Paradigm Shift in the Education Sector Amidst COVID-19 to Improve Online Engagement:
Opportunities and Challenges

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ABSTRACT

The study aims to identify social, intellectual, and conceptual structures along with key areas, contributors, current dynamics, and suggest future research directions in the field of engagement with e-learning systems. An objective analysis of a sample of 358 articles taken from the Web of Science database, supported by subjective assessments based on the research, focused on the integration of management into e-learning domain. Citations and page rank metrics were used to identify the most influential papers along with most influential authors. To understand the intellectual structure of the research area, a co-citation network was developed. The study may help to explore effective ways of delivering education during a crisis, while also taking a sustainable approach to the promotion of education through online methods. By understanding the behavior of learners towards various forms of content delivery, policy makers at national level can develop a framework to implement it nationwide.

1. INTRODUCTION

The year 2020 has presented the world with unanticipated challenges amidst the pandemic COVID-19. The upsurge of this virus has questioned the existing way of life and practices that were believed as a routine among the individuals. Education sector is one of the many other sectors which have been impinged upon by the lockdowns due to Covid-19. In response to pandemic COVID-19, the lockdowns have been implemented in nearly every country around the world since February 2020. Consequently, 1.57 billion learners representing more than 90% of the world's total enrolled student population suffered, due to abrupt shutting down of schools and other educational institutions (UNESCO, 2020).

Academicians, Governments and various other organizations all around the world are making efforts to evolve a robust teaching-learning methodology that benefits all the stakeholders in education sector. Therefore, the main concern was to build modalities which could bring the learning content from traditional face to face learning to at home learning. It can be observed that the educational institutions worldwide have initiated for the E-learning modalities to make education interactive and accessible to the learners. E- learning has turned out to be a most important driving force towards a better economy, society and life quality by amalgamating multiple technological services (Pinto et al.,2012).

The rapid development in the field of Information and Communications Technology (ICT) has led to a disruption in the management of learning activities in academic institutions. With the introduction of Internet Enabled Learning, multiple learning methodologies became one of the most significant factors to contribute in the learning and teaching process. It has been observed that with the application of Internet Enabled Learning and IT tools in teaching and learning methodology, the quality of education in academic institutions has improved.

The World Wide Web (WWW) and the Internet has revolutionized various aspects of our lives ranging from professional and personal networks to sources of information, learning and news. The internet has made e-learning possible and various researchers and educators are interested in online courses to improve and enhance the student learning outcomes, and overcoming diverse challenges particularly in higher education institutions (Pape, 2010). Also, surge in demand for e-learning courses from students of different demographics has been seen.

According to a study by Sherry, E-learning has been in existence for more than a century and has its roots in European correspondence courses. It is a subset of education that allows students to participate in classroom while never setting foot inside one (Sherry, 1995). One of the reasons as to why e-learning is a significant topic of discussion is that there are various benefits and applications of e-learning. Some of the vital ones are its cost effectiveness to tackle the surging costs associated with post-secondary and post graduate education, the possibility of delivering a world-class learning experience to any leaner with a broadband connection, effectiveness in educating students from different backgrounds and its utility as a professional development tool (Lorenzetti, 2013).

Studies also point out the growth in internationalization of higher education through e-learning as an educational method. Students from various geographies and demographics are taking online degrees and courses from abroad (Huynh, Umesh, & Valacich,2003; Hannon & D'Netto,2007). Many Education Institutes from US are expanding their educational territories across borders due to business and academic reasons (Bollag,2006).

With the growth in world population, the corresponding trend in learning and studying is rising rapidly. As a result, there has been a continuous change in delivering education, academic institutes are looking for ways to connect with more and more students through marketing. The 21st century learner can be anyone, ranging from someone who is married and has children, with either a part time or full-time job to a student living a far distance from institute. This scenario facilitates the need for e-learning to assist today's student's educational requirements. With the explosive growth of the internet and its impact on the learning system has formed an important factor that is considered as a paramount help in the education domain. E-learning refers to the kind of learning that learner's take a educational or professional course without using traditional modes, using web as a classroom to learn. It also refers to the delivery of learning material via any electronic channel like intranet, satellite broadcasts, internet, extranets, video conferencing, CDs, computer-aided training and audio/ videotape. Owing to its advantages, online learning is currently one of the most popular modes of learning. According to a study done by Finch and Jacobs, online learning offers benefits such as offering flexibility to the students by accessing courses as per their convenience, reduced cost of time and travel and teaming up with subject experts at a global level (Finch and Jacobs,2012).

With the rising acceptance of e-learning, there is a strong need for establishing an effective management design model to enable the expansion and delivery of e-learning environments. This

signifies the need for a comprehensive review of the management in e-learning, which can help in identifying knowledge structures in the research area and avenues for future research directions.

The research methodology applied in the study is a combination of Bibliometric analysis, Systematic Literature Review and network analysis, which enabled in identifying the intellectual structure and provided a comprehensive outline of the research domain.

The following six research questions are addressed in the study-

RQ1: What is the current publication trend in the field of management in e-learning?
RQ2: Who are the most influential authors and what is the collaboration trend among the authors?
RQ3: What are the most influential works in this field?
RQ4: Which are the most influential journals in this area?
RQ5: How can we explain the intellectual structure of this field?
RQ6: What is the common theme identified among the researchers in this domain?

To answer the research questions stated above, a combination of Systematic Literature Review, content analysis and Bibliometric network analysis has been used. Bibliometric analysis has proved out to be the most suitable way to understand the conceptual structure of a research domain (Castriotta et al. 2019). It helps in identifying the present state of research and recognition of future avenues (Li et al. 2017). Firstly, Systematic Literature Review was performed by defining the search terms and then systematically mining the sample set of articles with appropriate inclusion and exclusion criteria. After this, comprehensive bibliometric analysis was performed in multiple ways – such as, affiliation analysis, journal influence analysis etc. To understand the intellectual structure, citation and co-citation analysis were performed using BibExcel. Gephi was used to view the thematic flow of knowledge and the formation of clusters using co-citation network. PageRank was used to identify the lead papers from clusters and was used to perform cluster analysis.

