

A survey of eLearning practices during COVID-19 pandemic

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Abstract:

COVID-19 pandemic has driven everyone towards a new type of education called eLearning. eLearning has helped almost all the schools all over the world to continue educating their students with the same style of teaching as before. It has also helped the people from different parts of the world to come together and learn. However, it has some serious limitations and issues which has to be considered before developing an application for virtual collaboration. This paper overviews the previous works which provide various guidelines and suggestions that become helpful in the success of an eLearning portal. It presents different existing technologies for eLearning and points out the limitations. Finally, it provides some suggestions in order to enhance UI to be interactive.

Keywords — COVID-19, eLearning, Virtual Collaboration, User Interface.

I. INTRODUCTION

COVID-19 has had a great impact on almost all sectors worldwide, education sector affecting the most. The disease has led to closure of nearly all schools. Over a 100 million students belong to below proficiency level in reading. Hence, prioritizing education recovery has become very crucial to avoid a general catastrophe. However, given the abruptness of the situation, administration and teachers were forced to build emergency remote learning systems. Online teaching has been followed by world class universities over a last decade. But due to COVID-19 pandemic, it has become possible for all students, teachers and other affiliations to use online tools.

eLearning is a process of conducting regular classes or providing materials with the help of electronic resources. This makes it very convenient for students to learn anywhere and anytime with very less restrictions. Thus, it has paved a way out to become a solution for education crisis in pandemic. Currently, almost all the schools worldwide have become successful in adoption of this new learning process. However, with this sudden shift to remote

system, many are wondering if the adoption of online learning will continue to persist in post-pandemic situation. In addition, its impact on worldwide education market is unpredictable.

eLearning has resulted as more cost-effective method due to reduction in teaching time. This is because the single largest cost of teaching is cost of teaching for staff rather than direct delivery costs in terms of course materials, travel and accommodation. Students can be able to study at home at their own pace of learning. It takes very less time to start and wind up a session avoiding time spent for travelling.

Although online learning can help to continue the education remotely, there exist some challenges which can become a barrier. The requirement of internet access and enough bandwidth is the most challenging factor for both students and teachers. The sudden shift of education to online has left both teachers and students unprepared for the new kind of education system. Most of the students find it hard to connect to teacher and keep up with the pace of teaching. The online learning has also given rise to the exploitation of technology by mere young students. This has also caused distraction towards irrelevant information such as online games,

unnecessary chats, etc. The young students who are expected to learn by exploring the environment in schools in their initial phase of education are being forced to use electronic devices such as mobile, tablets or desktops which can harm them even more.

The paper is organized into 6 sections. Section II gives a glimpse of current trends of online learning, Section III reviews different user interface development practices discussed in previous works. Section IV introduces virtual conferences, its challenges, existing virtual conferences and social network analysis being applied to enhance interactive UI. Section V discusses about works related to different cloud hosted databases. The paper finally concludes giving a summary of its outcomes.

II. ONLINE LEARNING TRENDS

A comparative study of existing platforms for virtual meeting in terms of live feed, cost, compatibility and maximum participants has been done in [1]. It discusses 4 potential tools currently trending for virtual education: Cisco WebEx, Google classroom, Microsoft teams and Zoom. During the standard learning (not influenced by a pandemic), the department used to host 2 hours of didactic conference-based learning per day [1]. Since the pandemic, these conferences have been conducted to all the residents who hope to attend. Surprisingly, it was found that the attendance is higher than normal at these virtual conferences with positive feedbacks from both teachers and students. The authors also discuss other potential tools such as self-study, simulation of surgery and nurturing management opportunities which can help in resident growth and development. The study in [2] indicates the possibility of usage of virtual learning environment as a tool for hosting virtual journal clubs. It provides guidance for all those who consider virtual system in their own training programme. With the increase of trainee participation, it is very probable that the use of virtual conditions will increase to include newer technological methods to personal and professional growth. However, the study was conducted in a single city i.e., Leicester. The authors in [3] have performed a systematic analysis of evolution of educational research by performing an exhaustive of

248 articles across three journals that gives answers to the three goals: to identify a) the research areas; b) the most researched modalities; c) the most relevant theories. From the text analysis, three important nodes were identified: curriculum-interactive learning environments, online students and teachers. MOOC (Massive open online course) was revealed to be the most researched eLearning modality. However, the study being conducted on long period, was not accurate.

