence	Above Average	29
		Average	62
		Below Average	36

The intelligence of students was assessed by administrating the Verbal Intelligence Test developed and standardised by R. K. Ojha and K. Ray Chowdhery. Intelligence quotients were awarded on the basis of final score which was matched with table value provided in manual. Responded were categories in to three categories as above average (all the combined categories listed above average), average and below average (all the combined categories were listed below average).

Research Design

Present research was quasi experimental in nature. In this study researcher followed non-equivalent pre-test post-test control group design. It is a type of Quasi Experimental design by Campbell and Stanley. The researcher uses quasi experimental design because the experiment and control group were not made equivalent by assigning the individual in two groups randomly. Although the group to whom treatment is given was randomly assigned but, the groups that were intact were taken. The layout of the design is as follows:

O X O

.....

O O

Where X denotes the treatment, O before X denotes the Pre-Test & O after X denotes the Post Test. The dotted line means the group were not made equivalent before experiment. There were two groups; one group designated as Experimental group and the other as Control group. Experimental group was taught by Computer Based Instructional Package in Educational Psychology and control group was taught by Traditional method (Table -2).

Table – 2: Research Design

Group	Pre-Test	Treatment	Post- Test	Testing Effectiveness
Control Group N=52	O	Conventional Method of teaching	O	
Experiment Group N=75	O	Computer based instruction package	O	

Analysis of Data

Data was analysed objective wise with the help of following statistical techniques:

1. For comparing adjusted mean scores of Achievement in Educational Psychology of B.Ed. students taught through Computer Based Instructional Package & Traditional method of teaching by considering Pre- Achievement in Educational Psychology as covariate one-way ANCOVA was used.
2. For studying the effect of Treatment, Gender and their interaction on of Achievement in Educational Psychology of B.Ed. students by considering Pre- Achievement in Educational Psychology as covariate 2×2 Factorial Design ANCOVA was used.
3. For studying the effect of Treatment, Intelligence and their interaction on of Achievement in Educational Psychology of B.Ed. students by considering Pre- Achievement in Educational Psychology as covariate 3×2 Factorial Design ANCOVA was used.

Results and Interpretation

Analysis and interpretation of results has been done objective wise as follows:

1. Comparison of Adjusted Mean Scores of Achievement in Educational Psychology of Experimental and Control Group by Considering Pre-Achievement in Educational Psychology as Covariate.

The First objective of the study was to compare the adjusted mean scores of Achievement in Educational Psychology of B.Ed. students taught through Computer Based Instruction Package and Traditional Method of teaching by considering Pre-Achievement in Educational Psychology as covariate. There were two groups based on treatment, namely, Experimental group and Control group. For comparing the adjusted mean scores of Achievement in Educational Psychology of the two groups by taking Pre-Achievement in Educational Psychology as covariate, the data were analysed with the help of One-Way-ANCOVA. The results are given in Table - 3.

Table - 3: Summary of One Way ANCOVA of Achievement in Educational Psychology of B.Ed. Students by taking Pre-Achievement in Educational Psychology as covariate

Sources of Variation	Df	SSy.x	MSSy.x	Fy.x	Sig. (p)	Remark
Treatment	1	711.686	711.686	22.495	0.00	p< .01
Error	124	3923.110	31.638			
Total	125					

Table - 3 shows that adjusted F Value for treatment is 22.49 whose probability of significance with df = (1, 124) is .000 which is less than 0.01, hence significant at 0.01 level of significance. It indicates that the adjusted mean scores of

Achievement in Educational Psychology of Experiment group and Control group by considering pre-Achievement in Educational Psychology as covariate differ significantly. Hence the null hypothesis, there is no Significant difference in the adjusted mean score of Achievement in Educational Psychology of Experimental group and Control group by considering Pre Achievement in Educational Psychology as covariate, is rejected.

Table - 4: Group-wise adjusted mean scores of Achievement in Educational Psychology

Treatment	N	Adjusted Means
Experimental	75	34.43
Control	52	29.62

Further, it can be observed from Table – 4 that the adjusted mean scores of Achievement in Educational Psychology of the Experimental groups is 34.43 which is significantly higher than that of Traditional method group whose adjusted mean scores of Achievement in Educational Psychology is 29.62. It may, therefore, be concluded that the adjusted mean scores of Achievement in Educational Psychology taught through Computer Based Instructional Package was found to be significantly higher than that of Traditional method group when the groups were matched with respect to Pre-Achievement in Educational Psychology.

2. Effect of Treatment, Gender and Their Interaction on Achievement in Educational Psychology of B.Ed. Students by Considering Pre - Achievement in Educational Psychology as Covariate.

The second objective of the study was to study the effect of Treatment, Gender and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre - Achievement in Educational Psychology as covariate. There were two levels each of the Treatment and Gender. Thus, the data with respect to this objective was analysed with the help of 2 * 2 Factorial Design ANCOVA. The results are given in Table - 5.

Table - 5: Summary of 2×2 Factorial Design ANCOVA of Treatment, Gender and their interaction on Achievement in Educational Psychology of B.Ed. Students by considering Pre-Achievement in Educational Psychology as covariate

Source of Variance	Df	SSy.x	MSSy.x	Fy.x	Sig (p)	Remark
Treatment	1	703.005	703.005	21.900	.000	P< 0.01
Gender	1	3.176	3.176	.009	.754	P > 0.05
Treatment * Gender	1	5.056	5.056	.157	.692	P > 0.05
Error	122	3916.350	32.101			
Total	125					

2.1. Effect of Treatment on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate

Table shows that adjusted F Value for Treatment is 21.900 whose probability of significance with df = (1, 122) is .000 which is less than 0.01, hence significant at 0.01 level of significance. It indicates that the adjusted mean scores of Achievement in Educational Psychology of Experiment Group & Control Group by considering Pre-Achievement in Educational Psychology as covariate differ significantly. Hence the null hypothesis, there is no Significant difference in the adjusted mean score of Achievement in Educational Psychology of Experimental group and Control group by considering Pre - Achievement in Educational Psychology as covariate, is rejected. In order to find out which group of students have performed significantly better, the adjusted means of Experimental Group & Control Group are given in Table - 6.

Table - 6: Group wise adjusted mean scores of Achievement in Educational Psychology

Treatment	Adjusted Means
Experimental Group	34.43
Control Group	29.50

From the table, it is evident that the adjusted mean score of Achievement in Educational Psychology of the Experimental group is 34.43 which is significantly higher than that of Traditional method group whose adjusted mean score of Achievement in Educational Psychology is 29.50. It may, therefore, be concluded that the adjusted mean score of Achievement in Educational Psychology taught through Computer Based Instructional Package was found to be significantly higher than that of Traditional method group when Pre-Achievement in Educational Psychology was taken as covariate.

2.2. Effect of Gender on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate

Table shows that the adjusted F value for Gender is .009, whose probability of significance with df = (1,122) is 0.754, which is greater than 0.05, hence not significant at 0.05 level of significance. It indicates that adjusted mean scores of Achievement in Educational Psychology of Males & Females do not differ significantly by taking Pre-Achievement in Educational Psychology as covariate. Hence the null hypothesis, there is no significant influence of Gender on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate is not rejected. It may therefore, be concluded that Achievement in Educational Psychology of Males and Females was found to be equally enhanced, when both the groups were matched with respect to Pre - Achievement in Educational Psychology.

2.3. Effect of Interaction between Treatment & Gender on Achievement

in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate

The adjusted F value for interaction between Treatment & Gender is 0.157 whose probability of significance with df = (1,122) is 0.692 which is greater than 0.05, hence not significant at 0.05 level of significance. It indicates that there is no significant effect of interaction between Treatment and Gender on Achievement in Educational Psychology by considering Pre - Achievement in Educational Psychology as covariate. Hence the null hypothesis, there is no significant effect of interaction of Treatment & Gender on Achievement in Educational Psychology of B.Ed. students by considering Pre - Achievement in Educational Psychology as covariate, is not rejected. It may, therefore, be concluded that Achievement in Educational Psychology of Males and Females was found to be equally enhanced when taught through Computer Based Instructional Package by considering Pre-Achievement in Educational Psychology as covariate.

3. Effect of Treatment, Intelligence and Their Interaction on Achievement in Educational Psychology of B.Ed. Students by Considering Pre - Achievement in Educational Psychology as Covariate.

The third objective of the study was to study the effect of Treatment, Intelligence and their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre - Achievement in Educational Psychology as covariate. There were two levels of Treatment and three levels of Intelligence. Thus, the data with respect to this objective was analysed with the help of 2×3 Factorial Design ANCOVA. The results are given in Table - 7.

Table - 7: Summary of 2 * 3 Factorial Design ANCOVA of Treatment, Intelligence & their interaction on Achievement in Educational Psychology of B.Ed. students by considering Pre-Achievement in Educational Psychology as covariate

Source of Variance	Df	SSy.x	MSSy.x	Fy.x	Sig (p)	Remark
Treatment	1	673.972	673.972	24.929	.000	P < 0.01
Intelligence	2	430.633	215.317	7.964	.001	P < 0.01
Treatment * Intelligence	2	130.872	65.436	2.420	.093	P > 0.05
Error	120	3244.338	27.036			
Total	125					

3.1. Effect of Treatment on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate

Table shows that adjusted F Value for Treatment is 24.929 whose probability of significance with df = (1, 120) is .000 which is less than 0.01, hence significant at 0.01 level of significance. It indicates that the adjusted mean scores of Achievement in Educational Psychology of Experiment Group and Control

Group by considering Pre-Achievement in Educational Psychology as covariate differ significantly. Hence the null hypothesis, there is no Significant difference in the adjusted mean score of Achievement in Educational Psychology of Experimental group & Control group by considering Pre Achievement in Educational Psychology as covariate, is rejected.

In order to find out which group of students have performed significantly better, the adjusted means of Experimental Group and Control Group are given in Table - 8.

Table – 8: Group wise adjusted mean scores of Achievement in Educational Psychology

Treatment	Adjusted Means
Experimental Group	34.68
Control Group	29.71

From the above table, it is evident that the adjusted mean scores of Achievement in Educational Psychology of the Experimental Group is 34.68 which is significantly higher than that of Control Group whose adjusted mean scores of Achievement in Educational Psychology is 29.71. It may, therefore, be concluded that the adjusted mean scores of Achievement in Educational Psychology taught through Computer Based Instructional Package was found to be significantly higher than that of Traditional method group when Pre-Achievement in Educational Psychology was taken as covariate.

3.2. Effect of Intelligence on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate

From the table, it can be seen that adjusted F value for Intelligence is 7.964 whose probability of significance with df = (1, 120) is .001 which is less than 0.01, hence significant at 0.01 level of significance. It indicates that the adjusted mean scores of Achievement in Educational Psychology of three groups namely Above Average, Average and Below Average by considering Pre-Achievement in Educational Psychology as covariate differ significantly. Hence the null hypothesis, there is no significant effect of Intelligence on Achievement in Educational Psychology by considering Pre - Achievement in Educational Psychology as covariate, is rejected.

To study as to where the difference in Achievement in Educational Psychology lie, Pairwise comparison of the three Intelligence groups were undertaken, the results of which are given below in Table - 9.

Table – 9: Pairwise Comparison of Achievement in Educational Psychology of the three Intelligence Groups by considering Pre-Achievement in Educational Psychology as covariate

Intelligence Pairs (I)	(J)	Mean Difference (I - J)	Standard Error	Sig (p)	Remark
Above Average	Average	3.01	1.21	.04	P< 0.05
Above Average	Below Average	5.44	1.36	.00	P < 0.05
Average	Below Average	2.42	1.13	.10	P > 0.05

It can be observed from the table - 9 that out of three pairs of Intelligence groups, the difference in mean scores of Achievements of students in two pairs are significant where as in third pair this difference is not significant at 0.05 level of significance. The difference in mean scores of Achievement in Educational Psychology between the Above Average Intelligence group and Average Intelligence Group is 3.01 (the mean score of Achievement in Educational Psychology Above Average being the higher one) is significant at .05 level of significance. This means that the Achievement in Educational Psychology of Above Average Intelligence group was found to be significantly higher than Average group. Thus, Above Average Intelligence group was found to be more effective in terms of Achievement in Educational Psychology. Likewise, the difference between mean scores of Achievement between Above Average Intelligence group and Below Average Intelligence group was found to be 5.44 which is significant at .01 level of significance. It means that the Above Average Intelligence group was found to be superior to the Below Average Intelligence group in terms of Achievement in Educational Psychology. Further, the difference in mean scores of Achievement of Average Intelligence Group and Below Average Intelligence group was found to be 2.42 which are no significant at 0.05 level of significance. This means that the two groups were not found to be different from each other as far as Achievement in Educational Psychology of students is concerned.

3.3. Effect of Interaction between Treatment and Intelligence on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate.

Table-7 shows that the adjusted F value for the interaction between Treatment and Intelligence is 2.420 whose probability of significance with df = (1,120) is .093 which is greater than 0.05, hence not significant at 0.05 level of significance. It indicates that there is no significant effect of interaction between Treatment and Intelligence on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate. Hence the null hypothesis, there is no significant effect of interaction of Treatment and Intelligence on Achievement in Educational Psychology of B.Ed. students by considering

Pre-Achievement in Educational Psychology as covariate, is not rejected. It may, therefore be concluded that Achievement in Educational Psychology was found to be independent of the interaction between Treatment and Intelligence when taught through Computer Based Instructional Package by considering Pre Achievement in Educational Psychology as covariate, and it may also be concluded that irrespective of level of Intelligence, Achievement in Educational Psychology can be equally enhanced when taught through Computer Based Instructional Package.

Findings and Discussion

The following were the findings of the present research:

- Computer Based Instructional Package in Educational Psychology was found to be effective in terms of Achievement in Educational Psychology
- Computer Based Instructional Package in Educational Psychology was found to be significantly enhance the Achievement in Educational Psychology of the Pupil Teachers as compared to the Traditional Method of Teaching
- There was no significant effect of Gender on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate.
- There was no significant effect of interaction between Treatment and Gender on Achievement in Educational Psychology by considering Pre-Achievement in Educational Psychology as covariate. Achievement in Educational Psychology of males and females was found to equally enhance when taught through Computer Based Instructional Package.
- Achievement in Educational Psychology of the three groups namely Above Average Intelligence, Average Intelligence and Below Average Intelligence by considering Pre-Achievement in Educational Psychology as covariate differs significantly. It was found that the Achievement in Educational Psychology of Above Average Intelligence group was found to be significantly higher than Average group Intelligence. Thus, Above Average Intelligence group was found to be more effective in terms of Achievement in Educational Psychology. Likewise, the difference between mean scores of Achievement between Above Average Intelligence group and Below Average Intelligence group was found to be significant. It means that the Above Average Intelligence group was found to be superior to the Below Average Intelligence group in terms of Achievement in Educational Psychology. Achievement of Average Intelligence and Below Average Intelligence group was found to be not significant. It indicates that the two groups were not found to be different from each other as far as Achievement in Educational Psychology of students is concerned.
- There was no significant effect of interaction between Treatment and Intelligence on Achievement in Educational Psychology by considering

Pre Achievement in Educational Psychology as covariate. Achievement in Educational Psychology was found to be independent of the interaction between Treatment and Intelligence by considering Pre-Achievement in Educational Psychology as covariate, and it may be concluded that irrespective of level of Intelligence, Educational Psychology can be taught equally well through Computer Based Instructional Package

Discussion of Findings

Findings of the study are being discussed below objective-wise:

1. *Achievement in Educational Psychology of Students Taught through Computer Based Instructional Package*

Computer Based Instructional Package in Educational Psychology was found to be enhanced the Achievement of B.Ed. Students in Educational Psychology. The finding was supported by Sheingold (1990), Collins (1990), Dede (1990), Idayani (1991), Singh (1991), Sarangi (1992), Pandya (1994), Flinn & Gravatt (1995), Shinde (2002),Kanwaria (2010), Gurtu (2011), Cornelius & Gordon (2012), Banerjee, Murthy & Iyer (2011), Khare (2015), Johnson (2010), Patel (2011), Nikolas (2012), Fard et al. (2014), Sultan (2013), Sharma (2016), Shinde (2016) who found that Video Instructional Material and other audio-visual program enhanced the Achievement of students in different subjects while not supported by Sarangi (1992), Singh (2001), Gupta (2008), Sultan (2013), Jhariya (2014), Sharma (2016), who found that video instructional material and other ICT-based instructional material was not found to be effective in terms of Achievement. Further, the Computer Based Instructional Material was found to be effective as well as superior to Traditional method when groups were matched with respect to Pre-Achievement. This finding was supported by James(1998), Idayani (1991), Kaimuthu (1991), Singh (1991), Sahoo (1994), Lal (1996), Behera (1997), Shinde (2002), Ajmera (2002), Shukla (2003), Hancer & Tuzeman (2008), Singh & Sansanwal (2009), Aqd et al. (2011), Celikler & Aksan (2011), Serin (2011), Sang et al. (2012), Sharma (2013) and Jhariya (2014) who found learning through viewing of the video films and other ICT related instructional material was more effective than learning through traditional method. Computer Based Instructional Package in Educational Psychology was prepared on the basis of scripts which were developed after going through content analysis and reviewing researches concerned to this topic. Investigator used a variety of internet resources to make the package comprehensive and interesting. Computer Based Instructional Package covers the whole content comprehensively & appropriate graphics and animations were used to illustrate experiments and theories related to the specific content. The classroom climate was active and students thoroughly enjoyed studying Educational Psychology with the help of developed CBI Package. Students were felt free of fear while studying through CBI Package in comparison to their traditional classes. In traditional method, students cannot talk and feel passive in classroom while teacher is

active. Students learn according the pace of teacher and could not clear their all doubts in traditional method and most of the time repletion of content is not possible. But students who were studied through CBI Package in Educational Psychology were free to see any part of the package as many times as they like and they were free to stop the content at any point of time. They also had the freedom to discuss among themselves as well as with the teacher since think & reflect questions were also there in CBI Package to give opportunity to students to reflect. These might be the reason for present findings.