The rigorous study integrates the literature and provides an overall knowledge structure of research domain. The finings of this study will be beneficial to researchers and academicians in identifying the present research structure and will update them the evolution of the multiple themes in this domain. Avenues for future research against the five research questions will guide upcoming scholars and researchers for the progression in the field.. To the best of author's knowledge, this is the first study to undertake the combination of SLR and bibliometric analysis like keyword analysis, content analysis and co-citation network analysis on the management of e-learning programs.

This paper is divided into five sections. Section 2 contains methodology used and the descriptive analysis. Section 3 presents the bibliometric analysis and content analysis, followed by keyword analysis.. Section 4 provides discussion and future research avenues, followed by conclusion.

2. RESEARCH METHODOLOGY

In this paper, bibliometric analysis on engagement of e-learning has been done with help of tools like Keyword analysis, Citation analysis, Co-authorship analysis, co-occurrence analysis, PageRank analysis, and co-citation analysis like Cisneros et al. (2018), Fahimnia et al. (2015), Xu et al. (2018). Different softwares like BibExcel and HistCite have been used in the previous academic studies for bibliometric analysis (Garfield 2009; Persson et al. 2009). BibExcel was chosen because of its benefits of compatibility with various network analysis tools like Vosviewer, Gephi and Pajek, modification features and its flexibility (Persson et al. 2009). Contrary to the trial and error approach, Systematic Literature Review systematically searches and finds studies to perform a critical appraisal of the literature to recognize research gaps (Tranfield et al. 2003). To finish Systematic Literature Review, 3 steps were followed: determining appropriate keywords to search, recognizing relevant studies for analysis by giving exact inclusion and exclusion criteria, and studying found relevant papers for descriptive analysis. Bibliometric and content analysis was carried out on relevant studies. For a

proper understanding, Fig 1 presents the methodology used in analytical structure of this study. The fig also illustrates paper structure, indicators used, calculations and the tools implemented.

2.1 Defining Search Terms

The topic consists of two terms – 'Management' and 'E-learning'. Two search queries were taken to ensure that the keywords include both the terms. The first string involved all the possible management related keywords, while the second string contained all the e-learning related keywords (Table 1)

Table 1. *The keywords and search string*

Management related keywords	(("firm" OR "performance" OR "innovation" OR "starteg*" OR "cap abilit*" OR "resource" OR "knowledge" OR "absorptive" OR "man agement" OR "organization" OR "Business"))
And	
E-learning related keywords	("E-learning" OR "Online learning" OR "Internet Based Learning" OR "Digital learning")

2.2 Search Delimiting Criteria

The initial search was performed on the 'Web of Science' database on 25th November,2020 with the defined search query. Post this, search results were delimited using a combination of exclusion and inclusion method. On searching the topic on 'Web of Science', initially 11,829 articles were found. A three steps filtering process was performed to identify the most relevant papers for the final review (Fig 2). From 11,829 papers, only those concerning to criteria on Management, Business economics and Social Sciences were considered. Further, only papers in the English language were considered. Finally, a total of 338 articles was obtained for our SLR and Bibliometric analysis.

2.3 Descriptive Analysis

To understand the basic ongoing trend of publication, a descriptive analysis of 338 articles was done. To answer the first research question (RQ1), publication trend has been analysed in terms of total publications by year, country, region, journal, and institution.

2.3.1 Year-Wise Trend of Publications

Fig 2 depicts the publication trend on yearly basis. It shows a gradual upward trend in terms of publications per year from 2010 to 2016. The year 2019 shows the maximum number of articles i.e. 33. Before 2006, the average number of publications per year was 3. 2006 happens to be the turnaround year with 12 or more publications per year. The possible reason behind this turnaround could be the awareness and increased adoption of technology among individuals. Schools and colleges started adopting e-learning methods. This might have augmented the interest in this area.

Figure 1. Process applied for delimiting search
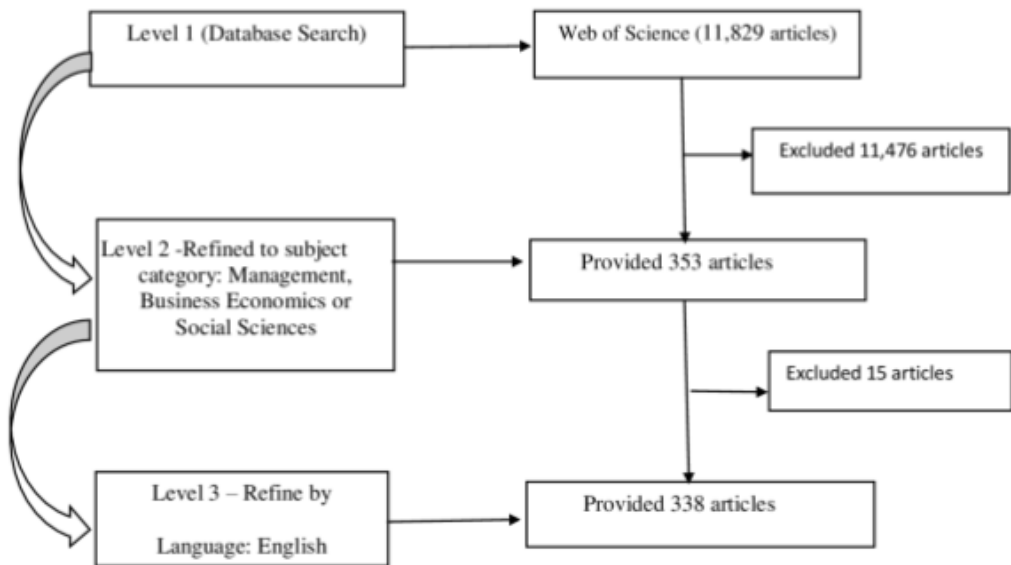
2.3.2 Top Contributing Journals

Table 2 presents the top 10 journals contributing to the research area; each journal is contributing at least 6 articles. It can be observed that "International Journal of Innovation and Learning" has the maximum contribution with 67 articles. The top 10 journals contribute a total of 134 articles out of a total of 338. There are numerous other journals that have contributed a small number to the research area.