2. Effect of Gender on Achievement in Educational Psychology

Both, Males and Females were found to achieve equally in terms of Achievement in Educational Psychology when the groups were matched with respect to Pre-Achievement in Educational Psychology. This finding was supported by Pandya (1994), Behera (1997), Singh (2001), Shukla (2003), Shinde (2007), Gupta (2008), Serin (2011), Sharma (2013), Sultan (2013), Jhariya (2014), Shinde (2016), and Sharma (2016) who found that Gender has no significant effect on Achievement in Educational Psychology when students were taught through different kind of ICT based instructional material while in a very few researches, Males were found to be superior in terms of Achievement on a specific topic of subject Research Methodology (Shinde, 2007) and Females were found to be significantly superior in terms of Achievement (Patel,2011). In present scenario, both Males and Females have not been discriminated and they both are getting equal opportunities to learn and excel in every field. Since the CBI Package was same in terms of content and presentation irrespective of Gender and all the activities carried out in classroom for teaching were same for Males & Females. They both got equal opportunity to discuss & reflect. Thus, this might be the reason for the present findings.

Further, there was no significant effect of interaction of Treatment and Gender on Achievement in Educational Psychology by considering Pre - Achievement in Educational Psychology as covariate. In other words, CBI Package was found to be equally effective in terms of Achievement for both Males and Females by considering Pre-Achievement as covariate. This finding was supported by Singh (2001), Sultan (2013), Shinde (2016) & Sharma (2016) who found that Gender was not significantly related to Achievement when different methods of teaching were used. This finding reveals that Gender may not be kept in mind while developing CBI Package. The CBI Package was same for Males and Females with respect to content, sequence, illustration & use of graphics and animations etc. There was no gender bias while teaching through CBI Package in classroom and the freedom to ask questions was same for Males and Females while studying through CBI Package. Both Male and Female B.Ed. students might have satisfied with the reply given by teacher. These might be the reason for present findings.

3. Effect of Intelligence on Achievement in Educational Psychology

Intelligence effect significantly the Achievement of students in Educational Psychology by considering Pre - Achievement in Educational Psychology as covariate. This finding is supported by few researches, Shinde (2007), Sharma (2016), Shinde (2016) which also reveal that students belonging to the Above Average group and Average Intelligence group were found to be significantly superior to students belonging to Below Average Intelligence group in terms of Achievement in Educational Psychology while not supported by Lal (1996) who found that low Intelligence students were superior to high Intelligence students when taught through Video Instructional material in Home Science. The reason for the present finding might be that Above Average Intelligence Students are fast learners and concentrate more while learning. They have strong grasping power, problem solving ability and reasoning ability. They can understand the abstract content easily and instead of cramming, they focus to understand the matter that helps them to retain the subject matter for longer time.

Effect of Interaction between Treatment and Intelligence on Achievement of Students in Educational Psychology

In present study, Achievement in Educational Psychology was found to be independent of interaction between Treatment & Intelligence by considering Pre-Achievement as covariate, and it may be concluded that irrespective of level of Intelligence, students belonging to all the three groups namely Above Average, Average and Below Average were found to be benefitted equally when taught through Computer Based Instructional Package in Educational Psychology in comparison to Traditional Method. This finding are supported by Lal (1996), Sharma (2013), Jhariya (2014), Sharma (2016), who found that Instructional Material alone as well as combination with other method of teaching was found to be equally benefitted in terms of Achievement for different level of Intelligence but the findings are not supported by Sharma (2016) and Shinde (2016) who reported that Intelligence and Achievement have a significant and positive relationship when taught through Instructional Material alone as well as combination with other Method of Teaching. The reason of the present finding might be that the content was presented through Computer Based Instructional Package was in simple and routine language, and daily life examples were also given that helped to understand the subject matter easily. Graphics and Animations were used to make content interesting and effective. Freedom was also given to the students to stop the Instructional Package and rewind it where needed. This might have helped the students to make better understand the subject matter and all these might have helped Average and Below Average Intelligent students to get Achievement quite close to Above Average Intelligent students. Thus, there was no significant effect of interaction of Treatment & Intelligence on Achievement in Educational Psychology when groups were matched with respect to Pre-Achievement in Educational Psychology.

Conclusions

The present study revealed that the Computer Based Instructional Package in Educational Psychology was found to enhance and strengthen the subject clarity and achievement in educational psychology of B.Ed. students irrespective of their Gender, Intelligence, Academic Discipline, Personality & Socio-Economic Status. This Computer Based Instructional Package can be very useful for teachers to gain better insight to access different e-resources in order to make them competent with respect to content and pedagogical approach required for this subject. It may be helpful for teacher educators to find out the new ways and means of teaching such a sensitive subject at this level. They can use this package at their own pace and they can go a long way for improving the quality of teaching of educational psychology. They can also get an idea how we can develop CBI Package according to their respective syllabus. In this way teachers can enhance the use of ICT is a tool in their classroom to create interesting projects and virtual exposure in effective learning conditions.

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Research Article

Interactive Effect of Meta-Cognitive Strategies-based Instruction in Mathematics and User experience on Student-Outcomes

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Abstract

This paper attempts to ascertain the interactive effect of meta-cognitive strategies based instruction in mathematics and learner (user) experience design. This study focuses more on meta-cognitive experiences than meta-cognitive skills. For this purpose, an intervention programme based on meta-cognitive strategies of about 35 hours was developed for students of standard eighth spreading over eight weeks. The aim of the research was to ascertain whether meta-cognitive strategies-based instruction facilitates the academic achievement of students and user experience and interaction design decisions significantly affect how well on users (students) learn through meta-cognitive strategies. Structured tools were used in study. The participants of the study included 62 and 60 students in the experimental and control groups respectively. Students were found to be significantly influenced by the intervention programme as well as to help user interface in a way that supports and enhances the cognitive domain. The effect size of the intervention programme on academic achievement of students was found to be 1.30 and mathematics anxiety 1.084 was high in magnitude.

Keywords: Meta-cognitive strategies, User experience, Academic achievement, Mathematics anxiety

Introduction

According to George Polya, we can think of two kinds of aims for school education: a good and narrow aim that of turning out employable adults who (eventually) contribute to social and economic development; and a higher aim, that of developing the inner resources of the growing child. With regard to school mathematics, the former aim specifically relates to numeracy. It affects the usability, simplicity and clarity of content. It also affects the way users conceive of interactive possibilities. Since usability is known to be an important factor in how deeply, how easily, and how successfully a user moves through the content of an environment, the more usable learning environment is the more successful it will likely be.

According to Indian National curriculum framework: Problems in teaching and learning of mathematics

Following are the four problems which have been deemed to be the core areas

of concern:

1. A sense of fear & failure regarding mathematics among a majority of children
2. A curriculum that disappoints both a talented minority as well as the non-participating majority at the same time
3. Crude methods of assessment that encourage perception of mathematics as mechanical computation
4. Lack of teacher preparation and support in the teaching of mathematics.

These problems encourage us to think about how we enhance students' academic achievement and reduce anxiety towards mathematics.

There is a reason, rarely if ever mentioned, why good visual design can facilitate learning. It can improve meta-cognition. That is my main objective here. It is not standard to associate visual design with meta-cognition. Meta-cognition, in its most basic form, is the activity of thinking about thinking. Since thinking is often taken to be a mental activity, largely a matter of manipulating internal representations, there has been little reason to look to the structure of the environment as a factor in thinking. According to Alben (1996) All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they're using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it. In principle, UXD (user experience design) is not different from HCD (Human centre design). However, UXD adds important dimensions to the challenge of implementing HCD in a mature form. These additions are not trivial. The main dimensions distinguishing UXD from a traditional view of HCD include UX factors; methods, tools and criteria used in UX work; representation of the UX idea; and UX positioning in the organization. UX matters, Encompasses all aspects of a digital product that users experience directly—and perceive, learn, and use—including its form, behaviour, and content. Learn ability, usability, usefulness, and aesthetic appeal are the key factors in users' experience of a product. According to McNamara & Kirakowski (2006), the user experience considers the wider relationship between the product and the user in order to investigate the individual's personal experience of using it.

What are User experiences?

User experiences are the methods that have the objective of improving user satisfaction with achieving both pragmatic and hedonic goals. UX is a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organizational /social setting, meaningfulness of the activity, voluntariness of use, etc.). Obviously, this creates innumerable design and experience opportunities.

Review of literature

According to Kirsh (1995), the way visual cues are structured and the way interaction is designed can make an important difference in the ease and effectiveness of cognition and meta-cognition. Documents that make effective use of markers such as headings, callouts, italics can improve students' ability to comprehend documents and 'plan' the way they review and process content. Interaction can be designed to improve 'the proximal zone of planning' – the look ahead and apprehension of what is nearby in activity space that facilitates decisions. This final concept is elaborated in a discussion of how e-newspapers combine effective visual and interactive design to enhance user control over their reading experience. (Howe at all, 2000); Lucangeli, Coi and Bosco (1997) found that fifth graders viewed problems containing large numbers as more difficult than problems with smaller numbers in their study examining the meta-cognition of mathematics difficulty in elementary school children. In this study, students who were classified as poor problem solvers showed lower meta-cognitive awareness and made more errors when solving problem. Such learners keep planning in mind during the learning activity and assess their performance against them. During the learning activity, teachers can encourage learners to share their progress, their cognitive procedures and their views of their conduct. The emphasis is on the affective character of ME, which has received little attention in the past, Efklides (2006). Unlike online task-specific knowledge, which is conscious and analytic, the other ME are products of non-conscious, non-analytic inferential processes. Because of their nature, ME can trigger either rapid, non-conscious control decisions or conscious analytic ones. However, ME can make use of both the affective and the cognitive regulatory loops, and this has a series of implications for learning. Evidence is presented regarding the relations of ME with affect and cognition, and the implications of the lack of accuracy of ME for the self-regulation of learning. Particular emphasis is given on judgment of learning, feeling of difficulty, and feeling of confidence. The challenges for future research on meta-cognition are underscored.

Need of the Study

Prior research, especially on Indian students from lower socio-economic background and with an average ability has not been conducted with a view to enhance such students' knowledge about cognition and knowledge about regulation.

Meta-cognitive awareness forms a cognitive doctrine and meta-cognition could begin when cognition fails. It is essential to study the interactive influence of meta-cognitive strategies-based instruction and user experience of student outcomes in mathematics. Meta-cognition enables students to benefit from instruction (Carr, Kurtz, Schneider, Turner & Borkowski, 1989; Van Zile-Tamsen, 1996) and influences the use and maintenance of cognitive strategies.

In the present research, there is an

attempt to study the effect of meta-cognitive strategies-based instruction in mathematics on students' levels of Knowledge about Cognition (procedural knowledge, declarative knowledge and conditional) in terms of User experience on student academic achievement and mathematics anxiety.

Operational Definition of the Terms

- Meta-Cognition: Meta-cognition refers to learner's awareness of their own knowledge & cognitive processes & their ability to understand control and manipulate their own cognitive processes.
- User Experience: Every aspect of the user's interaction with a product, service, or company that makeup the user's perceptions of the whole. UE works to coordinate these elements to allow for the best possible interaction by users.
- Meta Cognitive Strategies :Meta-cognitive strategies refers to methods used to help students understand the way they learn and refers to the processes designed for students to manage, monitor and evaluate their learning and 'think' about their 'thinking'.

Statement of the Problem

Interactive Effect of Meta-Cognitive Strategies-based Instruction in Mathematics and User experience on Student-Outcomes

Scope and Delimitations of the Study

In the present study, English medium schools from the Greater Mumbai affiliated to the SSC board have been included. It excludes schools with other media of instruction such as Marathi, Hindi, Urdu, Gujarati etc. The present study includes eighth standard from English medium schools situated in Greater Mumbai. Students from other primary and secondary classes have been excluded. It also excludes schools affiliated to ICSE or CBSE boards.

Aim of the Study

The aim of the study was to ascertain the interactive effect of the intervention programme as user experience on academic achievement & mathematics anxiety of student.

Research Questions

1. Do Meta-cognitive strategies & user experiences effect on academic achievement of eight standard students?
2. Do Meta-cognitive strategies & user experiences effect on mathematic anxiety of eight standard students?
3. What is the effect size of the intervention programme (UX) on the academic achievement and mathematics anxiety in the subject of Mathematics?

Methodology of the Study

Mixed method approach has been used for collecting a data, Qualitative data has been collected through classroom observations and quantitative data has recorded through experimental research which is called as, embedded design. According to Pandya (2011), the study has adopted the quasi-

experimental method. In the present research, the quasi-experimental design of the pre-test post-test, non-equivalent group type was used. It can be described as follows:

The pre-test-post-test non-equivalent groups design:

O1X O2 O3 C O4

Where, O1 and O3: Pre-test Scores & O2 and O4: Post- test Scores

X: Experimental Group & C: Control Group

Tool of the Study: In the present study, following tools were used by the researcher to collect data quantitatively:

1. Mathematics Anxiety Rating Scale (MARS-I) (Karimi, 2008)
2. Academic Achievement Test (Ingole, 2013)

Prototype/Intervention Programme

The duration of the intervention programme is 35 hours. The control group was taught using the traditional method. The experimental group was taught using intervention programme, which was divided into two levels. The first level included knowledge about cognition, which was ascertained through achievement test and KWL chart. The second level included regulation about cognition which consisted of three steps, namely, planning (understanding the problem, devising a plan, carrying out the plan & looking back), monitoring (self - awareness of one's thought processes), control (self-monitoring of one's thought processes, beliefs and intuitions about one's cognition) and evaluation (problems on the topic and self -reflection sheet).The three step process is explained further using the following questions: (a) Planning: What is the nature of the task? What is my goal? What kind of information and strategies do I need? How much time and resources do I need? In term of user experience this is IDEAT (b) Monitoring: Do I have a clear understanding of what I am doing? Does the task make sense to me? Am I reaching my goals? Do I need to make changes? In terms of user experience, this is PROTOTYPE (c) Evaluating: Have I reached my goal? What worked? What didn't work? Would I do things differently the next time? The meta-cognitive strategies included in the study were (a) Knowledge about cognition, (b) Regulation about cognition, (c) Ask questions, (d) Foster Self-reflection, (e) Encourage self-questioning, (f) Think aloud & (g) Self-explanation. The teaching units were selected from the syllabus prescribed for the schools affiliated to the SSC board for the state of Maharashtra and included the topics on Cube, Indices, Construction of Quadrilateral, Joint Bar Graph and Discount and Commission. In term of user experience this is TEST/ Evaluate.

While working with meta-cognitive strategies in form of user experience or interactive product are given below.

1. Initiate – What are challenge faced by students while learning Mathematics?
2. Investigate – Personas will be eight standard students & will investigate actual problems of mathematic anxiety.
3. Inspire & ideate – Do a benchmarking analysis & define the user scenarios

(benchmarking is inform of instructional design in this case meta-cognitive strategies where ideate for making mathematics content more fragmented and simpler)

4. Prototype - Lesson plan are based on meta-cognitive strategies like Think aloud, KWL charts, concept map, Graphic organizers & self-reflection sheets.
5. Evaluate and reflect – For evaluation Reflection of think aloud sheet, self-reflection sheet were used.

Initially, researcher focus on the selection of the right resource and the actions to be carried out are decided together with the faculty members interested in the project.

Activities have been conducted for 8th standard enact class.

Techniques of Data Analysis: The present research used statistical techniques of ANCOVA and Wolf's formula.

a) Data Analysis:

Null Hypothesis 1: There is no significant difference in the pre-test scores of students from the experimental and control group on the following variables:

a) Academic Achievement

b) Mathematics Anxiety

This hypothesis was tested with the objective of comparing the initial status of the experimental and control groups on dependent variable viz. academic achievement and mathematics anxiety of students. The technique used for testing the null hypotheses is the t-test.

Table-1 shows the relevant statistics of the scores of academic achievement and mathematics anxiety of students of control and experimental group

Table - 1: Relevant Statistics of Pre-Test on The Dependent Variables of CG and EG

No.	Variable	Group	N	Mean	SD	T	P (two-tailed)	LoS
1.	AAS	CG	60	5.316	2.266	0.03	0.98	N.S
		EG	62	5.306	2.236			
3.	MAnS	CG	60	79.23	19.881	0.41	0.682	N.S
		EG	62	80.62	19.881			

Null Hypothesis 2: There is no significant difference in the post- test scores of students of experimental group and control group of following variables.

a) Academic Achievement

b) Mathematics Anxiety

Table - 2 shows the post-test AAS of EG and CG after partialling out effect of pre-test AAS.

Table -2: Post –Test AAS of EG and CG

Groups	Observed Mean	Adjusted Mean
Experimental	14.61	14.61
Control	9.61	9.61

Table-3: ANCOVA for Post- Test Mean of AAS of EG and CG

Sources of Variation	SS	df	MS	F-ratio	P
Adjusted A	762.45	1	762.45	96.14	<0.0001
Adjusted B	6.51	2	3.25		
Adjusted A×B	92.85	2			

In Table-3 it can be seen that the 'P' value is <.0001, Hence a significance difference is found between the EG and CG. Thus, the null hypothesis is rejected. It can be stated that there is a significant difference in the post-test scores of students' academic achievement of experimental group and control group. Mean AAS of students from EG is significantly greater than that of CG.

Table - 4: Post –Test MAnS of EG and CG

Group	Observed Mean	Adjusted Mean
Experimental	49.56	49.34
Control	61.76	61.99

ANCOVA determines whether these two adjusted post-test means differ significantly from each other.

Table-5 shows the relevant statistics of ANCOVA for post-test mean MAnS of EG and CG.