3. BIBLIOMETRIC ANALYSIS

According to Zupic and Cater (2015), structural images of scientific areas are constructed by employing bibliographic data from multiple publication databases. Pritchard (1969) defined bibliometrics as "the application of statistical and mathematical ways to books and other means of communication". It also helps in describing, followed by evaluating and monitoring publications in a journal. In addition to its common usage in the field of library science, information science etc., bibliometric method has witnessed recent application in social-science research as well. Bibliometric analysis can be classified into two categories by relationship indicators or productivity. The first identifies interrelated linkages among various research domains as well as researchers, while the second presents facts about the impact factor (measure of the influence of research). The final result of the two activities is a complete thorough analysis of research activity and its progress (Ramos Rodriguez and Ruiz Navarro, 2004). Citation and co-citation analysis are the most frequently used methods for obtaining these results.

3.1 Affiliation Analysis

The author affiliations were filtered to identify the top contributing institutions. Affiliation analysis is done to understand the top contributing regions as well. Table 3 shows the top contributing organizations that have 5 or more research publications. The State University of New York Suny System, University of North Carolina and UOC Universitat Oberta De Catalunya emerge as the top contributing universities with 6 articles each.
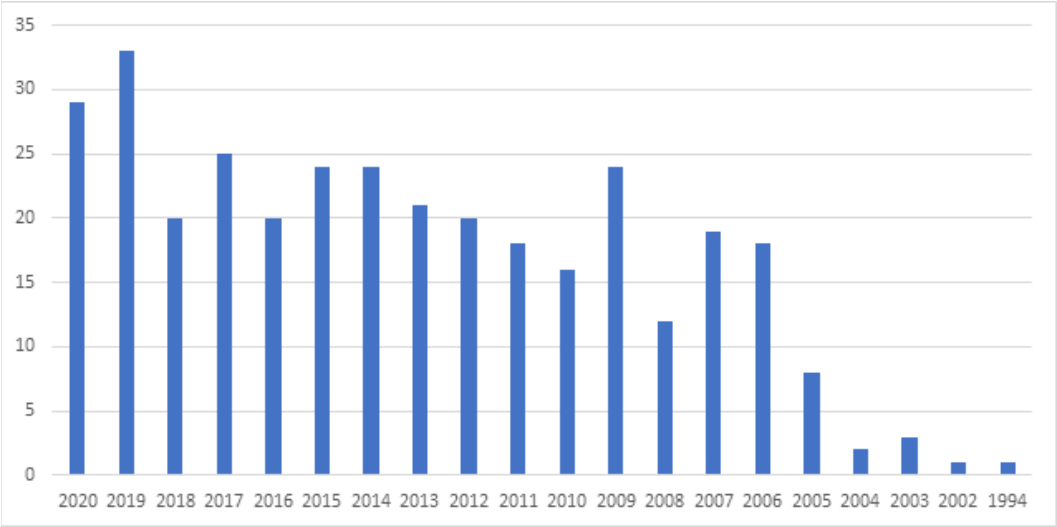
Figure 2. Publication trend on yearly basis

Table 2. Top contributing journals

Source Titles	Records
INTERNATIONAL JOURNAL OF INNOVATION AND LEARNING	67
INTERNATIONAL JOURNAL OF EDUCATIONAL MANAGEMENT	14
HUMAN RESOURCE DEVELOPMENT INTERNATIONAL	9
INFORMATION MANAGEMENT	9
INTERNATIONAL JOURNAL OF MANAGEMENT EDUCATION	9
AMFITEATRU ECONOMIC	7
EUROPEAN JOURNAL OF TRAINING AND DEVELOPMENT	7
INTERNATIONAL JOURNAL OF HUMAN CAPITAL AND INFORMATION TECHNOLOGY PROFESSIONALS	7
INTERNATIONAL JOURNAL OF TRAINING AND DEVELOPMENT	6
KNOWLEDGE AND PROCESS MANAGEMENT	6

On analysing the contributions by the geographical region (Table 4), it can be observed that around 47% of the publications have an affiliation to the USA region, followed by China with 24% of publications.

To gain an understanding on the collaboration pattern among organizations and countries, co-authorship analysis for organizations and countries was done using VOSviewer software. VOSviewer identifies the nodes (keywords) by minimizing the effect of a conditional function as per the similarity measures (AS_{ij}) between keywords (Van Eck and Waltman, 2010). AC_{ij} can be explained as

$$AS_{ij} = C_{ij} / C_i C_j$$

Table 3. Top contributing institutions

Organizations	Count of articles
STATE UNIVERSITY OF NEW YORK SUNY SYSTEM	6
UNIVERSITY OF NORTH CAROLINA	6
UOC UNIVERSITAT OBERTA DE CATALUNYA	6
BUCHAREST UNIVERSITY OF ECONOMIC STUDIES	5
CORNELL UNIVERSITY	5
OLD DOMINION UNIVERSITY	5
OPEN UNIVERSITY OF HONG KONG	5
STATE UNIVERSITY SYSTEM OF FLORIDA	5
UNIVERSITY OF HONG KONG	5
UNIVERSITY SYSTEM OF GEORGIA	5

Table 4. Top contributing regions

Geographical region	Count of articles
USA	160
CHINA	82
UK	47
INDIA	36
SPAIN	35
AUSTRALIA	29
CANADA	19

Here, count of occurrence of words i and j is represented by C_{ij}, while expected number of co-occurrences of the nodes is represented by C_i and C_j, assuming that i and j are co-occurring while being statistically independent (Van Eck and Waltman, 2009). On analysing co-authorship network (Fig 3) among countries, USA ranks the highest in co-authorship strength with other countries, followed by England and Australia. It can also be observed that there is scarcity of collaborations from developing countries like India, Taiwan and Malaysia.

3.2 Author Influence Analysis

Table 5 outlines top authors (with no less than three articles) alongwith number of articles they authored or co-authored. It can also be observed that there is a long list of authors that are not reported with articles 3 or less, thus reflecting a handful of scholars have specialized in E-learning through managerial lens.

3.3 Document Co-Citation Analysis

The intellectual base of a research domain can be represented by observing articles that have been cited collectively. This helps in understanding the micro-structure profiling and cumulative movement of a certain knowledge domain as well as the latent micro-level networks between diverse knowledge dots (Wagner, 2008), which will present co-citation clusters showcasing diverse channels of literature,

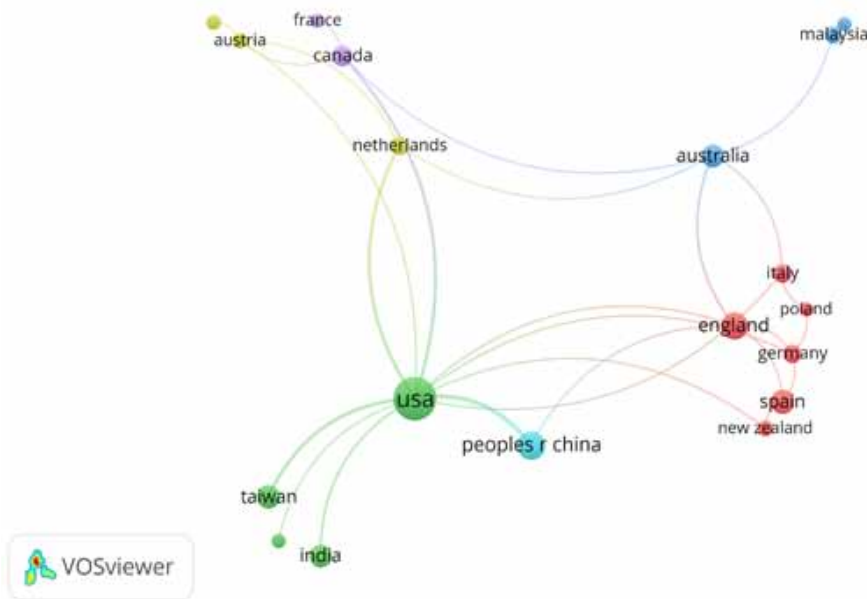**Figure 3. Network diagram for co-authorship of countries**

Table 5. Authors with no less than 3 publications

Number of Publications	Author
5	Wang MH
3	Liu CC
3	Pandit P
3	Wang FL
3	Kwan R
3	Sharma K
3	Chen CC

highlighted by the research domain (Bornmann and Leydeysdorff,2015; Hjorland, 2013). Hence, the study carried out a document co-citation analysis on the references of shortlisted articles, with the ultimate goal of identifying important clusters. Following this, we rely on a subjective approach leading to objective selection of cluster, this step was supplemented with a screening of the already identified clusters through their combination with some specific research streams (Chen et al, 2010). Certainly, the objective selection is no ancillary for careful analysis through reading and content analysis of the results (White and McCain, 1998).

The latest version of VOSviewer 1.6.15 was used to generate maps using VOS clustering techniques and VOS mapping. These techniques are novel in nature and hence present a good alternative to the Multidimensional scaling approach (Waltman et al., 2010; van Eck and Waltman, 2010). Although, VOS techniques are similar to MDS approach in "locating items in a low dimension

space in such a way that the distance between any two items reflects the similarity or relatedness of the items as accurately as possible" (Appio et al.,2014, p. 628).

Figure 4 presents the map for co-cited references resulting from the citing behaviour of the respective authors. The map highlights the most relevant co-citing pairings, i.e. articles co-cited more than five times (Appio et al; 2014). The larger the node, more the number of citations received by the article, and thickness of the links represent that the number of co-cited connected nodes. The map presents 73 nodes, 1148 links and 4 clusters. As there were high number of papers in each cluster, we carefully identified lead papers in each cluster.

Table 6. Four major clusters

| Cluster	Number of articles	Labels
1	26	Role of IT in Knowledge Management Processes
2	24	Adoption of expectation-confirmation theory
3	12	Usage of self-regulated learning
4	11	Success factors for adoption of e-learning

Table 7. Lead authors in each cluster

Cluster 1 - Red	Cluster 2 - Green	Cluster 3 - Blue	Cluster 4 - Yellow
Alavi, M. and Leidner, D.E. (2001), Arbaugh and J. Ben (2000), Jay Barney (1991), Derouin, Renée E., Barbara A. Fritzsche, and Eduardo Salas (2005), Glaser, Barney G. (1967),Grant, Robert M.(1996), Holsapple, Clyde W., and Anita Lee-Post. (2006), Kirkpatrick, Donald, and James Kirkpatrick. (2006), Lave, Jean, and Etienne Wenger. (1991), Marks, Ronald B., and S. D. Sibley.	Fishbein, M., Jaccard, J., Davidson, A. R., Ajzen, I., & Loken, B. (1980), ANDERSON, J. Y. G. DW (1988), Venkatesh, V., Brown, S. A., & Bala, H. (2013), Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989), Davis, F. D. (1989), Hashim, H. S., & Hassan, Z. B. (2015), Ajzen, I., & Fishbein, M. (1975),	Alge, B., & Klein, H. J. (1991), Bandura, Albert (1986), Bandura, Albert (1997), BARON, R., & Af, M. K. D. (1986), Benbunan-Fich, Raquel, and Starr Roxanne Hiltz (2003), Ceyhan, A. Aykut (2006), Colquitt, Jason A., Jeffrey A. LePine, and Raymond A. Noe (2000)	Alavi, Maryam, and Dorothy E. Leidner. (2001), Leidner, Dorothy E., and Sirkka L. Jarvenpaa (1995), Ong, Chorng-Shyong, Jung-Yu Lai, and Yi-Shun Wang (2004), Hendrawan, C., & Yudhoatmojo, S. B. (2001)

4. LITERATURE REVIEW

E-learning can be defined as the use of any electronic gadget for the purpose of learning, which encompasses the content delivery via computer network, audio or video, interactive TV, satellite broadcast etc (Shee &Wang,2008). As learning becomes more collaborative, ubiquitous, learner-centered and individualized, e-learning has shaped out to be more networked, user-centered, personalized, ubiquitous and durable (Motiwalla,2007). The success factors of E-learning help in bridging the gap for learning in a global society and thus create a significant demand for e-learning from business to institutes (Sun et al.,2008).