Table - 5: ANCOVA for Post- Test Mean of MAnS of EG and CG

Sources of Variation	SS	df	MS	F-ratio	P
Adjusted A	4874.17	1	4874.17	36.97	<.0001
Adjusted B	96.4	2	48.2		
Adjusted A×B	1268.16	2			

Table - 6: Effect Size of the Treatment and LA on the Dependent Variables

Dependent variables	Effect Size
Academic Achievement	1.30
Mathematics Anxiety	1.084

Qualitative Data Analysis:

Observation was tool used for collecting qualitative data, as approach was embedded design, during a quantitative experiment, the researcher may collect qualitative data to examine how participants in the treatment condition are experiencing the intervention, behavioural and attitudinal metrics of usability (i.e. users' performance and satisfaction). Indeed, different attempts

have been undertaken to demarcate or even dismiss the boundary between usability and UX at the conceptual as well as operational level (e.g. Law et al., 2008).

Mainly two themes that come from observation are: first, usability is subsumed by UX; second, UX is an elaborated form of satisfaction, which was checked through self-reflection sheets and Think aloud sheets in Mathematics.

Conclusion

Implications for the learning outcomes

Students of the experimental group are found to have a higher academic achievement and reduced mathematics anxiety as compared to those from the control group. In other words, the meta-cognitive strategies-based intervention programmed in Mathematics has been effective in enhancing academic achievement and reducing mathematics anxiety among students of standard eighth.

Discussion

In the experimental group, user (learner) experience about meta-cognitive strategies such as think aloud strategies, KWL charts, concept map, planning and monitoring and self-reflection sheets. These are expected to facilitate awareness of personal success, beliefs for factors that influence academic performance in mathematics, knowledge of ways for effective learning, knowledge of strategies that should be used. This in turn would have enhanced students' confidence in learning mathematics, thereby enhancing their problem solving ability. This ultimately could have facilitated higher academic achievement and reduced mathematics anxiety in students of the experimental group as compared to those from the control group.

Having outlined the affective and cognitive modes of regulation through which UX (learner) effect behaviour, we come now to some intuitive or counterintuitive implications the functioning of UX (learner) has for the learning outcomes. There are two issues that are of importance here: the accuracy of UX (learner) & the effects of the particular UX (learner) on learning. The response of UX (learner) is a very important issue because it has a bearing on the efficiency of the control decisions in learning situations with respect to effort allocation, time investment, or strategy use. There are various possible reasons why a meta-cognitive judgment is not accurate. The first one is that ME are based on non-conscious, heuristic, inferential processes that make use of various cues, which regard the task and its presentation or the fluency of processing (Koriat, 1997; see also Whittlesea, 1993). This user experience does not only include usability, but also other cognitive, socio-cognitive and affective aspects of users' experience in their interaction with artefacts(meta-cognitive strategies), such as users' enjoyment, aesthetic experience, desire to repeat use, positive decision to use a digital artefact and enhanced meta-cognitive experiences.

Furthermore, finding was user

experience (UX) manifests as quality in design, in interaction and in value, with diverse measures from many methods and instruments. While observation of class researcher faced challenges related to UX is how to select appropriate measures to address the particularities of an evaluation context. According to Effie (2010), the necessity and utility of UX measures is apparent, because such measures enable professionals to benchmark competitive design artefacts & to select appropriate design options. However, both the construct validity and predictive power of some UX measures are of particular concern. Consequently, modelling users' experience – as a basis for producing design guidance – is especially important.

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Research Article

Use of Computer Assisted Instruction as an Innovative Tool for Remedial Teaching of Children with Figure Constancy type of Learning Disability

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Abstract

The National Mission on Education through Information and Communication Technology (NMEICT) have been envisaged as a centrally sponsored scheme to leverage the potential of ICT, in teaching and learning process for the benefit of all the learners in primary level to higher education level in any time anywhere mode. For the enhancement of school education through information and communication technology, the study investigated whether educational games and videos as remedial teaching for children with image or figure constancy type of learning disability (FCLD) among fifth grade students. The study adopted the pre-test-post-test-control group design. Simple random sample of sixty four students were drawn from seven schools in Meerut, Uttar Pradesh, India. The researcher coordinates the educational games and videos for children with FCLD which was used as an instrument for experimental group while control group were exposed to traditional teaching method. The instrument for data collection was diagnostic test of learning disability DTLD Test. The t-test statistics was used to analyze the hypothesis. The findings revealed that experimental group performed better than the control group. The study found to be use of educational games and videos were better than traditional method on fifth grade FCLD students.

Keywords: Computer assisted instruction, Figure constancy type of learning disability (FCLD), diagnostic test of learning disability, innovative tool, remedial teaching.

Introduction

The computer assisted instruction (games and videos) is interactive and can illustrate a concept through attractive animation, sound, and demonstration. They allow students to progress at their own pace and work individually or solve problems in a group. Computers provide immediate feedback, letting students know whether their answer is correct. If the answer is not correct, then the program gives the correct answer to the question. Computers offer a different type of activity and a change of pace

from teacher-led or group instruction. (http://www.readingrockets.org).

The computer assisted instruction (games and videos) is new teaching-learning strategy in which the topics to be taught is carefully planned, written and programmed in a computer which could be run at the same time in several computer units and allows each student a computer terminal. The instructions are also programmed on a computer disc, which could be played using audio, video, drag & drop, gaming and simulation activity for the student to learn the topic at his/her leisure time and at his/her own pace. The potential benefit of computer games cannot be underestimated in the contemporary world. There is lot of established findings on the instructional value of computer, particularly in advanced countries. There are now several educational games & videos packages on different subjects. It is obvious that current trend in research all over the world is the use of computer facilities and resources to enhance students' learning. Chang (2000) and Yusuf (2009) opined that 'many exercises that depart from traditional method are now readily accessible on the web (p.521), even though teachers do not use these facilities'. Jenk & Springer (2005) opined that the way computer assisted instruction is delivered can affect its effectiveness, and that new studies are needed to clarify the effect of computer assisted instruction in contemporary student environment. Instructional material and strategies through computer assisted instruction have been found to aid academic achievement and retention. Orisebiyi (2007), who investigated the effect of computer assisted instruction package on student's achievement in learning disability found computer assisted instruction with reference to games and videos to be effective on student's achievement. However from reviews, it was observed that many of the studies were focused on some parts of Mathematics such as Algebra, Statistics, word problem and quadratic equation, not much on geometry using computer assisted instruction package.

The computer assisted instruction (games and videos) improve instruction for students with disabilities because students receive immediate feedback and do not continue to practice the wrong skills. Computers capture the children attention because the programs are interactive and engage the children spirit of competitiveness to increase their scores. Also, computer-assisted instruction moves at the students' pace and usually does not move ahead until they have mastered the skill. Programs provide differentiated lessons to students with challenges.

Now-a-day the assistive technology or computer assisted instruction is available to help individuals with various types of learning disabilities i.e. pictures, shapes, graphics, symbols, letters & figures constancy disabilities. This research paper will focus specifically on computer assisted instruction (games and videos) for individuals with learning disabilities. The use of technology to enhance learning is an effective approach for many children. Additionally, children

with learning disability often experience greater success when they are allowed to use their abilities (strengths) to work around their disabilities (challenges).

Disability: Disability is more than a problem or difficulty with how our body works – a child with impairment may experience disability when functioning in an environment that impact the child's successful performance at a task (NCERT, 2006).

A person with disability is one who has a long term physical, mental, intellectual or sensory impairment which, coupled with different barriers around him, hinders his full and effective participation in society equally with others (RPwD Act, 2016, pp-12).

Innovative Tools: Information and Communication Technology (ICT) is a popular topic among many teachers and teacher educators today. There are many ICT tools on the Internet which are available in online and offline and many of them open up new possibilities of teaching & learning in the classroom. In this text the research reviewed one of the most important offline innovative tools with a lot of potential as computer assisted instruction (games & videos).

Learning Disabilities: "Learning disability is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to Central Nervous System dysfunction." Even though learning disability may occur concomitantly with other handicapping conditions (e.g., sensory impairment, mental retardation, social & emotional disturbance) or environmental influences (e.g., cultural differences, insufficient/inappropriate instruction, psychogenic factors) it is not the direct result of these condition or influences.

Figure Constancy (FC): It is the subject's ability to identify symbols, figures, shapes despite its apparent change in size, direction and position. It involves the recognition of pictures, shapes, graphics, symbols, letters and figures. It also entails the transfer of the visual imprint from a three-dimensional to a two-dimensional level (Swarup & Mehta, 2011).

The purpose of this study was to investigate the effect of computer assisted instruction (games & videos) package developed by researcher for use with primary school students, particularly fifth graders, for improving their image or figure constancy type of learning disability. Follow up was gathered to determine the maintenance of computer assisted instruction (games and videos).

Objectives of the Study

1. To compare the effectiveness of remediation of figure constancy type of learning disability with pre-test and post-test of traditional method of teaching.
2. To compare the effectiveness of remediation of figure constancy type of learning disability with pre-test and post-test of computer assisted instruction (games & videos) method of teaching.
3. To compare the relative effectiveness of remediation of figure constancy

type of learning disability with computer assisted instruction (games and videos) and traditional method of teaching.

Hypotheses of the Study

1. There was no significant difference between the pre-test and post-test of traditional method of teaching in remediation of children with figure constancy type of learning disability.
2. There was no significant difference between the pre-test and post-test of computer assisted instruction (games and videos) method of teaching in remediation of children with figure constancy type of learning disability.
3. There was no significant difference between the effectiveness of computer assisted instruction (games and videos) and traditional method of teaching in remediation of children with figure constancy type of learning disability.

Scope of the Study

The study focused on the effect of educational games, videos and simulations as remedial teaching for learning disabled fifth grade students. It was limited to children with figure constancy type of learning disability of fifth grades of Central Board of Secondary Education (CBSE) students.

Methodology

The research design for this study was pre-test-post-test experimental group and pre-test-post-test control group design. At the preliminary stage 749 students selected as population. Entire population selected from inclusive schools. From these population, with the help of Behavioural checklist for screening the learning disabled (BCSLD) filled by respective school teachers, only 202 students identified as possible learning disabled. In next step by administering Diagnostic test of learning disability (DTLD) only 102 students identified as learning disabled. As the experiment was to be performed in special setting so far the convenience, researcher administered Non-verbal group of Intelligence test (NGIT). On the basis of score obtained by students only 64 students of medium range of intelligence were selected as final sample. So in this way after administering three level of screening finally 64 students considered as sample. This sample consist 43 boys and 30 girls fifth grade students. The target population was seven hundred and forty-nine (749) from seven (07) CBSE schools in Utter Pradesh, India. The sample for this study was made up of 64 students using simple random sampling techniques. A breakdown revealed that the experimental group consisted of 32 students with a gender balance of boys (n=17) and girls (n=15), while the control group had a gender balance of boys (n=17) and girls (n=15) respectively. The experimental group was taught using educational games and video package which covered figure constancy type of learning disability, while control group was taught using traditional method.

Research Instruments

The following tools were used to conduct the study i.e. (i) Behavioural checklist for screening the learning

disabled (BCSLD), (ii) Diagnostic test of learning disability (DTLD) developed by Swarup & Mehta (2011) (iii) Non-verbal group of intelligence test (NGIT) developed by Imtisungba Ao [Kohima] (2011), and (iv) Computer assisted instruction (games and videos) package developed by researcher.

Computer assisted instruction (games and videos) package for children with figure constancy type of learning disability: In this package following games and videos were selected for remediation of figure constancy type of learning disability.

1. Learning Shapes videos: In this simulation children needs to select learning shapes and watching carefully. Every shape describes itself in audio-video form.
2. Shapes Match Game: In this game children needs to select the many shape according to question shape. There are many shapes arranged in this game as square, triangle, rectangle, oval, diamond, star etc. After completion of particular shapes children take reinforcement.
3. Painting Completion games-1: In this game children needs to make a complete picture by joining different part of the particular picture. This game provides five different pictures those are arranged as per difficulty order.
4. Painting Completion games-2: In this game children needs to make a complete picture by joining the different part of the particular picture. This game also provides five different pictures arranged in difficulty order.
5. Ni-Ni Puzzle Picture: In this game children needs to make the complete picture by rearranging the small pieces of the target picture showing on the screen.
6. Fishing Puzzle Picture: In this game the difficulty level has been enhanced by increasing the number of pieces & their ability to turn in all direction.

The computer assisted instruction is arranged as per order and children train to participate in the games, videos and simulations. These educational games and videos overcome figure constancy learning disabilities completely or to some extent.

Method of Data Collection

The teachers in the sampled schools were trained as research assistants in the use of computer assisted instrcution (games and videos) package. The study period was of 45 classes for five months, twice a week. The classes were conducted in a computer institute with educational games and videos for remediation of figure constancy type of learning disability. There was an orientation between the researcher and the students who underwent the test from the selected schools. The experimental group students were exposed to computer assisted instruction package which had been installed in computer, while control group students were taught using traditional teaching method having the same content used for the experimental group. At the end of the experimental study, DTLD was administered as the post-test to measure the outcome of learning disability of the students. The DTLD test was administered in the

same manner for the post-test also. The test was conducted at the same time with the help of research assistants in each school and the script collected immediately for scoring. The 't'-test was used to test all the null hypotheses using Statistical Package for Social Sciences (SPSS) version 20 at 0.01 alpha level.

Results and Discussion

Phase 1: Remediation of learning disability through traditional method with reference of children with figure constancy type of learning disability.

Table No. 1: Statistical values on the DTLD sub test of figure constancy type of learning disability of group–A (control group) students on the pre-test and post-test.

Testing	N	M	S.D.	r	t
Pre-test	32	2.03	0.89		
				0.68	5.35*
Post-test	32	2.65	0.70		

* Significant at 0.01 level

A perusal of table No. 1 clearly stated that mean DTLD scores achieved by group–A subject. Taught through the traditional method, on the subtest of figure constancy type of learning disability on pre-test were 2.03 and 2.65 respectively. The difference in mean-scores was highly significant ($t=5.35$, $p<0.01$). The significant gain in scores on the post-test reveals that traditional method of teaching was significantly effective in improving figure constancy abilities in learning disabled fifth grade students. Furthermore, the pre-test & post-test scores of the sample-subjects were positively & highly correlated ($r = 0.68$). Thus, the students, who achieved higher on the pre-test were high-achievers on the post-test as well and vice-versa. This indicates that the improvement in figure constancy abilities was almost equal among all the students regardless of their prior achievement on this sub-test of DTLD. Hence, it may be concluded that traditional method of teaching was equally beneficial in improving the figure constancy ability for all the learning disabled children or the selected fifth grade students. The result found that drill and practice method is more effective. Kim (1998) also found similar result that drill and practice method was quite effective to improve in spelling difficulties of the learning disable students.

Phase 2: Remediation of learning disability through computer assisted instruction (games and videos) method of teaching with reference to children with figure constancy type of learning disability.

Table No. 2: Statistical values on the DTLD sub-test of figure constancy learning disability of group–B (experiment group) students on the pre-test and post-test.

Testing	N	M	S.D.	r	t
Pre-test	32	2.12	0.90	0.52	13.75*
Post-test	32	4.15	0.84		

* Significant at 0.01 level

An observation of the data displayed in table No. 2 shows that mean scores on the DTLD sub-test of figure constancy type of learning disability yielded by group–B subjects, taught through computer assisted instruction (games and videos) methods, on pre-test and post-test were 2.12 & 4.15 respectively, the difference being 2.03. The obtained 't' value ($t=13.75$, $p<0.01$) was highly significant. It concludes that educational games and videos are also beneficial in improving figure constancy abilities of fifth grade children with learning disabilities.

Also, the product moment correlation between pre-test and post-test scores on this sub-test of DTLD was found to be highly positive ($r=0.52$). These finding are almost similar to those reported for the traditional method (refer table No.1). However, the value of 'r' for computer assisted instruction (games and videos) method ($r=0.52$) is much less than its value for traditional method. Therefore, improvement in figure constancy abilities was more consistent among subjects taught through traditional method as compared to their counterparts belonging to computer assisted instruction (games and videos) group or experimental group.

This finding is also in line with study of Haberman (1977). In his study they found that computer assisted instruction is effective method for socially-emotionally disturbed children. CMI is an effective tool for the enhancement of learning but this effect was not found significant.

Phase 3: Comparing relative effectiveness of computer games and videos instruction method & traditional methods in remediation of figure constancy type of learning disability.

Table No. 3. Statistical values on the DTLD sub-test of figure constancy type of learning disability of group–A and B students on the post-test.

Groups	N	M	S.D.	t
Group A	32	2.65	0.70	
				8.10*
Group B	32	4.15	0.84	

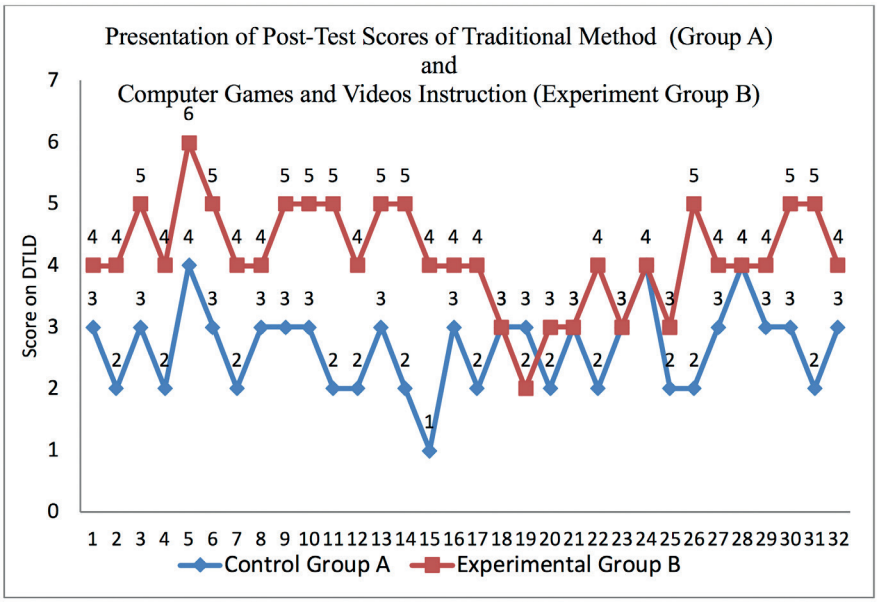
* Significant at 0.01 level

A look at table No. 3 indicates that mean scores on the DTLD sub-test of figure constancy type of learning disability of group A and group B students on the post-test were 2.65 and 4.15 respectively. The 't' value yielded (t=8.10, p<0.01) was highly significant. This infers that computer assisted instruction (games and videos) was better than the traditional method in improving the figure constancy learning abilities among the learning disabled students studying in fifth grade.