According to Bouhnik and Marcus(2006), e-learning offers four advantages: students having their own freedom to schedule the lessons, this further helps in reducing time constraint on teachers, students are able to express their thoughts and ask queries without any limitation, and learners having the flexibility of choosing their desired subjects and related materials. Also, Capper (2001) proposed

Figure 4. Co-citation map of articles' references
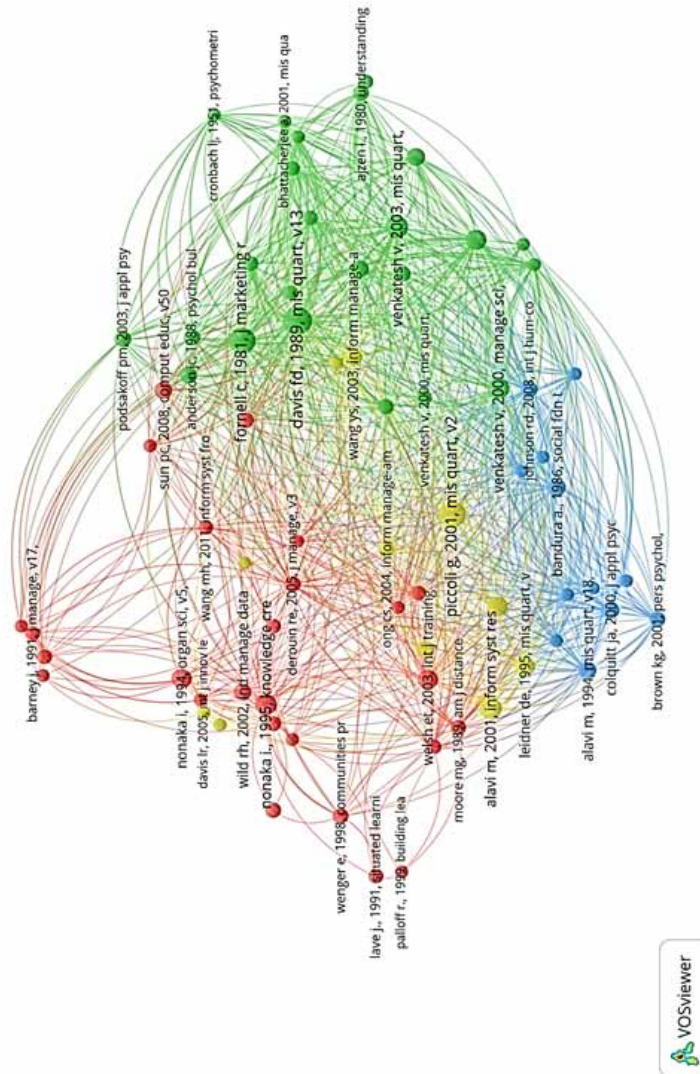
five advantages of digital learning: asynchronous interaction, group collaboration, time flexibility, independent of location, and new approaches to education.

The foremost requirement of education is to understand the students and the major challenge for e-learning in a classroom environment is to figure out whether the target listeners get it or not. Miller, (2012) reveals that face-to-face method of learning persists to be the main teaching modality. On the other side, the researchers also consider that with the passage of time new technology driven mode of learning (Rosen et al, 2006) with a blend of hybrid methods and online videos (Arbaugh,2014) akin to flipped classroom (Bergmann and Sams,2012) have made their way into student's life.

In conventional face to face teaching, instructor delivers the content to students verbally in a physical classroom (Martin et.al, 2014). With the advent of technology-based information and greater than before usage of internet, the learners are getting familiar with the concept of flexibility, collaborative teaching and face to face learning (Burke and Fedorek, 2017). Also, this form of learning is identified as hybrid means of education as it assimilates online recording of lectures with in-classroom face to face sessions while sticking to the scheduled class time. It offers the benefits of interactive learning, face to face communication, ease of access and flexibility of video-based learning. The justification behind choosing video-based, face-to-face or hybrid method of learning lies on three factors i.e. outreach, imparting education and economic viability offered by the platform. Arabasz et al, (2013) disclosed in his study that the accessibility and outreach of the hybrid form of learning has led to its adoption in 80% of higher educational institutes. According to Bloom's Taxonomy Theory, traditional classroom lectures and face to face education have been deliberated as a default approach for learning. However, in recent times, it is implicit from the extensively available literature that flipped classroom can be associated to higher-order learning (Burke and Fedorek, 2017),classroom-based face to face lectures can be coupled with lower order learning (Martin et al, 2014) and link video based lectures with learning through symbolic systems (Salomon,1994). In case of flipped instruction modality, there is literature that has established its positive impact on education (Lopes and Soares, 2018)and documented the improvement in low-performing students (Sergis et al,2018).Comparable findings can also be witnessed for exclusive online based teaching method (Friday et al, 2006; Grandzol, 2004; Kock et al, 2007).On the contrary, a few unfavorable outcomes have been observed (Anstine and Skidmore, 2005) in completely online based instruction technique. Taking evidences from these diverse outcomes, (Boniface Michael, Rashmi Michael, 2019) have tried to form a linkage with memory effects in terms of long-term and short-term learning under different instruction modalities such as face-to-face, flipped and online video. Boniface Michael, Rashmi Michael, (2019), have put forward through quantitative analysis, that technology-enabled approach is apt for long-term memory over face-to-face modality. For introductory courses that involve understanding of basic fundamental information, face-to-face method of learning is a better choice. Video based learning evidenced to be more effectual in case of long-term memory, as there is control mechanism with learner via rewinding, replaying, pausing and watching later. Likewise, flipped classroom technique is also a better alternate for content that suits a collaborative approach with critical thoughts on the subject.