Summing up, the tables infer that computer assisted instruction (games and videos) as well as traditional method are effective in improving sample subject's ability of recognizing an objectives figure constancy but computer assisted instruction (games and videos) was better than the traditional method.

The result found that computer assisted instruction or computer based instruction was effective than traditional method of teaching for remediation of learning disability. Lavin & Kareev (1980) Watkins & Webb (1981), Bukatman, (1981), Chiang (1986), Gleason, Carnine & Boriero (1990), Vasanthal (1994), Crute (2000), Pandya & Chaudhary (2000), Maccini, Gagnon, & Hughes (2002), Vaupel (2002), Fuchs, Hamlet, Powell, et al. (2006), Kundu (2008), Seo & Bryant (2009), Scheid (2010), Anyamene, Nwokolo, Anyachebelu et.al. (2012), Singh & Agrawal (2013), and Kumar (2017) also found similar results that computer based instruction was quite effective than tradition method of teaching for removal of the learning disabilities of disabled children.

Graph 1: Graphical presentation of post-test scores on the DTLD sub-test of figure constancy type of learning disability of group–A (control group) and group-B (experiment group) students on the post-test



A look at graph no. 1 indicates that mean scores on the DTLD sub-test of figure constancy type of learning disability of group A and group B students on the post-test. The graph shows that experimental group scores were better than traditional group scores. It is indicated that the computer assisted instruction better than traditional method of teaching.

Educational Implications of the Findings

The findings of the study provide the awareness to the teachers, parents and guardians of learning disabled children. The educational implications of the findings of study are as follows:

1. The findings of the study may be used to develop the tendency of practices, trial and error habits in students.
2. All educational games and videos may be used for helping the learning disabled children because such type of games and videos are easily created by the open sources software i.e. H5P, TimelineJS, Presentation Tube Recorder, Open Shot Video Editor etc. Also such games & videos can be downloaded and supported all the operating systems.
3. It was found that the computer assisted instruction package may provide to be effective but is not the panacea for students with learning disabilities.
4. The findings of the study that computer assisted instruction package may improves the thinking process of learning disabled children can also be useful in providing the ways to teach for learning disabled students.
5. The findings of the study reveals that the computer assisted instrcution (games and videos) package may be helpful in making teacher aware to consider them as teaching learning material.
6. Various education institutions may be created such type of games and videos and upload on various web-portals for users. These games and videos are useful as a teaching material to improving the performance of students.

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Review Article

Integrating Technology into Classroom Learning

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Abstract

Technology and Education have been two sides of the same coin since mid-1600's when picture technology was invented. In the last 30 years, there has been a marked interest towards integration of technology into every aspect of classroom learning. Many research studies have proved that higher order thinking skills can be inculcated by integration of technology into the instructional design. Many scholars have come out with various models and integration approaches towards building a blended learning environment. This review article covers details of some of the most popular technology integration models such as SAMR, LOTI, TPACK, Tripe E to name a few. Despite having different approach towards integration, each of the frameworks puts learner at the center of focus and tries to improve learning experience & higher order thinking skills (HOTS). No single framework fits across all learning environments. As part of this review article, we look at some comparative assessment of these integration models.

Keywords: Technology Integration, Blended Learning, HOTS (higher order thinking skills), Education, TPACK, SAMR

Introduction

It was during mid-1600's that the first textbook was published titled 'Orbus Pictures' or 'World in Pictures' (Figure - 1). This marked the beginning of printed text usage in education field.

Figure – 1: Snapshot from Orbus Pictures – first children textbook
Source: http://www.openculture.com/2014/05/first-childrens-picture-book-1658s-orbis-sensualium-pictus.html

Similarly, chalkboard came into existence in the 1800's and that's something that is still widely used in many classroom setups. It is very interesting to see how some of these technologies has had significant bearings on the educational settings and practices and transformed the field of learning and education. Clearly, technology has been synonymous with education. More so in early 1900's when motion pictures started to be used for educational purpose. This generated significant interest in the learners and educationists due to the nature of visual instructions. Termed as 'wonder technology', radio truly transformed the nature of education with the establishment of educational radio station in 1920's and 1930's. During the 1990's, there was a technology overload with its availability and ease of use. Terms like, digital technology were introduced. Information could be recorded, transformed and transmitted. This also included all educational content. Things such as mobile and internet further accentuated the process of digital technology & its spread among the new generation or millennials. As seen in last 30 years, introduction of a new technology such as mobile, web technologies, Virtual reality, etc. may initially help to engage students better and develop interest, but this may not be sustainable.

In last 15 years, there has been a lot of attention being paid to integration of technology into education. In the United States of America, guidelines have been laid down on integration of technology for K-12 education. Similarly, in Europe, we are seeing a growing interest in technology integration in education and even across APAC (Asia Pacific – India, Australia, etc.) countries. The rapid growth of technological tools with their declining prices, spiralled the growth &

usage. The advantages of integrating technology into education are well documented and some of them being:

- Versatile education set up such as distance education, satellite classrooms, to name a few
- Many-fold increase in learning opportunities for learners
- Possibilities of massive information storage which helps to record & then transmit or teach again (repetitive learning)
- Low cost of building technology infrastructure

With such a focus on educational technology, one of the major tasks of school is how technology could help transform the learning process. It is important that slowly schools' transition from low-value use of digital technologies to high-value use of digital technologies. Students who graduate should be technology literate and assumptions are that technology would have aided in the overall learning process. Teachers and books, which were the authoritative source of all knowledge has completely been transformed. Technology has enabled access to multiple sources of authentic knowledge which is verifiable. Education has entered a new phase of profound disruption. Any disruption changes the status-quo. Role of teachers is going through a big change with this technological disruption. Teachers are key to transforming this learning paradigm where technology is enabling the new learning process. However, as quoted by researchers Roberto and Miguel in the year 2013 (Computers in Human behaviour), Teachers are lagging in the adoption of new technologies and unless significant time contribution is made towards it, its adoption will be slow and weak. But more concerning is the fact that many teachers still are afraid / reluctant to embrace technology to move from teacher centric learning approach to student centric learning approach and induce HOTS (Higher order thinking skills) among students. Even though many empirical researches in 1990's to 2010's seem to indicate a positive correlation between achievement in school and usage of technology, however, one critical thing that is missed is the long-term effect of such interventions.

Without structural reforms in school system, these changes may not have a long-term impact on students' learning and achievement.

If we look at modern pedagogy principles, they are based on some of these foundations:

1. Learning builds on previous experiences
2. Learning in a social activity
3. Context is very important in how content is presented
4. Content should be well-connected, organized and relevant.
5. Feedback and active evaluation

Since the 1990's there have been numerous technology frameworks that have been created which help in evaluation of the current state of technology integration and suggest on best approach on how to move ahead.

In this paper we will look at some of these frameworks, their creation, philosophy, current usage & challenges. Let's look at some of the most popular

Technology integration models. In this paper we will do our analysis on the following technology integration models

1. SAMR Model
2. Level of Teaching Innovation (LOTI) Model
3. Technology Integration Matrix (TIM)
4. Technology, Pedagogy and Content knowledge framework (TPACK)
5. Triple E framework (Extend, Enhance and Engage)
6. T3 framework

One thing to be watchful of is that technology integration models are theoretical models that are designed to help teachers, researchers, and others in the education field to think about technology integration in meaningful ways. The key advantage of using one of these frameworks is that it helps in better evaluation of technology integration efforts in learning and teaching process.

SAMR Model

Origin

Ruben Puentedura in the year 2009 came out with this model, namely SAMR, which describes four levels of technology integration. This model has its origins in the year 2006 where Ruben had worked on Maine Learning Technology Initiative. The main objective was to improve the quality of education using technology integration in the state of Maine. The four levels of SAMR model proposed by Ruben were:

1. Substitution – Technology substitutes what you might already be doing as-is.
2. Augmentation – Technology once again is a direct substitute, but there is a functional improvement as technology is now involved
3. Modification – Significant re-design of the task is enabled with technology
4. Redefinition – Something which could not be done earlier, is now achievable using technology and being redefined

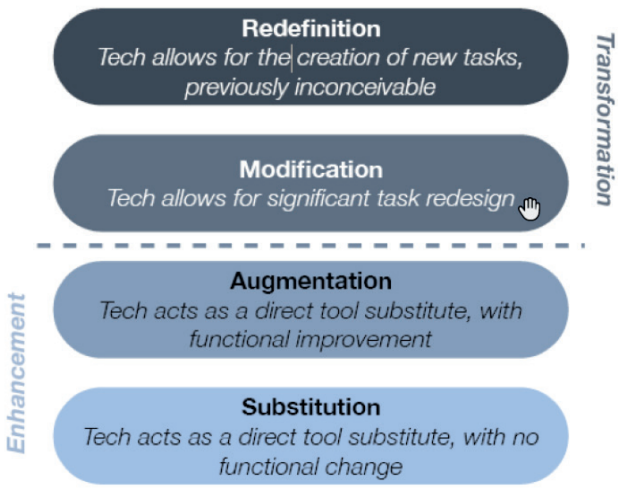

Figure – 2: SAMR Model by Ruben Puentedura, 2009

Technology Integration and Researches

Some of the areas where SAMR model has been used with success are in areas of vocational education. Romrell, Kidder, and Wood (2014) explained that one of the frameworks to evaluate technology integration for instructional activities used is SAMR. According to Romrell et al. (2014), SAMR can help to improve quality of classroom instructions by implementing technology.

SAMR model draws many similarities to Bloom's taxonomy model since both share similar levels. Another area where SAMR model has been used is to evaluate mLearning activities and in which of these four levels do they fall and finally trying to measure impact on quality of education. Hockly (2013) used SAMR model in context of mLearning with special focus on English language teaching. To understand the concept in-depth, let's look at the above four levels from the lens of mLearning vs conventional learning (Table - 1).

Table – 1: Four levels from mLearning Vs conventional learning

Substitution	Augmentation	Modification	Redefinition
Instead of giving lecture, the same is recorded and can be played as a podcast (audio podcast) or Recording of a lecture being played	For revision, instead of students creating flash cards or small notes, students are provided sms or small snippets on their mobile which summarize the same.	Using Google groups and google docs for building a presentation on a topic and then sharing that using various collaboration features. Instead of just a presentation being shared, it became a collaborative and highly enriched learning environment.	Using technology and Augmented reality explaining the concept of a black hole or very abstract concepts

Clearly true potential of mLearning is realized with Modification and Redefinition levels and how SAMR models explains that so clearly. However, there are differing views on implementation of SAMR model and there are many challenges that are also cited. The biggest challenge is the adoption of technology tools. Teachers are bombarded with so many technology tools such as VR experiences, laptops, tablets, smartphones, smartboards, etc. How do they find time to learn these tools and build their confidence in using these new tools? As a result, teachers

may choose the easy path out and keep focusing on levels – Substitution and Augmentation. These will also enhance learning but not to the degree the other two. Cochrane et al (2014), also confirms that SAMR helps represent the evolution of new technology with its four phases of substitution, augmentation, modification and redefinition. As late as 2018, Budiman et al have carried out research in the area of ICT integration in English as a foreign language using SAMR model. The research concluded that ICT integration can have profound effects on quality of education. In a research undertaken by Hilton (2016) in case of iPad integration for social studies, between SAMR & Technological Pedagogical Content Knowledge (TPACK), SAMR gives a better perspective on use of a technology to accomplish an instructional objective and since it helps teachers strive to achieve higher levels is a motivational factor.

Level of Technology Innovation (LOTI) Model

Origin

Level of technology innovation (LOTI) framework was a conceptual framework that measured level of technology implementation and assist schools to include concept/process-based instructions, authentic uses of technology & qualitative assessments. It was conceptualized by Cristopher Moersch in year 1995. LoTi is aligned conceptually with the work of Hall Loucks, Rutherford, and Newlove (1975); Thomas and Knezek (1991); and Dwyer, Ringstaff, and Sandholtz (1992). There are seven (7) discrete levels of technology implementation. As the teacher progresses from one to another, changes in how curriculum is taught can be observed and focus of teaching shifts from being teacher centred to learner centred. The seven levels as outlined in the LOTI model have been given in Table- 2.

Table – 2: Seven levels outlined in the LOTI model

Level	Category	Description
0	No use	Lack of know-how or time to pursue technology-based learning.
1	Awareness	Use of computers via computer labs is prevalent. Computer based learning apps have little to no use for the teachers at large.
2	Exploration	Technology based tools supplement existing teaching methods. They aid in extension or enrichment activities.
3	Infusion	Technology tools such as, multimedia application, graphics or spreadsheets are used when teaching.
4	Integration	Technology tools are used to ensure that learners get rich context on the concept and their understanding improves. The scope is still limited to classroom only.

5	Expansion	The scope of technology integration expands outside of classroom. With technology application and networking from outside of classroom to enhance the learner's learning. Such as video conferencing with ISRO scientists on space related topics.
6	Refinement	Technology scope increases to be the process, product and tool in hands of learners to achieve their learning and learner takes the center-piece and objective is to learn the best and use any technology means for the same.

Technology Integration and Researches

LOTI framework has been used in many research publications to assess the impact of student achievement as technology integration happens in school. One such research is to assess the technology integration and impact off same in rural Nigerian schools. LoTI questionnaire was used to measure the extent of technology integration in schools. The results were not conclusive to indicate that level of technology integration in schools was leading to better quality of education & students learning. But, one of the aspects that did come to light was around teacher's phobia around technology and usage of technology. Clearly an area to be addressed during teacher's pre-service education and with regular in-service education programs that can address the same. In the year 2012, Berkeley was able to prove a positive correlation indicating a relationship between teacher Levels of Technology Implementation (LoTi) and student achievement scores on the Texas Assessment of Knowledge and Skills (TAKS) tests at the junior high level, 6th, 7th, and 8th grades for English Language Arts and Mathematics. Farsaii (2014) conducted a study on how administrators were sensitized on technology integration using LoTi framework. Many other researches such as Stoltzfus (2006) and Lin Janet Mei Chuen et al. (2010) have used the Levels of Technology Implementation (LoTi) framework for assessing technology integration & how learners can move to higher order thinking skills and leads to better learning outcomes.

LoTI framework has gone through a refresh to becoming the LoTi® Digital-Age Survey that helps creates profiles basis NETS technology standards. Initially what was the Level of Technology implementation have become Levels of Technology Innovation. Instead of focusing on technology integration in teaching curriculum basis the new 21st century paradigm, it has been refreshed to focus on how across various levels we move from teacher-centred approach to a learner-centred approach. Some of the marked changes in the new LOTI framework are:

1. Moving from knowledge and comprehension at lower levels to evaluation, problem-solving and issues resolutions at higher levels.
2. Moving from simple classroom constructs of providing feedback to building hypothesis & validating those

LoTI framework consists of two models. CIP (Current instructional practices) and PCU (Personal Computer Use). CIP focuses on how in a classroom teaching evolves from teacher or instruction led learning to student centric learning. PCU focuses on understanding the level of fluency in using various technology tools. A new framework that is increasingly being used is H.E.A.T. framework from Chris. H.E.A.T.—higher-order thinking, engaged learning, authenticity, and technology use can significantly add value over LoTI framework (Figure-3).

Figure – 3: H.E.A.T. framework;
Source: www.loticonnection.com

Several researches over the course of last decade have used LoTi and its new age survey to assess the technology integration in classrooms and areas to further improve the same. The recent one from 2017 is around K-12 schools

and analysis to assess the level of LoTi, CIP and PCU usage and substantiate the findings with qualitative insights to arrive at areas to further improve the technology integration in school. The key findings are around professional development of school teachers and directing them towards elevated LoTi. In a study conducted in the year 2015 by Roth, among various frameworks for integration of digital technologies focuses on LoTi and H.E.A.T (Moersch, 1995; Rielley, 2015) and how these connect to HOTS (higher-order thinking) and engaged learning.

Technology Integration Matrix

Origin

Technology Integration Matrix (TIM) is a framework for using technology to enhance learning. The Technology Integration Matrix (TIM) (Allsopp et al.) was developed by the University of South Florida in conjunction with the Florida Department of Education to identify the level of technology integration in the class. The TIM is well accepted throughout the academic community as a valid instrument for this purpose (Arizona K12 Center at Northern Arizona University, 2012; Allsopp et al., 2007; Bruder, 2010; Cozakos, 2013; Rhode Island Department of Education [RIDE], 2013; Ulster BOCES School Library System, 2011; The Virginia Department of Education, 2008). TIM is a framework which is 5X5 matrix. On one axis are five meaningful learning environments namely:

- Active
- Collaborative
- Constructive
- Authentic
- Goal-directed

On the other axis are five levels of technology integration namely:

- Entry
- Adoption
- Adaptation
- Infusion
- Transformation

Together this creates a 5X5 multi-dimensional matrix consisting of 25 cells. The origins of TIM framework are in Florida Center for Instructional technology in the year 2005.