Researchers have unveiled the assimilation between e-learning and e-assessments. Bennet (2006) is of the opinion that the manner in which technology is pairing with education, it is unavoidable to find its usage in e-assessment, but, it should be done without compromising the fairness, credibility, utility and validity of the process. Siozos et al., (2009) underlined the fact that the e-education must be initiated in an evolutionary manner rather a coerced way to glorify the technological innovation. The research proposed a platform for e-assessment based on assigning importance to performance in reading and writing. This will supplement the usage of digital ink-based tablet devices that permit users to read and write directly on the screen. Further, Fluck and Hillier, (2013); Hillier, (2014) submits that the higher rate of acceptance of technology in education can lead to computerized examinations in the forthcoming years.

Dermo (2009) researched on emotional overtone among learners during an e-assessment capturing their predilection and expectations. The findings of the study confirmed an affirmative bond between students' keenness and e-examination to adopt the methodology. El-Gayar et al. (2011) in the study tried to comprehend the acceptance of tablet PCs among students with ease in usage and societal influence as the major determinants. The outcomes pointed towards societal influence and performance expectancy to be the key drivers. Juinn and Tan (2013) applied use of technology model and Unified Theory of Acceptance to understand learner's mind-set and adoption of e-assessment in University settings. The results revealed affirmative effect of social influence of peers and parents on students' willingness to adopt e-assessment.

Hillier (2015) disclosed the pedagogical benefits of e-exams and e-assessment. According to his study, mobile laptops could be seen as a replacement of pen-on-paper assessments. Moreover, if the students are permitted to carry their laptops, it could have twofold benefit for students as well as educational institutes. The students can turn out to be user- interface and this may develop into a viable solution for cash crunched universities.

Shute et al (2016) investigated the association between science of assessing and academic accomplishment as a result of technological advancement. The study examined the paper from historical point of view and recommended a wide-ranging parameters of assessment system by including progress in learning science theory, instructional technology and design advancements. The research also considered technologically enhanced assessment tools to quantify student skills required to fulfill the 21st century skill requirements.

Pillai K., R. and Prakash, A.V. (2017) proposed an innovative method of introducing an exam-pad as a solution to e-assessment for their study. They identified six most important constructs such as affective dimension, security, practicality, teaching and learning, validity and reliability to measure an association relating to students' behavioral intent to embrace e-assessments through exam-pads. From the results, it could be observed that affective factors turned out to be of decidedly significant element for willingness to accept e-assessments. The corresponding indicators for this dimension were feeling of extra ease and better attentiveness during the examination. The results for affective dimensions of this study are harmonious with the argument presented by Shute et al (2016). Taking indication from the results in literature, it can be suggested to give priority to affective factors construct while designing the gadgets. Haywood et al., 2004 and Terzis and Economides (2011), recognized that online exams play a decisive role in the higher education. The results indicated that e-assessment proved to be more effective if curriculum is delivered through an e-learning modality. In terms of demographics, it was surprising to notice that students from rural areas were more eager to take e-exams when compared to their urban counterparts. Likewise, the insight on e-assessment revealed a significant difference between males and females. There was less liking towards e-exams by female students and they needed more support for computer-based assessments. Findings from prior studies also line up with this argument.

From the literature, it can be argued that as a pre-requisite to e-assessments, teaching-learning process must consist of technology-based interfaces so as to develop the skills for computers and gadgets among learners. All the same, the success of e-assessments depends upon continuous usage of e-learning platforms and comprehensive overhaul in the curriculum delivery.

4.1. Role of Information and Communications Technology in E-learning

Information and Communications Technology (ICT) includes the usage of multiple hardware devices and software with their allied functions, to regulate and communicate information adeptly (Talebian et al., 2014). ICT has its distinguished benefits conferring to the corresponding uses in a specific sector. According to Rowley (2000), knowledge creation and broadcasting are encompassed in the business of higher education. Therefore, ICT is not just a tool that makes education accessible and quantifies its related parameters but also create, transform and utilize the knowledge in the best way possible. Affordability, accessibility and quality in education can be considered of prima significance for all Governments worldwide. Peeraer and Van Petegem, (2011) are of the opinion that, assimilation of ICT in educational is vital for the education sector. Margaryan et al, (2008) has also emphasized upon the ease of sharing of knowledge, making it accessible and decentralizing the education with the usage of ICT. Previous studies highlighted on the usage of digital tools such as emails, web and other web-based tools in education domain (Kirkwood and Price, 2005; Conole et al., 2008; Venkatesh et al., 2014). Built upon the recommendations of studies by Liu et al., (2010); Venkatesh et al., (2014), web-based tools like virtual environments, podcasts, social networks, blogs and wikis have been espoused in the higher education environment.

Thus, for the execution of an e-learning system, students' attitude and conviction along with teachers' learning intention, teaching environment and embracing of digital environment are basic driving forces.

4.2. Factors Impacting Development of an Effective e-Learning Environment

To improve the outcomes and success of an e-learning program, Liaw and Huang (2007) recommend four significant elements which should be considered: useful learning environments, positive learning attitudes, effective learning activities and enhancing environmental satisfaction. In addition to this, Shee and Wang (2008) also suggested four elements: useful system content, user-friendly interface, personalization and interactive learning community. Taking inputs from the comments of Shee and Wang (2008) as well as Liaw and Huang (2007), the following are identified as significant elements in developing a robust and effective e-learning environment: positive learning attitudes (usefulness and perceived satisfaction), individual learning factors (anxiety and self-efficacy), effective learning characteristics (perceived self-regulation) and useful learning environment(interactivity). Fig. 5 represents the observed factors.