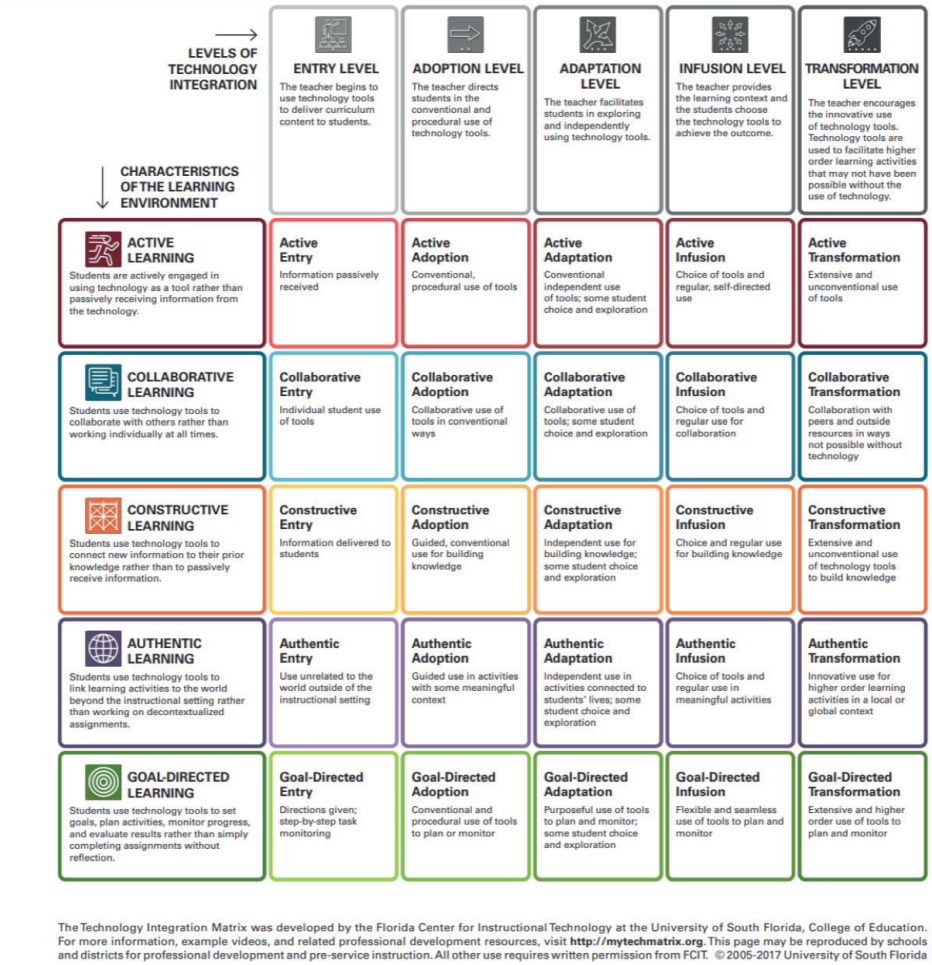

Figure – 4: TIM framework

As with other models, the ideal state is to be at the highest level across both learning environment and technology integration. Starting with Active learning environment where technology integration is at entry level to being at a level where learning environment which is Goal-directed and Transformational technology integration. The final goal is to use higher order tools to plan and monitor students learning.

Technology Integration and Researches

There have been numerous researches in which using TIM Framework, impact on student learning can be seen. In one study conducted in Bangalore, for a Physics experiment this test was done with students using traditional approach for measuring certain parameters manually versus using TIM enabled Science laboratory. The difference was huge and students learning and understanding of the concept was vastly different than in

traditional classroom. Clearly, reaching to higher levels as mentioned in TIM framework leads to higher order thinking skills. Hornack (2011), Jonassen, Howland, Moore & Marra (2003) and Barbour (2014) discuss how TIM can be a great asset to improve student engagement by integrating technology in the classroom learning and improve from initially active to finally goal directed learning.

In Kansas (2010) for high school teachers when evaluation was done with TIM framework, a good mapping of the current state helped the school and education administration at large to better understand what is required from professional development stand point to move the needle towards higher levels of attainment and to further improve the learning opportunities for students in these schools. Likewise, teachers will be able to reflect on their individual practice, become aware of ways they can increase the level of technology integration, and facilitate increased student engagement.

Technology, Pedagogy and Content Knowledge (TPaCK)

Origin

TPACK has its origin in 1986 work of Shulman who focused on knowledge of pedagogy applied to teaching of specific content. Shulman (1987) describes how understanding pedagogical knowledge needs to be combined with understanding content knowledge. He explained how teachers need to "understand deeply, not only the content that they are responsible for, but how to represent that content for learners of all kinds" (p. 202). Shulman argues the most effective teachers knew more than their subject matter and more than just good pedagogy. He asserts teachers also know how students understand & misunderstand their subjects. Figure - 5 describes Schulman's model (1987).

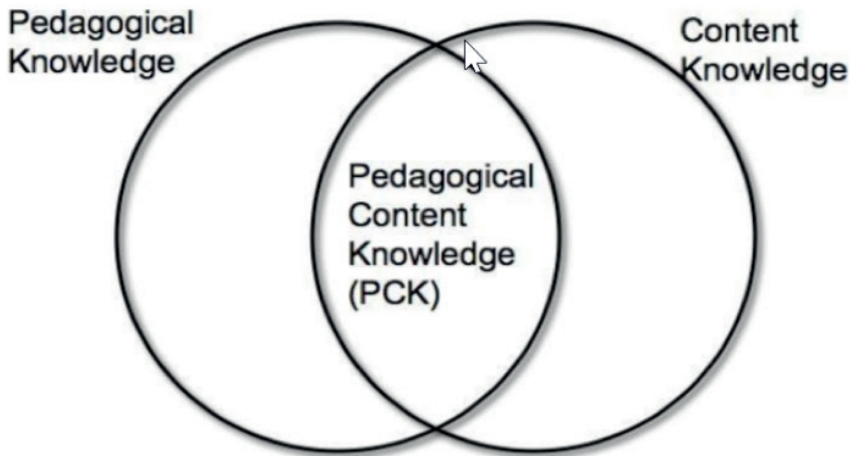

Figure- 5: Schulman's Model (1987)

Effective teachers know how to check for these misunderstandings, and how to deal with them when they arise. In the year 2006, Kohler and Mishra proposed TPACK by introducing the concept of Technology in PCK framework from Shulman. They described an integrated connection between content knowledge, pedagogical knowledge & technological knowledge in order to aid with integration of ICT tools in classroom environment for enhanced learning of students. The more interesting amalgamation which is part of this framework is the part where P (pedagogy), C (content) and T (technology) overlap. This framework can be very helpful tool in hands of educators to develop teachers' competencies in school teaching and ICT integration. In numerous case studies published on the success of TPACK, the approach followed is mostly around

1. Evaluation of the current teaching practice
2. Figuring out which are the areas which are amiss from the perspective of TPACK.
3. Discussing and addressing those in the teaching pedagogy

Technology Integration and Researches

During initial enquiry questions such as "I can adapt my teaching style to XYZ" or "I frequently play around with the technology" help to gauge teacher's confident on the seven domains defined in TPACK. Mostly TPACK survey based investigations are good to get an overall understanding however things such as pedagogy are quite complex and involve planning, teaching, assessment or any other aspects which are hard to measure in a survey. In recent times, TPACK model has further been refined from assessment to implementation perspective (Figure-6).

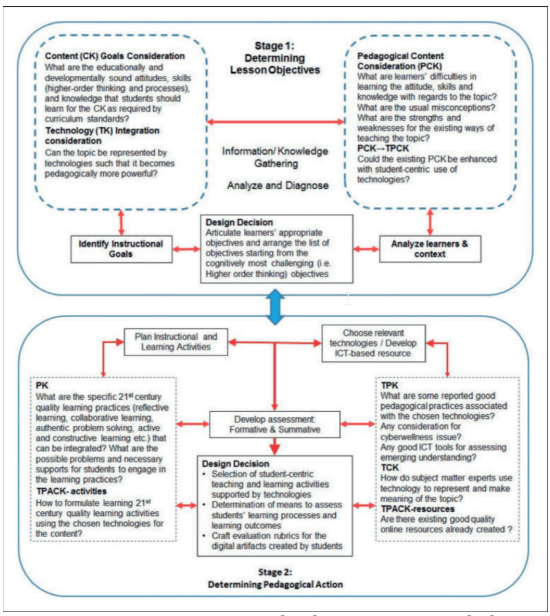

Figure – 6: Detailed TPACK Model

TPACK as a conceptual framework gives good insights on how teachers can integrate technology into pedagogy and this has been validated in various researches such as Chai et al., 2011; Jimoyiannis, 2010. TPACK has also been used as a framework to develop competencies of teachers in school teaching by Doering et al., 2009; Lee & Tsai, 2009; Voogt et al., 2009. In another study Srisawaasdi (2012) where for pre-service physics teachers, TPACK model was used to build best practices for physics teaching method. In the year 2011, Wetzel et al. observed a middle school teacher and how they applied TPACK theoretical framework and integrated technology with content (language arts) and pedagogy (project based learning).

In last few years there have been multiple enhancements suggested to TPACK model. Another variant that has come out is TPACK-21CQL which considers aspects such as Reflective learning, Authentic Learning, Collaborative Learning, Active Constructive Learning, Belied of New Culture of Learning, Design Deposition, Design thinking efficacy & Teachers as Designers. These design beliefs are important for the 21st century teacher.

Triple E (Extend, Enhance and Engage) framework

Origin

Triple E framework was developed in 2011 by Professor Liz Kolb with the aim of bridging the gap between the researches on education technologies and teaching practice in classrooms. Some of the key differentiators in Triple E framework over other technology frameworks are as below:

- Focus is on learning goals rather than technology tools
- Significance of instructional strategies along with using technology tools
- Quality of technology usage rather than quantity
- Understanding that technology is an amplifier and cannot lead to higher achievement. It needs to be applied correctly along with other learning methodologies to achieve the same
- Technology is applied to lesson plans from the purpose on how it can add value to learning goals rather than applying the same to increase technology usage.

Triple E framework can aid earlier technology frameworks towards practically implementing technology for classroom lessons with focus on learning improvement and measuring the same (Figure-7).

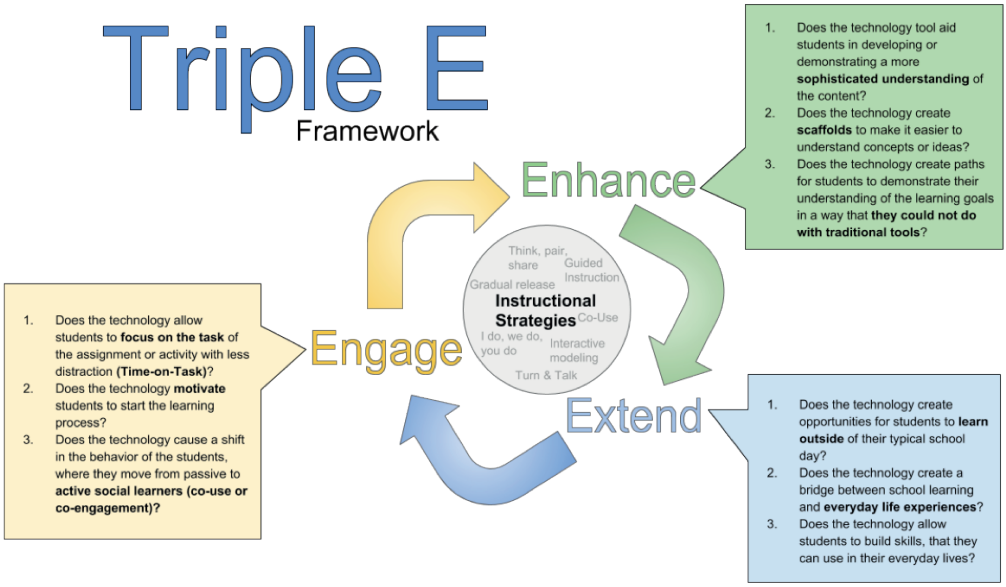

Figure – 7: Triple E Framework

(Source: https://www.tripleeframework.com/)

Technology Integration and Researches

In 2019, there have been two researches related to Triple E framework. In one case, Ibrahim et al. (2019) used HSP (HTML5 package) application in teaching architecture theory and history module to transform facts and dry content to a rich, fun & engaging learning activities based on Triple E framework. Its usefulness in tertiary education could be gauged easily by the increased student's performance in the module. Similarly, Ruzaman et al. (2019) used mobile learning application for teaching science in a study titled - "SIM for Science: Scaffold in Inquiry- Based Learning".

T3 framework

Origin

The T3 Framework is designed by Sonny Magana (2017) to disrupt the current application about educational technology by contextualizing its use into 3 stages:

1. Translational

2. Transformational

3. Transcendent

T1: Translational refers to the act of transferring. When we translate a message from one language into another, we are really transferring a method of generating meaning to another language but keeping the original message as intact. When one engages in translational technology use, one is transferring or translating the task or experiences from an analog mode to a digital mode. The two stages of translational technology are:

T1.1: Automation – When teacher or the student uses technology to automate i.e. to translate from an analog to a digital mode. Thus, saving

time, increasing the efficiency and accuracy.

T1.2: Consumption - The teacher or the student uses the digitized content information in teaching learning experiences. As so much information is available in digitized form that the teachers have to consume it. Thus, aiding the learner to consume content related text, images, videos, pictures or any combination.

T2: Transformational – A shift from Translational stage to transformational use of technology in classrooms where the locus of control of learning experience, transforms from teachers to learners. When this shift happens there is an active learning reflection of the learner. The two steps of transformational technology use in education are shown in Figure - 8.

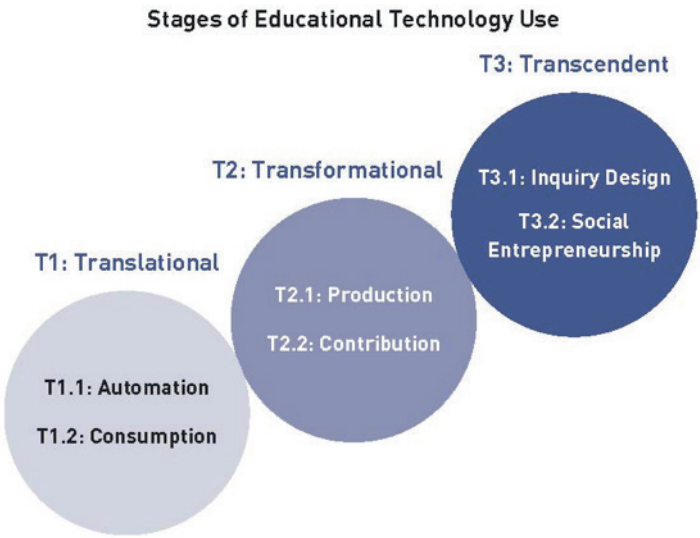

Figure – 8: Stages of Educational Technology Use

T2.1 Production – students use technology not only to experience new knowledge but to actively apply knowledge in the production of digital artifacts that represents what students know and how they came to know it.

T2.2 Contribution -Students are given opportunity to use digital tools to teach others what they know, what they can do, and how they think about their knowledge being transformational. Students' role changes from that of student to teacher. Thus, students will contribute not only to their knowledge but also to the knowledge of others. Students get the opportunity to develop empathy and consideration for the way others interpret and experience.

T3: Transcendent -Students use technology in transcendent ways that result in growth of knowledge, contribution, and value – generating performance. The students engaged in constructing and applying knowledge and skills in ways that transcend common curriculum standards. They contribute something of value to the society. The two steps in the transcendent stage of educational technology are

T3.1: Inquiry Design – Students use technology tools to resolve a problem that matters to them

T3.2: Social Entrepreneurship – Students use digital tools to engage in the process of creating solutions to the problem that matters to them.

Technology Integration and Researches

T3 Framework is designed to support the classroom technologies to unleash student learning potential. Teachers instructions should be based on T2 and T3 stages, pushing themselves to transform education by having students produce and contribute, and to "transcend" by using technology tools to facilitate inquiry and solve world problems that matter. Recently, Carpenter (2019) in her doctoral dissertation identified one of the areas which were lagging in TPACK namely guidance or measurable standards to help teachers attain the actual knowledge, something which has been addressed as part of T3 framework. This guidance in TPACK framework hinders self-assessment by teachers on their current knowledge and then improve.

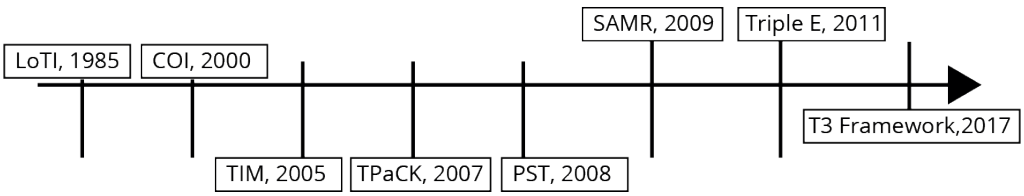

Figure - 9: Timeline of Technology Integration Models

Here (Figure - 9) is a timeline of the various technology integration models. Post-2000, with increase in focus on technology and education at large, three new models have been introduced in a matter of 5 years. Each unique and addresses aspect around technology integration and how to fill the gaps around the same. All these models talk about various aspects as described below:

- Student-centric learning
- Integrate technology into learning
- Induce higher order thinking skills for students

Comparative Review

It is difficult to compare one over the others. Each of these have had researches and validated case studies in last 10 years. Depending on the context of classroom, one or other technology integration model can be used. While the initial frameworks focused more in terms of what was the current level of technology integration for a classroom, lately most frame works have started suggesting how to improve this integration with focus being on learning for learners.