Figure 5. Significant elements in developing a robust and effective e-learning environment
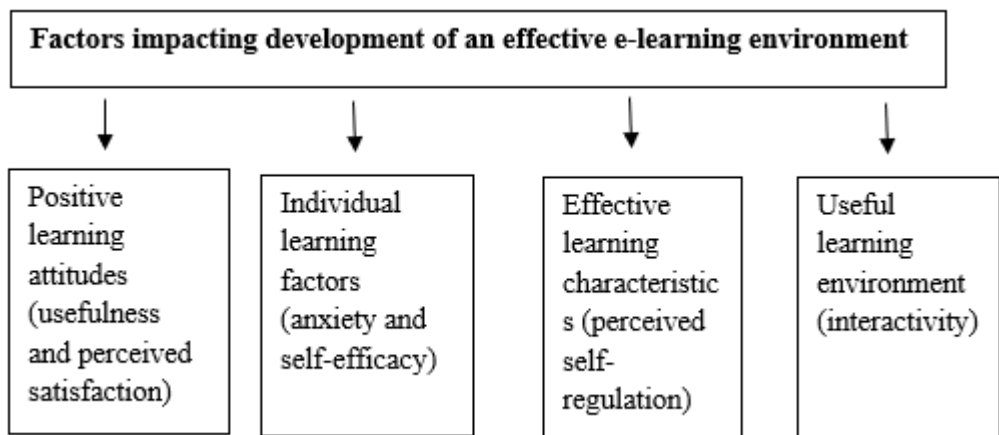
To further get a clear understanding of learners' behaviour, multiple researchers and scholars from information technology and psychology fields have identified variables impacting e-learning adoption behavior. Among them, the expectation and confirmation model (Lin,Wu, &Tsai,2005; Wu et al.,2006; Bhattacherjee,2001) and technology acceptance model(Oliver,1980; Davis, Bagozzi, &Warshaw,1989; Ajzen & Fishbein, 1977) are the seminal contributions that played a major role in understanding the success of e-learning modularity. According the theoretical models, six dimensions can be mapped to understand the success factors for a learners' satisfaction with e-learning: environment dimension, student dimension, instructor dimension, design dimension, course dimension and technology dimension.

4.3. Challenges Posed by COVID-19

With the shutdown of schools and educational institutes all over the world i.e. more than 150 countries, due to COVID-19 crisis, e-learning has seen extreme transformation from a supplemental facility to becoming the only way of education delivery during these times. The crisis struck at a

point when the education system was still getting ready to adopt e-learning. According to Program for International Student Assessment (PISA), in OECD countries, more than two thirds of students aged 15 years have been enrolled in the schools where technology adoption is supported by sufficient computing capacity. The education sector is witnessing an unprecedented shift on a global scale due to COVID-19. Lehmann (2020a) underlined the fact that in schools, students are strictly monitored as per discipline standards. As a result, the diverse range of young people get used to self-regulatory practices in their leaning style. The matter is of immense concern for students, teachers and parents regarding the enormous mental and emotional shift that they are going through.

4.3.1. Impact on Students

With the temporary cessation of classroom activities, there has been a significant impact on the students who were about to finish their high school with plans to being their tertiary education and undergraduate students. These students are now left in an altogether new situation with no clear idea further. This will have an immediate impact on their daily life and a further increased financial burden. (UNESCO, IESALC report, 2020). Due to this, there are chances that students might be forced to drop out, resulting in a situation of alienation as a consequence of inequality which has been prevailing in the higher education system already. Approximately only, fifty percent of the total students aged between 25 and 29 years, could not complete their education, either due to the reason they are still studying or due to abandonment (Ferreyra, Avitabile, Botero Álvarez, Haimovich Paz, & Urzúa, 2017). Among the drop outs, half do so in the first year of their enrollment.

4.4. Personal Adjustment to Daily Life

The crisis led to subsequent changes in the daily lives of students. Students within the same country have returned to their homes and adjusting to quarantine. The situation remains extremely unpredictable for the students, who went abroad for higher education. Thousands of students are stuck abroad either due to shut down of airports and country borders or waiting for on-site activities to recommence.

Effects of quarantine can be seen in terms of socio-economic balance, especially with those learners who were already going through the problems of isolation and loneliness. According to a survey conducted during the last week of March among higher education students in USA, indicated that 75% agreed to have experienced depression and anxiety as a repercussion of crisis. (UNESCO, IESALC report, 2020).

4.5. Financial Costs and Burdens

Apart from a few countries where education is free of cost, the educational institutes are charging the same education fees from students. Students along with their parents, are finding it tough to pay the education fee and the residence costs even if they have returned back to their home. Approximately 260,000 learners have signed a formal petition to the English Government asking for a part of their fees being refunded to them (UNESCO, IESALC report, 2020). Students argue that the proposed online teaching doesn't justify the cost of regular annual tuition they've paid. According to a recent survey (Byrne, 2020), 43% of MBA students enrolled in 20 most prestigious B-schools in USA are convinced that with the sudden switch to online delivery of classes, at least a third of their fees should be returned, mainly due to the reason that classroom modality offers knowledge and ideas exchange among students for the creation of a professional network. According to Forbes (Byrne, 2020), amount of investment required to study in these b-schools can reach up to a quarter of a million dollars considering opportunity costs.

At present there is no country in the world where education fees have been suspended. This is essentially based on an assumption that the crisis will influence only for a short term and the the classes are being continued by alternative methods. Likewise, no actions have been taken for temporary waiver of education loans and credit installments (UNESCO, IESALC report, 2020). It is also necessary to anticipate the situation in which the graduating class of 2020 or even 2021 will find it hard to pay

their education loans in a depressed job market due to crisis. Sanz, Sáinz, & Capilla (2020) predict considerable declines in the income of new graduates due to the crisis.