For example, in case of SMAR model, the integration approach is across a single axis with focus being more on technology tools & how as one moves from one technology tool to another, one case see changes in learning. Various levels indicated in LoTi model

also focused more on technology tools and their use but with the introduction of H.E.A.T. model in conjunction with LoTi, focus shifted from technology tools to learners' ability to gain Higher order thinking skills (indicated by H.E.A.T. intensity levels). TIM model was one of the first few models which had two-dimensional view on technology and learning. On one axis, like SMAR model, it had technology augmentation levels but on the other axis the focus was on achieving higher learning and balancing out both technology and learning to achieve maximum in both.

TPACK, though one of the most widely used models, has its origin from PCK model or Pedagogy, Content and Knowledge model that was had its origin in year 1987 by Shulman. Typically, in classroom education, teachers prepare lesson plans which mention the pedagogy of teaching that lesson plan followed by content that would be covered and heavily relies on teacher's knowledge on the subject. TPACK brought in additional factor of technology into the existing PCK framework. Starting from how lesson plans need to be created to final evaluation methodology (learning to assessment), these new frameworks try and address this wide spectrum of classroom learning.

Triple E Evaluation Rubric- *When to Use Technology* by Liz Kolb

Engagement in the learning	**0=No**	**1=Somewhat**	**2=Yes**
The technology allows students to focus on the assignment/activity/goals with less distraction (Time on Task).			
The technology motivates students to start the learning process.			
The technology causes a shift in the behavior of the students, where they move from passive to active social learners (through co-use or co-engagement).			
Enhancement of the learning goals	**0=No**	**1=Somewhat**	**2=Yes**
The technology tool allows students to develop or demonstrate a more sophisticated understanding of the learning goals or content (using higher-order thinking skills).			
The technology creates supports (scaffolds) to make it easier to understand concepts or ideas (e.g. differentiate, personalize or scaffold learning)			
The technology creates paths for students to demonstrate their understanding of the learning goals in a way that they could not do with traditional tools.			
Extending the learning goals	**0=No**	**1=Somewhat**	**2=Yes**
The technology creates opportunities for students to learn outside of their typical school day. (24/7 connection)			
The technology creates a bridge between students school learning and their everyday life experiences (connects learning goals with real life experiences).			
The technology allows students to build authentic life soft skills, which they can use in their everyday lives.			

Figure- 11: Triple E Evaluation Rubric

An example of Triple E framework and rubric evaluation has been given in Figure - 11. Against each lesson plan, rubric evaluation should be done with the thought through technology integration. On a total score of 18, the following is the way to evaluate if technology enhances learning for the learner for this lesson plan or it should not be used at all.

If number of points are 10 or above, it means technology is leading to enhancements or extending the learning goals. However, if score is below 10 but above 7, the current technology tools thought through for lesson may not be helping to enhance or extend the learning goals, so either teacher should re-look at the tools being leveraged or should all together look at not using technology for this lesson.

Similarly, other frameworks offer an approach towards evaluating use of technology and considerations on lesson plans so that learning is significantly enhanced. From a learner's perspective it is important to look at a model and see how it can be used in day-to-day usage from teacher's perspective to improve learning experience. It may also become useful for faculty/teachers to form an inquiry group of few teachers to discuss and figure out next steps towards technology integration and their observations. Lately, most popular frameworks have been TPACK and Triple E framework. Another important aspect to consider with these frameworks is that an educationist should not make efforts to forcefully fit technology into a lesson plan. Where ever technology can significant en hance the leaner experience, those are the areas of lesson plans where technology integration needs to be looked at.

Conclusion

In conclusion, teaching with technology is about learning first and the tool second. Aim for any technology integration must be learner's ability to learn. Most of the models that have been talked about have both positives and negatives. Though SAMR and TIM are both practical frameworks, but technology tool selection is the first aim followed by learning. TPACK is going through number of changes to better showcase the practical aspect of the framework. Triple E framework which has been introduced few years back addresses some of the concerns raised for other frameworks. The recommendation would be to use technology framework judiciously and integrate technology wherever it makes logical sense towards improving learner's ability to learn.

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General Article

New media: Subject, media literacy and educational technologies

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Abstract

The essay is an attempt to understand the constituent elements of new media educational technology while traversing through various definitions and possibilities of new media and educational technology. The paper argues that it is not just appropriation of the code or programme of the new media, but a reappropriation and reconceptualisation of the new media forms for educational purpose that is the chief quest of the new media educational technologies. In order to make this educational new media proactive, one needs to have not only the familiarity with the computer or new media technology but also needs to have certain knowledge in the field of new media literacy, especially when new media educational technologies are proven to give a space for automation and autono my for its user. It is in this context that the paper attempts to conceptualise the 'processual' formation of new media text and its subjectivity, in conjunction with the contemporary digital turn of educational technology.

Keywords: New media educational technology, new media text, digital literacy, interactive subject, convergence, sensory experience

Introduction

The emergence of the computational apparatus in the field of everyday life has substantially brought not only some new generative changes in the appropriation and reappropriation of educational technologies but also facilitates a salient move toward new media educational initiatives in India. This transitional phase of educational technology may be best understood as the digital or new media turn in the field of the teaching and learning cultures across India. Undoubtedly, this turn or the integration of new media into the field of educational technologies is dynamically widening the scope of the digitally mediatised pedagogical practices (Singh, 2019). Nevertheless, the transition is also marked by certain conceptual ambiguities over the very definition of the constituent elements of new media form as well as the nature of the mediated text and the enunciation of the interactive, but decentralised, subject (user) of the new media (NCERT 2006). It is in this context that the paper attempts to conceptualise the 'processual' formation of new media text and its subjectivity, in conjunction with the contemporary digital turn of educational technology.

New Media

The pervasive influences of the electronic digitality to transfer data, provide interactive information, pleasure, and knowledge is one of the distinguishable features of the present, which has its resonances in the spheres of educational technology, without radically destabilising or rejecting the forms and residues of analogue media practices. The technological and mediatised experiences of the latter—analogue—is indivisible from the ubiquitous flows of the digital mediation or networked communication of the present. In other words, there is no radical or complete rupture between 'old' and 'new' media. In fact, as Lister et al. (2003) states, 'net worked media distribution could not exist without the technological spine provided by existing media routes of transmission, from telephone networks to radio transmission and satellite communications' (p.30). 'Old' media systems of distribution are reconfigured into the logic of convergence of new media as essential and integral to it (Lister et al, 2003).This convergence of the analogue and digital united by computational language and optical fiber networks to transfer coded data in various formats for production and mediated consumption of the generative text or its alteration and modification through a hyperlink always makes it a difficult task to reach a unique definition about the new media forms. There are a number of conceptual schemes being used to define the constitutive 'epistemic technological and cultural regimes' of new media in relation to the 'digital' and the 'post-digital era' of the technology. It refers to new media as digital, innovative, convergent, everyday, appropriative, networked, global, generational, and unequal. In addition to this, interactivity, interconnectivity, and the formation of networked public and intersubjective communication are the major defining features of the new media (Samuels, 2009). Dispersal is yet another key characteristic that distinguishes new media from the existing form of mass media. As traditional analogue media is epitomised by standardisation of content, distribution and production processes, 'dispersal is the decentralisation that created a non uniform media that sends non-limited number of messages to a heterogeneous mass' (Lister, 2003). All these definitions primarily address two significant aspects of new media: the first one is related to the computational language and the processual formation of the new media text and the second one, indicates the nature of digital mediatisation, which is united by the technology and culture.

These definitions are grounded in the basic idea that the Internet' explosion' and the era of networks in the late 1990s, the sprawling assimilation of computer-generated digital modalities and media convergence as well as their transcoding and transcending power to code and decode data, text and image not only created a new sense of perception but also radically changed the existing field of technology and culture. It opens up a new era of 'new media' whereby individuals and masses immersed within the logic of

ICTs (Hassan, 2004, p. 15). Hence, the 'new' in new media refers to both the technological and perceptional change that has occurred as well as anticipate an optimistic utopian and progressive ideological change along with this technological rupture. However, the second sort of definitions, which focuses on the proliferation of new media activities such as new media art, education, popular culture, and politics, points to an emergence of a new interactive media subject (user) who is not only active & decentralised but also articulates embodied sensibilities that itself became an integral element of the new media practices. This approach, on the one hand, helps us to think of new media as something which is not entirely attached to the computational algorithms and data/codes. Rather they are, in some sense, 'a project that is not just static text on a screen but a temporal structure that has a past, a processing present and a futural orientation to the completion of a computational task' (Berry, 2014, p.185).

On the other hand, it stresses the extended materiality of new media and its power to activate and reactivate the multicultural and multisensorial embodiments of the subject or user. This latter idea is crucial to understand the realms of new media educational technologies in India where it is becoming a tool to disseminate or signify knowledge and learning practices to impart and incite the affective senses of the user (student/ teacher/practitioner). In the post-digital era, new media educational technologies are often concerned with the processing present of the media text to converge the past experiences and future orientation, rather than completely sticking to the computational logic and its language. It is not just appropriation of the code or programme of the new media, but a reappropriation & reconceptualisation of the new media forms for educational purpose that is the chief quest of the new media educational technologies. In the context of educational technology and the process of remediation of a media text, the processual media text itself functions as a digital medium for educational communication & further interaction and modification. So, in the context of educational technology, 'functioning digitally' is the key aspect of new media. However, in order to make this educational new media pro active, one needs to have not only the familiarity with the computer or new media technology but also have certain knowledge in the field of new media literacy, especially when new media educational technologies are proven to give a space for automation and autonomy for its user. Hence, when used or appropriated for a multicultural context to disseminate or symbolically signify educational knowledge, either through a new media visual, verbal, or sound text, or through any specific infotainment forms, both the sender and the receiver (student, teacher, practitioner, user, etc.) should be aware of the historical preludes associated with the new media representations such as Eurocentric, stereotype imaginaries or the bounded ideological implication of the digital capitalism.

The next section of the paper will

further elucidate the existing—both conventional & new - characterisations of new media to understand the aspects of new media literacy or digital literacy in the context of educational technologies.

New Media: some preludes

In general, what we understand today as new media can probably be described best as a seamless convergence of media and computers. The two trajectories had been born around the same time, with Charles Babbage's Analytical Engine as the prototype of computers and Louis Daguerre's daguerreotype as the first prototype of a photographic device. The former evolved into the modern-day computer and found large scale use in recording and storing the database of the population, while media expanded in prolific directions and made possible dissemination of images, music, and motion pictures across the mass society. Mass media & data processing are complementary technologies which appear together and develop alongside one another, making modern-day mass society possible (Manovich, 2001, p. 20). They travelled separate trajectories until around 1936 when German engineer Konrad Zuse came up with the first working digital computer. This invention allowed media as a whole, with all its audio-visual elements to be read, written and stored electronically in the form of binary code (Manovich, 2001). Therefore we are locating the newness of new media at a particular moment in modern human history where the birth of a new form of technology announced with new forms of consciousness.

New media are those forms of media that are native to and restricted to computers, are computational in their interface, and rely on computers for redistribution. They perform by the strict system of binary coding that reduces any material information to a series of binary compositions. Some examples of new media are computers, virtual worlds, single media, website games, human-computer interface, computer animation, and interactive computer installations. It might help to understand the newness when contrasted to "old media" such as television, radio, and print media, although scholars in communication and media studies have criticised rigid distinctions based on oldness and novelty. New media does not include television programs (only analog broadcast), feature films, magazines, books,– unless they contain technologies that enable digital generative or interactive processes. However, as we have already discussed the features of new media are processual and function digitally as well as have the potential to enact the user's sensibility. These preliminary and strict distinctions are sometimes not adequate to understand the new media educational practice, as it often used only as a converged digital text in a classroom to explain or signify a concept, theory or scientific or a mathematical formula. Here, it is the digital simulations and convergence of the forms as well as their bounded aesthetic & technological competence to enhance the listening, learning, and

sensing capacity of the student that could be assessed as the features of the new media education technologies. It is not the networked interconnectivity or interactivity that could be read as the main essence of new media. Rather, it is the digitally enabled media form that makes the new media as a tool or framework for educational resources and pedagogic practices. Interactivity, in this context, is not necessarily idealised as merely a physical engagement, rather it is enmeshed in and activated through the convergent and digitally-enabled new media program; interactivity is embedded in the form itself and activated by sonic, visual, verbal, or symbolic signifiers. This aspect is explained in the last part of this paper. It is imperatives here to go back to Manovich's classifications to get some earlier conceptualisation of new media.

The following seven propositions by Manovich (2003) help us understand some specificity of new media:

i) New media does not mean cyber culture: The former deals with new cultural objects that are made possible by network communication technologies and computing in general. Cyberculture is concerned with the social and on networking and not on cultural and computing.

ii) New media as a distribution platform: This specifically and exclusively uses computer technology for distribution and exhibition. Other cultural objects such as TV programs, feature films, magazines, etc. which might use computing for production & storage but not distribution, thus do not fall under new media.

iii) New media, as digital data controlled by software: This form of media, by the principle of variability, can exist in potentially infinite different states. However, fundamentally it is digital data that can be manipulated by software just like any other data, which allows a multiplicity of media operations to be performed and the variability to be affected in the first place. This software being culturally coded, through data structures and algorithms, computers today model reality.

iv) New media as a hybrid of cultural and software conventions: Despite technological possibilities, cultural impediments or checkpoints often come in the way of a total and often culturally irresponsible proliferation of new media outputs. The creative industry is probably the most skeptical with regards to entirely giving in to the automated modularity of evolving media technologies, e.g. film making. Computer games, on the other hand, have almost wholly responded to technological changes and incorporated them to the best of effects. Besides altering the dynamics of production, this shall profoundly impact the way users interact with the automated interfaces. The interactive module that continuously learns from the actions of the user and builds onto itself is an exemplary and ideal image of what new media automation is. For this reason, there is a massive demand for media literacy, which must catch up

with the ever-evolving trends of the media mechanism.

v) New media as early stage of every new modern media technology: Some authors have suggested that rather than trying to seclude new media as an utterly novel phenomenon, it is helpful to look at common aesthetic techniques and ideological tropes that have accompanied the introduction and dissemination of any modern media technology as photography, telephone, cinema, television, etc. the advantages of such ideological attitudes include better democracy, more realistic representation and greater representation in general. Pessimistic takes on such novelties are abundant, the most common being the erosion of moral values, destruction of the human-world natural relationship by obliterating the distance between the observer and the observed. Aesthetic similarities in the structure are many, where the general trend is towards a loosening up of media conservatism, towards capturing more immediate and realistic depictions.

vi) New media allows for faster execution of algorithms which earlier would be required to be done manually. In a world determined by capitalist clock time, speed has undoubtedly been a factor behind the popularity and purchase of new media across the world.

vii) New media as metamedia- Manovich suggests that with the coming of new communication techniques in the 1920s that became embedded in the commands and interface metaphors of computer software, new media did represent a new stage of the avant-garde. This aimed to filter the visible reality in new ways, with artists trying to represent the outside world with seeing it in as many different ways as possible. Decades of analog media archives became the raw data to be processed, re-articulated, mined and re-packaged through digital software, reformulating the accumulated, rather than trying just to represent the world in new ways (Manovich, 2003, p. 13-25).

Manovich's model is extremely resourceful in trying to understand new media as a phenomenon distinct from its predecessors. He lays down five characteristics by which we can make sense of the codes and languages in which new media works (Manovich, 2002, p.49-65). They are numerical representations, modularity, automation, variability, & transcoding (Ibid). In short, it is the numerical representation or digital figurations and its cultural transcoding while using appropriate imaginary, symbolic or simulation, which makes new media a consumable media object or digital image. Hence, new media focuses on culture and computing rather than a simple convergent reconfiguration of media and computational logic. Most significantly, new media's transcoding itself involves the facets of reconceptualisation of culture. New media, therefore, is a medium for conceptual transfer.

The field of remediation & reconceptualisation

What we find in Manovich is a rather restrictive and water-tight description of what is and is not new media. Other theorists have tended to be more accommodative in their definition of new media, to include a wider variety of virtual actions by populations that are facilitated by computation. A lot of them even reject the absolute novelty of the phenomenon and subscribe to the opinion that it is merely a fashionable refurbishment of the old collectibles. Jay David Bolter, for instance, says "if there is already a field of new media studies, it is a combination of strategies established for understanding and working with earlier media" (Bolter, 2003, p.15). He goes as far to say that the new interest in the field and all the brouhaha about it is because of a great deal of money that is expended in the development of new media forms as computer games, websites, computer graphics for film and television.

Similarly, if we look back to the Lister's (2003) and Rogers' (1998) theorisation of new media, we can find certain parallel connections with the conceptual schemas followed by Manovich. For instance, apart from giving specificity to digital, interactivity, hypertextuality, and virtuality as the kernel of new media, what Lister proposes is the idea of 'dispersion' (see the previous sections of the paper), which is similar to the concepts such as 'demassification' and 'asynchronousity' proposed by Rogers. According to them, new media does not transfer homogenous messages to large groups of people; 'demassification is the transfer of unique and personalised messages to every user in a heterogeneous mass.' (Roger, 1998 cited in Tingöy & Barbaros, p. 235). Asynchronousity, according to Rogers, indicates that sending and receiving messages in new media does not need to be synchronous processes. 'Anyone can transfer any knowledge anytime; and the response will likely be transferred when the receiver desires it to be' (Ibid).

These characterisations of new media articulated by Lister and Rogers are significant. They are pointing out a highly decentralised, fragmented and heterogeneous user or receiver—new media subject—of new media forms. It also opens up another critical aspect to the idea of mass mediation. As it always opens to the digital modification through a connective interaction or hyperlink, both the production and distribution of new media have become decentralised, highly individuated, 'and woven ever more closely into the fabric of everyday life. This dispersal is the product of shifts in our relationships with both the consumption and production of media texts' (Rayner, Wall & Kruger, 2004, p. 221). When production and distribution are fragmented in nature along with the multiplicity of messages and sources, the consumable audience is also heterogeneous but selective. In other words, the new media determine a heterogeneous and selective audience that, 'although massive in terms of numbers, is no longer a mass audience in terms of simultaneity and uniformity

of the message it receives. The new media are no longer mass media in the traditional sense of sending a limited number of messages to a homogeneous mass audience' (Castells, 1996, p. 339). In practice, the automation and autonomy of new media text further deepen the idea of segmentation of those who connect or intend to be connected with the specific or nonspecific content of new media text. This foregrounded mechanism of new media, thus creating a profound contradiction within the network society, as Castells points out, deepens our interconnectivity with each other, then so too does it fragment and alienate us (Castells, 1996, p. 3). As the internet reduces time and space, it also creates a sense of alienation. In one way, new media superimposes a sense of being and belonging in the world or always been there though its ubiquitous interconnectivity and signified communication. However, on the other way, it creates a sense of individualism, fragmentation, alienation or a misrecognised subjectivity.

Indeed, this dialectic is crucial in the context of the technological dissemination of knowledge and hence needs to be addressed within the instructional design of new media educational technologies. It is imperative because, as Neil man argues, we perceive the world through the tools and technologies we use. However, technology comes pre-encoded with its values, its own 'embedded ideology.' Technical development[s], for instance, is 'neither good, bad, nor neutral' but that, acting as part of a system, they create the technological and ideological environments that condition or 'predispose' (not compel) us to act in a certain way (Postman, 1993: 13 cited in Hassan 2004,p. 16). New media educational technologies are not exceptional from theses ideological blindness & their acts of predisposition through certain homogenise stereotypes, values, and moral perceptions. To overcome this embedded ideology and blind spots in technology, a critical new media literacy needs to be imparted in relation to production and consumption of new media educational technologies. The next section of the paper will further elucidate this point.

New media subject and new media literacy

When forms of tenacity, authority, popular opinion, and a priori, as well as the aesthetic and presentable rationality of the media, enunciates the experience of the media subject, this process is also being over-determined by the senses of cultural tastes, political self and civic self of the mediated subject (Gaines, 2010, p. 16-19: Corner, 2011, p. 87). This mutually inclusive and interactive relation between media and selfhood not only has both cognitive and affective implications in the process of the formation of the subjectivity but also highlighted with a highly media-dependent aspect of consciousness and action of the subject (Corner, 2011). New media subject, in this context, can be referred to as a person, who is either passively or actively engaging or

interacting with the new media product. As we have seen, new media provides certain degrees of autonomy to the subject, at the same time the formation of subjectivity is also conditioned by the technological predisposition as well as cultural embeddedness of the user. The fragmented and disembodied subject who enmeshes in the convergence logic of new media could reflect only a passive agency, which indirectly poses challenges to all initiatives taken by the new media educational technologies, to activate both the rationality and cultural sensibilities of the user. As the new media product and its grounded aesthetics often tend to reproduce certain stereotypes modularities, gestural politics and commodity spectacles and certainly some homogenous ideals involved in the historical prelude and embedded ideology of the medium itself. Nevertheless, recent researches on the extended fields of new media such as educational technology, new media theatre, new media art, and popular culture argue that the new media forms and technologies help to create a situation where individuals enter into a multicultural environment that stresses the social, dialogical, and interactive foundations of knowledge, communication, and education (Samuels 2009, p. 10). In this regard, let us take new media art as an example. In particular, with regard to its characteristics of interactivity, non linearity, immateriality, & ephemerality, and its intricate interrelation between artist, artwork, and spectator, new media art proposes an absolute reformulation in ways of doing art. Despite this feature finding increased resonance in other forms of art today, digital technologies exceptionally allow artists to develop interactive artworks, as in Internet art and virtual art, which provide the spectator with specific freedom of (aesthetic) choice. In other words, although it is the artist who assesses the framework and the particular context for the action and participation of the spectator, the aesthetic object is—in a majority of New Media Art—ultimately created by the spectator as a "user." (Grau, 2011).

On one hand, these new media practices, indicating a new era of technology—automodernity—a dialectical combination of automation and autonomy, which 'integrates a new ontology – literally a new way of being – both in the physical world and in the network of networks' (Hassan, 2004. 6). On the other hand, as a result of an encounter with these innovative new media products or texts, a new media subject has emerged, whose individual autonomy is seen as something that has to be constantly negotiated and revised and is thus not a finished product (Samuels, 2009). This new media subject is not someone who lost the self while floating through the network to network transit, rather the one who articulates phenomenological experiences, affective and tactile sensibilities through the new media interactions and negotiations. Here, new media or new media educational technologies are considered as a project (digit text, program, & product) replete with symbolic communication to enact the embodied sensibilities of the subject. The body-sense-impressions

are being 'modified through interactions facilitated by digital technology' (Lenoir, 2004, xx). New media, in this perspective, not only represents but also invokes senses of the subject (user, student, practitioner); 'technologies alter the very basis of our sensory experience and drastically affect what it means to live as embodied human agents. They accomplish this by reconfiguring the senses at a precognitional or even paracognitional level (not to privilege one level over the other) prior to conscious perception and assimilation to language' (ibid). As pointed out above, new media necessitate a reorganisation or reactivation of the human sensorium, and this results in a restructuring of human subjectivity. 'Furthermore, it is introducing new practices for the user, who will have to be taught, and in many cases presented with, quite different ways of consuming and interacting with these new media forms (Berry, 2014, p.73). In other words, to interact, apprehend, and use the new media technologies, a new kind of critical literacy is required. It is precisely at this moment that a crucial and challenging task of educational technologies is envisaged. It is not only to provide new media educational tools & programmes but also to disseminate a new media literacy to the subject, or what Berry calls 'iteracy', and 'which needs to draw back the screens and interfaces, and develop a deeper critical disposition to the underlying materiality and agency of the computational (Ibid, p. 169).

New Media Literacy

Being literate in the 21st century must shift from its operation category of being able to read something that is more comprehensive of its virtual engagements. Literacy in the age of new media can no longer remain confined to the words on paper or otherwise but must take into account the variety of media forms of which its content is made up. This has to heavily incorporate an informed understanding of the visual sphere, where engaging with visuals online automatically demands of us a knowledge of the semiotic vocabulary in which they convey meaning. One must also examine the roles that educational institutions and universities have to play in the fostering of such literacy. As noted by Samuels (2008)

The challenge for educators and public policymakers in the period of automodernity is first to recognise the dominant combination of autonomy and automation and then employ this new cultural order in a more self-critical and social way. For example, educators can create learning spaces where students engage in creative file-sharing activities; however, these same students need to be given critical thinking tools to reflect on the social and public aspects of their activities. This process will require the development of critical technology studies as a central core to auto modern educational systems, and essential to this new form of education will be a constant effort of forming a dialogue between "old" school and "new" home models of media and technology (p.236-37).

Media literacy, which is often discussed within the realms of media studies,

deals with a renewed investment in new modes of reading and writing that is taught to students. While reading media now incorporates semiotics, discourse analysis and genre study, writing media is profoundly concerned with the ways of production using technologies that complement the new reading of media. In general, media literacy provides a framework and skill to access, analyse, evaluate and create messages in a variety of forms – from print to video to the Internet' (Kalogeras, 2014). It also includes skills in search & retrieval, ability to identify sources and authorities, to check facts and evaluate accuracy and relevance of any form of media contents (Meikle, 2016). As mentioned above, there are many interpretations that are available on various aspects of media literacy, especially new media literacy to warn us about hallucination and fantasy effects propelled by the media technologies and their hegemonic discourses. Mostly, it asserts to demystifying or dematerialising media messages through critical inquiry is an important starting point for media literacy (Kellner and Jeff Share, 2005, 6). Media literacy enables students to read and analyse media its contents and their strategies symptomatically and enhances thought through active engagement for further apprehension and critical rendering. According to Zettl, 'media literacy is concerned with helping students develop an informal & critical understanding of the nature of mass media, the techniques used by them, and the impact of these techniques..., (I) t is education that aims to increase students' understanding and enjoyment of how the media work, how they produce meaning, how they are organised, and how they construct reality. Media literacy also aims to provide students with the ability to create media products.' (Zettl, 1998, 90 cited in Kalogeras, 2014, 72).

New media literacy and new media educational technologies are not to be considered as two different entities; rather it is to be understood that both share a common epistemic order—to enrich knowledge through critical pedagogical practices and technologies. In this backdrop, the new media educational technologies' must meet the dual challenges of teaching media literacy in a multicultural society and sensitising students and the public to the inequities and injustices of a society based on gender, race, and class inequalities and discrimination' (Kellner and Jeff, 2005, P. 370). This, on the one hand, helps to create a new critical perception for students and educators to adequately understand what appears to be a deeply computational economic and cultural environment. On the other hand, it offers the framework and insights to help students become subjects in the process of deconstructing injustices, expressing their own voices, and struggling to create a better society (Ibid, p.382).

Thus, literacy in the 21st century no longer remains confined to the traditional paradigm of a literate population receiving institutional education but demands accommodation of a much more diverse and democratic access to knowledge, according to personal interests and background, facilitated

by the Internet. With instruction itself being disassociated from confines of institutional spaces, there automatically comes into question the demand for large-scale evaluation and assessment distinct from those of the past, and more fitted to the emerging technologies, which shall include multimedia exercises and virtual reality simulations (Bennett, 1998). For students to perform well on such kinds of new assessments, they will be required to develop a critical understanding of their position as readers with respect to both print and non-print texts, within different social, cultural and historical contexts (Alvermann and Hagood, 2000). This work, therefore, compels us to look at literacies outside of school, at the possibility of any choice of virtually made available.

This idea is further exemplified in a book edited by Marsh on popular culture that takes into account a series of papers providing empirical work on contemporary technological transformations, with their impact on literacy. The main focus is on how contemporary childhoods are shaped by and in turn, help in shaping communicative practices of the century. The term popular culture with relation to children requires examination in that it is often understood as cultural texts distinct and far removed from what is 'high art.' Popular culture for children usually refers to those cultural texts, artefacts and practices which attract large numbers of children and which are then also mass-produced on a global scale. This finds its proliferation across a wide variety of platforms, and it is this "transmedia intertextuality" which children find very appealing, for encounters with the same narrative in different forms across a diversity of media platforms enable them to integrate various parts of their experiences and thus enhance, their 'narrative satisfaction.' As much as global meta-narratives determine to a fair degree pattern of popular consumption, it must also be noted that culture is not merely consumed but also simultaneously produced. Thus Marsh talks about the localised practices through which global consumer products and cultures are appropriated across the world. This makes it vital to not only look at the globalised production of children's popular culture but also the complex and dynamic interplay whereby children adopt more localised themes and texts that are specific to their cultural contexts(Marsh, 2005, p. 2). Thus screen-based technologies have to be dealt with in conjunction with children's meaning-making practices, how they interact with the available media, and how they make sense of their own subjectivities with respect to media.

The concept of media literacy needs to be stretched beyond its conventional locus of print and audio-visual media to incorporate the internet and other new media, both in academic and policy-oriented discourses. Livingstone (2010) defines media literacy as "the ability to access, analyse, evaluate and create messages across a variety of contexts" (Livingstone, 2010, p.1). This is then examined for its applicability to the

internet. Thus there is an intrinsic logic of skill or ability that underlies such approaches to literacy. The article further goes on to examine three interlinked processes in media literacy that is also crucial for our current endeavour. The processes are "(i) the symbolic and material representation of knowledge, culture and values; (ii) the diffusion of interpretative skills and abilities across a (stratified) population; and (iii) the institutional, especially, the state management of the power that access to and skilled use of knowledge brings to those who are 'literate'." (Livingstone, 2010, p.1)

Alternatively, media literacy has also been attempted to be studied as a reactionary mechanism against the harmful and ill effects of popular culture and mass media. Jim Potter, for instance, argues that media literacy is a response to the "wide range of potentially negative effects on individuals" and positions it as "helping people protect themselves" from potentially negative effects (2010, p. 681). He then goes on to discuss a bunch of literature on parental intervention and mediation, which he posits as a form of media literacy. Concerns about a materialistic, hyper-sexualised, hyper-violent mass media culture are not to be trivialised, as digital media and technology come to increasingly encompass children's lives resulting in an impact on personal and social identity. In new media productions, because of the lack of critical media literacy, there is always a representation of racial, gender, religious and ethnic stereotypes representation as cultural normative, even though people claim that we no longer live in a period structured by racism, sexism, and ethnocentrism, while they appropriate and remix social stereotypes (Samuels, 2009, 42).

However, positioning media literacy simply as an antidote to popular culture exposure limits the wider range of possibilities and complexities of the field, thereby missing out on crucial evidence and studies that contribute to the growth of digital media literacy across the world (Hobbs, 2011). While all of these studies pay an unprecedented amount of importance on the effects of transforming new media on literacy, focusing on the changes that the latter has to bring about in order to adapt, there has been little that talks about how media itself is evolving in response to the literate audience of today. The landscape of new media has changed drastically with the coming of new media technologies as ICT, its modularities & automated algorithms, and they demand new forms of cultural practice in working, learning and personal domain. These make media more significant and influential than at any point in human history, making it an absolute necessity for individuals to be new media literate to be able to fully function and interact in a society where everyone has a virtual presence and influence.

In a short piece of work on media literacy, Ivanovic traces the importance of inculcating the values and ethos of media communication among beneficiaries of education on a school level. In a work that is admittedly theoretical, she speculates that students today are often exposed to

opposed value judgments of family, school and media - and they are faced with a situation of crisis wherein an integration of all three seems impossibly difficult. The social system faces a challenge of how to successfully integrate all forms of media disclosure and how to alter the educational system adapted to the period in which students are developing and the one they are preparing for. She identifies the huge influence of media exposure on the young maturing minds of the students and that the period of school education is formative in a lot of long-standing life values. Therefore it is important to form a critical attitude towards media content which can be offered as a part of the school curriculum. Acquiring media literacy can be truly successful only if we consider that relationship between specificity of media and the way those specificities are understood by those getting educated, which can then translate into evolved social values.

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The Role of ICT in Science Education

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Abstract

ICT is helping to bring in a change in the way schools teach and assess students. The use of ICT is especially making inroads in the possibilities of how science is taught; going from rote-learning to developing higher order thinking skills like building scientific temper and critical thinking. To enable this journey, ICT makes available two types of interventions; content-based applications with rich multi media effects that explain concepts and software applications which help in data collection, documenting – thus helping children build knowledge actively rather than watch a readymade multimedia passively. Experts of education prefer the latter because in these applications lie the potential to reshape pedagogy, not just support it. The use of ICT in science education by itself cannot bring about change unless, we as educators consciously plan on how and where to use it within the teaching - learning processes in the classroom. The use of ICT in science can also holds the promise to bring in more constructivist learning experiences.

Key Words: ICT in Science, constructivism, science pedagogy, ICT pedagogy, re-shaping pedagogy, changing schools.

The Role of ICT in Science Education

There is a popular story that educators narrate to express the state of education. It goes like this. Those of us born in the 60s, have witnessed a great deal of development around us. We are surrounded by change. There are more cars on the street, homes have modern amenities like water heaters, mixer-blenders and perhaps even microwave ovens. Banks have ATM machines, hospitals have X-Ray machines & body scanners. Our modes of communication have changed dramatically. And the list goes on. But, what about schools? They still look the same as they did in the 60s. A class full of children, a teacher using mainly lecture-based methods and the good old chalk and duster. It is as though change has not touched schools all this time.

Fortunately, this story of an unchanging school is fast becoming untrue. And we have Information and Communication Technologies (ICT) to thank for that. The last decade has witnessed a host of Government-led and private initiatives which strive to bring ICT to schools. And while there is a long road ahead to be covered in terms of ensuring a complete bridging of the digital divide, it is safe to say that we are already witnessing a change in the way schools look and function.

This article introduces and describes

two ideas. First, it describes the various ICT-led interventions and their use specifically for Science education. Next, it suggests how these interventions may be integrated into a science classroom as is recommended in the NCF 2005 document.

Learning science is about developing a scientific temper. Learning science is about being curious, being a keen observer of patterns and being the owner of a mind-set asking questions relentlessly. It is the ability to move from casual observations to the next level of systematic enquiry which involves the recording of observations, hypothesizing, constructing experiments and proposing theories or models that support the hypothesis. The aim of science education is thus to inculcate a spirit of enquiry. This approach to science education is also reflected in the NCF 2005 Position Paper on Teaching on Science. The paper states that science education should nurture children's natural curiosity and creativity & aid cognitive development. The paper goes on to add that science education must lead to the cultivation of objectivity, critical thinking and freedom from fear and prejudice. And hence a good pedagogy must essentially be a judicious mix of approaches, with the inquiry approach being one of them (NCERT, 2005).

ICT is a collective term that refers to a wide range of tools that includes hardware, software and Internet based applications. The way it can be used in education is limited only by our imagination. Technological advances ranging from stand-alone desktop applications to Internet enabled mobile technology has given us many different types of interventions that can be used creatively to support educational practices. Given below is a description of some the popular ICT interventions, classified on the basis of their function and how they help while learning.

As such it is beyond the scope of this paper to list all the possible applications of ICT in science education. Hence this paper emphasizes two broad categories of ICT that can be used in science education; Type A–ICT based multimedia learning content that serves as a vehicle for the development of scientific reasoning and Type B – Software applications that support practical work as a vehicle for scientific investigations (McFarlane & Sakellariou, 2010).

a) ICT-based multimedia learning content: This type of ICT intervention is where students interact with content specially created for learning. ICT based learning content is a direct form of ICT in education.