4.6. Replacing Face-to-Face Classes

Learners all over the world are putting sizeable efforts to familiarize themselves for the new format of e-learning where the education is possible only if the learners have internet connectivity.

Traditional set-up of distance learning, incorporating lectures being broadcasted live, can be re-watched at a later time by downloading or accessing it via cloud. Students feel contented with such format as it is the best way to reproduce the knowledge gained. Formats that radically alter the delivery design of content and require learners to get out of their comfort zone without any background training are less cherished in case of undergraduate students as they tend to be more conservative when it comes to switching between learning modes (Watts, 2016).

Overall, changes in modalities have not garnered very positive responses. Part of the dissatisfaction can be attributed to the fact that the content being offered was never optimized for the framework of distance learning program, but instead it tries to make up for the cessation of face-to-face classes through virtual platform without much preparation. Secondly, the expectations of students are not the same when they enroll for a face-to face experience with all the social and experiential elements. Distance education needs more discipline and commitment on the part of a student which perhaps could explain why this mode of learning is more common among postgraduates. Also, the face-to-face experience is vital for those students who have had fewer opportunities for social interaction and university campus offers them a platform to work upon their social skills. If the lockdown and cessation of institutes is prolonged, this section of students will be more affected than others.

These issues address the most important question that whether the students will achieve the learning objects designed for the course, assuming that teaching- learning activities are continued. The literature leaves no room for doubt and confirms that the results should be positive, given the duration is short (Yen, Lo, Lee, & Enriquez, 2018); but due to involvement of multiple variables and the fact that every student's milieu is different, it is tough to assume that this will hold true in all situations.

4.6.1. Impact on Higher Education Institutions

With a hiatus in the daily activities of HEIs, there has been a huge disruption in their functioning due to the pandemic. The impact of this disruption hinges primarily on their capability to remain dynamic in their academic chores and sustaining financially through the crisis.

The shift to virtual mode of delivering education has not been easy given the lack of experience amidst crisis. It is one thing to have necessary technical infrastructure to deliver e-learning for a segment of undergraduate students or the likes of it. But it is quite something else when it comes to delivering the virtual learning facilities for all courses for all students in a limited timeframe.

4.7. Impact on the System from Demand Perspective

In a scenario where the hiatus of face-to-face activities were to extend for a quarter or more, there are high chances that it will lead to a reduction in demand for admissions in the short term and a corresponding upsurge for the next academic year, provided that fees are very affordable or non-existent (like in Argentina).

In the short term there will be some students who may no longer be able to return to classrooms. According to a survey of undergraduate students in USA, it has been estimated that one in six students will not return to college when face-to-face activities are resumed

However, in case of medium-term impact, it is anticipated that a ricochet in the demand for higher education is probable by next academic year. The plausible reason behind this ricochet could be the consequential recession due to pandemic, leading to individuals seeking refuge by taking up admissions in universities. Many young people, in order to position themselves for a secured future in the face of economic recession or unemployment, will prefer to enroll in universities where fee is

low or nonexistent. It remains to be seen what will be the behavior of students and young working-class post covid-19.

5. CONCLUSION

Researchers have unveiled the assimilation between e-learning and e-assessments. Bennet (2006) is of the opinion that the manner in which technology is pairing with education, it is unavoidable to find its usage in e-assessment, but, it should be done without compromising the fairness, credibility, utility and validity of the process. Siozos et al., (2009) underlined the fact that the e-education must be initiated in an evolutionary manner rather a coerced way to glorify the technological innovation. The research proposed a platform for e-assessment based on assigning importance to performance in reading and writing. This will supplement the usage of digital ink-based tablet devices that permit users to read and write directly on the screen. Further, Fluck and Hillier, (2013); Hillier, (2014) submits that the higher rate of acceptance of technology in education can lead to computerized examinations in the forthcoming years. With the advancement of millennia, the progressions in the field of e-learning and usage of ICT has been making strides in the field of education sector. As can be seen from the previous studies, Internet has evolved to incorporate web-based tool and applications and hence enabled a free flow of information with ease globally. As the technology is progressing, it is imperative to integrate the right technical tools with the delivery of knowledge in education sector. Adopting a multi modal way of learning has proved to be efficient when it comes to gauging it by adding the cognition factor. Efficient short term and enhanced long term memory has been proven to be a match with instruction modalities such as video-based learning, flipped and face-to-face teaching. These findings could serve as a reference point for validly assessing knowledge delivery to students at different levels. Through the various studies reviewed in the literature endorsing the inevitable role of technology in the education sector, empirically proving the enrichment in the teaching-learning, skepticism towards the use of technology in enhancing the quality of teaching and student achievement (Cuban,2001) can be ruled out. The literature suggests the success of digital exams and the perceptions students hold for the applications. However, the implementation of the e-assessment would require a comprehensive overhaul in the content delivery and relentless usage of e-learning management platform. But it is suggested that such a change must be a result of a conscious process of progression rather than a hasty off-shoot of unthoughtful revolution.

5.1. Limitations and Future Scope of Study

This study provides a useful reference point for students, faculties, policymakers, and e-learning education providers to consider developing personalised e-learning courses based on the student's demographic by establishing a balance between the different learning modalities. The study also paves way for policymakers to find out ways to influence the policy design which enables a nation to keep up with the sustainable development goal of leaving no student behind in terms of learning.

One of the limitations that can be identified relates to the challenge in capturing multiplicity of major e-learning platforms under one review because the usage patterns of these learning platforms may vary as per socio-economic demographics. Also, with the rapid change in technology, there are high chances of obsolescence and decreased rate in the usage of such platforms. For the studies pertaining to long-term and short-term cognitive thinking with respect to different learning modalities and e-assessments, consideration of student demographics is vital too, which has not been seen in the studies so far. Anent the pressing concern of sustainability and scalability of e-assessments, the concern of Hillier (2015) is mutually shared between myriad scholars, along with the widespread implementation of such assessments. The pandemic has provided us with an opportunity to translate the academic landscape, by putting these innovations to a practical usage.

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