This type of ICT intervention is where learning content, designed by experts, is presented in various forms as described below:

- Text with graphics -Text with graphics followed by interaction in the form of quizzes.
- Animation - Animation is where a complex process like cell division or respiration can be shown in detail, at a pace that the student prefers. The animation is usually accompanied by a voice over that also explains each aspect of cell division in detail. Students may be asked to answer a few questions

about cell division after the animation, to check their knowledge.

- Simulations - In simulations, students can manipulate certain variables and observe the results. For example, students can increase or decrease the 'wetness' of a road and see the resulting change in speed of a car that travels on it to study the concept of friction.
- Games - Games are a type of simulation, where students can learn specific skills. For example a computer-based card game that makes it fun to learn about the valence of various elements while trying to form molecules and compounds.
- Computer-based laboratories

Virtual labs try to give students a virtual laboratory set up experience. These labs are similar to simulations, except that are often visually rich and try to give a feel of a real lab. For example, students may 'pick up' different types of lenses from a 'box' to study the refraction of light. Another example could be where they could 'select' different compounds from a 'shelf' full of compounds and apply different variables of heat and pressure to see how the compounds are affected.

Science education content offered in these formats is not just educative, it can also be engaging. The flip side however is that while this type of content brings alive scientific concepts, it is simply a visually rich & interactive form of existing knowledge. While there is no denying of their role in helping students understand scientific concepts, the role of ICT must be expanded to not just visualization of scientific concepts but also to foster higher order thinking skills. In his paper, 'The role of ICT in teaching science education in schools' Hannatu Abdullahi states the use of ICT is largely done to support, enhance and complement existing classroom practice rather than re-shaping subject contents, goals and pedagogy. (Abdullahi, 2014).

b) Software applications: This is a more indirect form of learning through the use of different software applications (that may be used for other work as well).

Practically most software applications, desktop or mobile-based, which enable us to accomplish our tasks in an efficient manner can be also be used effectively in our educational tasks. ICT applications that may be used for education are listed here.

- Spreadsheets - Spreadsheets allow us to organize data (usually numbers or text) in rows & columns. Once this data is stored in a spreadsheet, mathematical operations can be performed on it using different formulae available in the spreadsheet. This data can also be represented graphically. For example, you may use the spreadsheet to record subject wise scores of your students of each academic year and compare their progress over the years in a graphic form. Microsoft Excel is an example of a spreadsheet. Let's say your students are working on a project related to climate change where they are collecting data about maximum and minimum temperatures in their district over the last 10 years. A

spreadsheet can help them record this data systematically and represent it graphically.

- Search engines and browsers - Search engines provide a space for us to enter a 'search string' - like 'examples of ICT tools' whereas a browser is a software which allows us to see what is inside those pages. Students can search for information on various topics using software applications like Google and Firefox which are both search engines. An application like Duck Duck Go is only a search engine. For the climate change science project example given above, students are likely to find past information about temperature for their district. They can even find data about neighbouring districts for a comparison.
- Presentation software - This software allows us to display text and graphic information on slides. Students and teachers may use this software to share information in a systematic way, or to prepare a poster or a small book.
- Mind mapping software - Mindmaps are a powerful tool for education which students can use to meaningfully organize the concepts they have learned. Mind mapping software can be used by both teachers and students. Teachers can use mind maps to show how different scientific concepts are linked to one another. For example, a teacher may create a mind map to show how various concepts distributed across the Physics syllabus converge into core concepts of Physics. Not just this, when students make mind maps on their own, the retention and comprehension of these concepts is far greater.
- Modeling software - Modeling software allows us to create virtual 2D or 3D models of physical objects as well as of concepts. A classic example would be to be able to create and manipulate a model of the atom. For example, ISIS-Draw is a software that allows students to create molecular structures. Drawing these structures can help students in understanding aspects of molecular structure that is not otherwise possible to appreciate in regular learning.

There are other software applications equally important and useful; such as Email, Blogging, Wikis, Video sharing platforms; each of these can take up a specific role in learning - either by way of gaining new knowledge, viewing it in different forms or by sharing it.

Recent advances in technology have brought advanced forms of knowledge sharing and representation to our fingertips for example, Augmented and Virtual Reality. Augmented Reality or AR enhances reality by taking you closer to it. For example, there are specifically designed AR apps on a mobile phone, which when you point at a plant, you can see a simulated (artificial, not the actual) process of photosynthesis taking place. Virtual Reality or VR on the other hand takes you away from reality. For example you may able to witness a chemical reaction at the level of orbitals where particles of an atom get exchanged during the formation of

an electrovalent bond.

The ICT interventions discussed above hold the potential to bring new life to science education. If we want to use ICT for the development of the desired science educational outcomes, we need to find ways to place the ICT interventions listed above into a classroom.

ICT by itself cannot bring about change unless, we as educators, consciously plan on how and where to use it within the school's learning environment and the teaching - learning process in the classroom. This calls for a seamless integration of ICT in within the existing learning environment.

One of the ways to consider ICT in classrooms is by aligning it with the teaching-learning process. While teaching science, or any other subject, a teacher might be doing any one of the following; introducing a topic, providing deeper explanation of that topic and assessing students' knowledge in the form of a quiz or a test. She may carry out additional activities, like projects, to reinforce what they already know, or to enable them to learn advanced concepts. Other such activities in the classroom may include refreshing a prior lesson, providing new information and so on.

The tools and applications described above may be used creatively in conjunction with the process of teaching described above. For example, a video or an animation may be an appropriate tool to introduce a new topic or to refresh an earlier topic. A spreadsheet may serve as a simulation to show how mass is directly proportional to potential energy. Similarly, a presentation software can be used to share information having text and graphics in a step-by-step manner. Effectively, each tool can be leveraged to bring out its inherent strength and limitation. The idea is to use each tool judiciously; in a way that it is effective and simple, both for the teacher and the students.

Imagine a classroom where high school students are learning about sound waves. The classroom has a large number of students, a teacher, the usual chalkboard or whiteboard, textbooks, notebooks, pencils and wall charts. The class may even have an access to a well-stocked library. The teacher is explaining waves, & eliciting different examples from students and provides some of her own. She may also occasionally use a few selected diagrams from a reference book or display charts. Students may also access a laboratory and use tuning forks to perform experiments in science.

In which parts of a learning environment and the teaching - learning process above should ICT interventions be placed in?

While it is relatively easy to imagine how ICT-based multimedia content (Type A) can fit into a classroom, in some cases it may be difficult, as well as expensive to acquire. Fortunately though, the last few years have seen a surge in the availability of OER or Open Educational Resources which are based on the science curriculum here in India. The OER initiative for schools developed with the collaboration of Homi Bhabha Centre for Science Education (HBCSE), Tata Institute of Fundamental Research

(TIFR) and Maharashtra Knowledge Corporation (MKCL) is a case in point (MHRD, 2013). Software applications (Type B) on the other hand, can be relatively easier to obtain and use. Most of the type B software applications can be acquired easily as they are available free of cost for educational purposes and also offer freedom from privacy concerns. The word Free here refers to not just free of cost, but software where your data and personal details also remain secure. To learn more about 'free' software, read about the FOSS movement.

Here is an example of how some of the type B applications may be used in a science classroom.

Imagine the physics classroom described above, except that this one is ICT enabled, mainly using type b software applications. This classroom has the potential to look and function in a very different way.

The teacher may now conduct her classroom as a flipped classroom where instead of teaching a chapter from the textbook, she might have students pre-read definitions and explanations of sound waves from the Web using a browser. She may begin the class with a question based on what students have read. She may then proceed to show them a simulation of a sound wave where she might ask students to observe the behaviour of waves in a different medium. Using the simulation as a base she can trigger discussions about where they may have observed sound behave differently in real life applications. She can search for and show simulations of how sound waves are involved in the functioning of a stethoscope or a mic. She may direct their attention to questions about waves, providing guidance & feedback to their responses. She may also have students record their voices or clapping sounds and observe the waveform of each through an audio recording software like, Audacity. Students may manipulate the wave to create modifications of their own voices.

The activities above are likely to generate a different level of engagement and learning about sound waves compared to the classroom described earlier. So much of this transformation in a classroom is possible due to the ICT tools that are now easily available to teachers. Incorporating ICT in the classroom also has the potential to lay the foundation of a learning environment that is far more constructivist than one without.

In the example of the ICT enabled classroom above, it can be seen that students are not just receiving and storing information. They develop deep understanding of sound as a wave, experience it, think about it and visualize it (using a software like, Audacity). Above all students are likely to feel highly engaged and excited with the knowledge the concept learned in the classroom is not tied to the textbook - that it is in fact all around them. They are more likely to experiment about it in their own way and discover a few more principles related to Sound on their own. This is the way in which ICT tools, when used and placed meaningfully in a classroom, can change the learning characteristics of the classroom. As an additional example, let's say

students may be asked to work on a project where they can collect different types of flowering and non-flowering plants from their surroundings and create a Wiki page for the same. Similarly, they may also catalogue the different types of illnesses children in primary section of their school and co-relate illnesses these with concepts in biology. They may use spreadsheets like Google spreadsheet or MS-Excel to record their data and presentation software like, LibreOffice presentation or MS-PowerPoint to share their findings.

This article begins with a story of a 'school, unchanged and untouched' by time and technological advances. ICT in education has brought in the potential to change the way schools look and function. There is a need to utilize this potential fully. On our part, we as educators need to shift our ideas about pedagogy rooted in many years of conditioning. We need to move toward learning by doing, creating and thinking rather than by just listening. And ICT in education makes that shift possible.

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Book Review

21 Lessons for the 21st Century By Yuval Noah Harari, 2018, Jonathan Cape, Penguin Random House, London ISBN (hardback) 978187330672, ISBN (paperback) 9781787330870

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The rapid changes in technology have changed polity, society and the way people interact with each other at a pace that has confounded even thinkers of our time. A niggling question exists whether society is on the path to further human progress or is it hurtling towards destruction? Twenty years into the 21st century, social scientists to technologists, climate scientists to politicians, educationists to activists are debating on the shape that is being acquired by this century. Specialists are finding specialization inadequate for comprehending the breadth of changes, even when their tools of analysis become even more important in an increasingly complex world. The turn to the new millennium has added the question: will human beings survive as a species after having contributed to the extinction of several fellow life forms on earth?

The murkiness of the problems has added to the anxiety of our times. However, quick-fix solutions, barrage of suggestions and abundance of technology driven information have also created a noise that has made it even more difficult to make sense of the world. Yuval Noah Harari pithily announces in the first line of his book, 21 Lessons for 21st century (pix), the primary challenge of our times: 'In a world deluged by irrelevant information, clarity is power'. He acknowledges that most people in the world do not have the luxury of thinking on where humanity is headed even when they have to bear its consequences. And thus assumes the role of a teacher by deploying his skills as a historian and philosopher to explain the swift turns of this century.

The book itself is an outcome of Harari's talks, articles and lectures that have sought to clarify the human past and its future, thoroughly elaborated in his two previous works: the Sapiens and the Homo Deus. The first book Sapiens gave a spectacular view of the human past, right from the beginning 6 billion years ago to its becoming the only species left in the human genus about 10,000 years ago; and the revolutions that transformed it as well as the violent, sometimes accidental turns in history and culture. This compelling book was followed by Homo Deus, an extrapolation of human future based on current developments in technology. It presents a future

world where human beings have conquered nature and cyborgs are common and artificial intelligence replicate and reproduce itself. He also presents the chilling possibility of human beings becoming incapable of predicting a future for itself, with loss of consciousness, imagination and other markers of human mind as inorganic life begins to dominate it. The current book, 21 lessons attempts to fill the gap that has been left between the human past and extrapolated future, to meditate on the contemporary and present.

As in the previous work, 21 Lessons also adopts a large canvas and addresses a world audience. The exemplars are international, geographies vast, societies referred to diverse and research taken up from a variety of disciplines. According to Harari, if human existence was transformed by cognitive, agricultural, scientific revolution in the past, the current times are witnessing a technological revolution where human limitations of the body is getting conquered, human experience is getting digitised and artificial intelligence is getting better. He pitches for a thorough critique of the contemporary and puts under the scanner both the challenges and the thrilling possibilities offered by the combination of info-tech and bio-tech. Like many people writing on the subject of technology and society, Harari warns against ignorance that underlies most digital consumption and the threats it pose.

The 21 lessons are organised under five sections: the technological challenge (consisting of four chapters; disillusionment, work, liberty and equality), the political challenge (five chapters; community, civilization, nationalism, religion and immigration), despair and hope (five chapters; terrorism, war, humility, God and secularism), truth (four chapters; ignorance, justice, post-truth and Science fiction) and resilience (three chapters; education, meaning and meditation). The section on technological challenge presents the current upheavals caused by disruptive technology and its fraught relationship with liberalism. In the chapter on 'work' there is an elaboration of these tensions. Take this puzzle: Liberalism thrives with economic growth, but that in turn depends on better and better artificial intelligence. What does jobless growth then mean? What happens to the people made irrelevant? Could technology be ethical in open markets, and are humans ethical enough for technology form interesting deliberation. Nothing is final however the urgency is communicated on thinking about post work scenarios to give human life new meanings.

There are long deliberations on future of liberal values, in a world where data bases are controlled by corporations and governments. Accordingly, frightening scenarios of digital dictatorships and irrelevant humans may be a near possibility and liberty, equality and human rights may not mean the same in a cyborg world. There is also the unsettling indication that familiar social political frameworks of human cooperation such as nation, religion, culture and

restricted civilizational views may not offer enough answers to the menace of the problems of the 21st century. Global ecological disaster may not stop at national boundaries, digital communities may demand far more from the human brain than its evolutionary equipment. Yet, there is no space for smugness in the writing: technology is neither a panacea for all ills, nor is a Luddite slamming down of artificial intelligence demanded. The examples are riveting and the reader is persuaded to recognize the monumental changes taking place and the sheer ignorance through which most people walk into its consequences.

The human predicaments of contemporary times are also deeply personal and significantly political. Achievements, ethics and personal values are seen by most people from own cultural reference point, which has often led to significant animosity towards other groups and destructive wars. Harari tears into 'self-important narratives' (p 181) in the chapter on 'Humility', by placing claims within thousands of years of world history and animal studies to point ethics as an evolutionary development and ridiculousness of contending claims of superiority by one community over another.

In a bewildering world is there anything that could anchor people to reality? Harari refers to humility as a key requirement in order to wade through ignorance, secular ideals and a few thumb rules for seeking out truth in an era of post truth. One of the important discussions in the book is on the future of education. As technological disruption increases, it is pointed out that there is as yet no scaleable model for preparing people for the disruptions that awaits them and their mental systems. Most learning from today may become irrelevant and the skills for thriving in 2050 and beyond, is unpredictable as bodies, brains and minds get engineered. The stress of fluidity and responding to change requires mental stamina and this could be the life resource of the future. He opines that education also will have to eventually prepare humans to decide if they will retain control over themselves or if they surrender themselves to acts of algorithms. In this light, Harari opines that the grand narratives may have to come back to the classroom, if students have to make sense of mountains of information that are at their disposal. He leaves us with his own experiences of seeing through fiction, and his personal experience of corporal reality.

Harari has emerged as a popular thought provoking public intellectual of the current times. For a historian who demonstrated an absolute command on the narrative with Sapiens, he wanders in the current book as themes overlap and present defies structure. It may even be asked, are big challenges of global ecological crisis, social-political upheavals even possible to be addressed with experiencing the bodily reality of breath. Or is it another fiction. There could even be quibbles with his style of arguments. At times it may even sound preposterous to some to find examples of Disney's Lion King sharing space with national and human

histories-seen in the chapter on 'Meaning'. But, the message is clear: Sapiens are going through a century that will require them to constantly reinvent themselves as bewildering changes envelop them in all possible ways. Nothing is pre-destined and there could still be a liberal hope from society, even as liberalism faces the biggest challenge since its emergence as a political system. The book is a tribute for a level global playing field in a technologically disruptive world.

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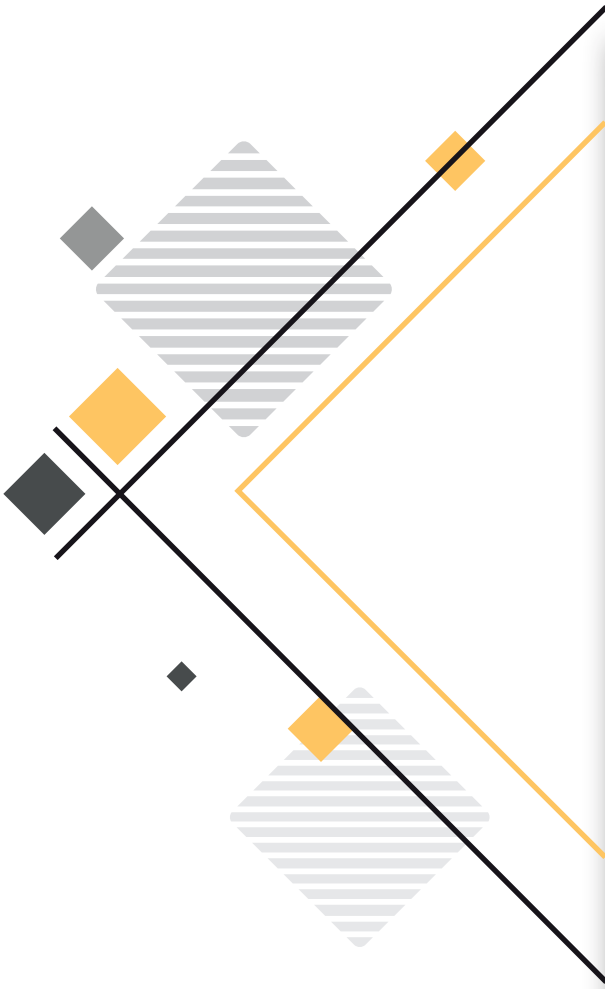

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