III. USER INTERFACE DEVELOPMENT PRACTICES

User interface (UI) enables human to interact the with a computer, website or an application. Apart from facilitating students with online materials and classes, a user-friendly UI is the main component to consider for developing an eLearning application. The research done by authors in [4] confirms that a significant factor for getting positive outcomes is web design since it impacts on users and insights of online consumers. It also proposes guidelines to identify the significant aspects for the achievement of high-level success of online business. User Interface design should initiate with an considering the profiles of envisioned users which include their age, gender, education, physical abilities and many more. Therefore, a user interface might not be beneficial for all the computer users, whereas it might be beneficial for explicit types of users. When it comes to eLearning, the important issues to be considered in terms of UI are curriculum, considering applications, benefits and training objectives, tools used for developing it, appearance and presentation of educational contents [5]. The authors propose three important guidelines to design user interface: a) Keep the consumer in charge; b) Decrease the consumer's memory burden; c) Build a reliable interface. Therefore, designing of UI also for real-world education such as music, carpentry, painting, etc., is important factor to consider. The study in [6] presents an effective evaluation index by obtaining user reviews of seven online education platforms before and after the pandemic. It performs data acquisition techniques to capture user comments on online education platforms, analyses their characteristics and finally evaluates user

experience of these platforms before and after the outbreak of pandemic.

IV. VIRTUAL CONFERENCING

Virtual events are completely hosted online with a potential for attendees to participate from any part of the world. In [7], the authors conducted a comparative based survey of web-based video conferencing software with the help of three different student discipline groups. The results of the study were widely distributed with 27% of students indicating little or no likelihood of using the environment, 21% indicating a bit likelihood and 52% showing they were very likely and definitely would use the environment. The study analyzed the differences between students studying different subjects as well as students in different year of studies. It was found that distanced students were found to be more motivated to use the online environment. [8] analyzed the barriers to the successful implementation of Second Life, which is a popular multi-user virtual world platform used in education. It also maps a number of components that are underway to address the issues faced by Second Life more broadly across the world. However, authors do not assess the recently emerging meeting platforms for higher education.

A. Challenges of virtual conferencing

At these virtual meetings, many factors become important such as setting the agenda and taking breaks [9]. Having of printed copy of the agenda and breaks can be very helpful both to track progress of the meeting and to avoid multitasking and distraction. The authors consider many human factor elements of remote meetings and hence provide suggestions on enhancing the experience of team during the pandemic. This will also optimize the meeting effectiveness and efficiency. The work in [10] generates some thoughts and discussion around the current multidisciplinary teams (MDTs) practice and suggests methods which can be helpful for embracing human factors and safety principles in a learning culture. It focuses on the human factors at an MDT that could lead to distraction and hence provides suggestions to improve and enhance discussion during the meetings. Technology

Acceptance Model (TAM) has been successfully applied for the first time on online meeting tool to investigate the product's adoption during the pandemic [11]. The work mainly focuses on applying TAM to investigate about the factors affecting behavior of using Google meet amid online learning platform competition in Indonesia. The study proves that the attitude to platforms influences the mention to use online meeting platforms. The attitude of the platforms is influenced by perceived ease of use and perceived usefulness.

B. Effective virtual collaboration

A review paper [12] presents options by which organizations might benefit from a fuller understanding of many aspects directly or indirectly related to virtual organizational structure and strategy. The authors in [13] conducted a survey by preparing approximately 150 questionnaires and sending those to 50 companies. Forty-six usable surveys from 41 different companies were used to compare high performing virtual teaming organization to that of low performing virtual teaming organization. The virtual teaming grid was divided into four quadrants, first quadrant representing low techno-team firms whereas fourth quadrant contains several major consulting firms. A greater cost on collaboration platform, comfort of collaboration platform procedure and quality and availability of support was given by 4th Quadrant. 1st Quadrant firm provided much significance on the necessity for group facilitation and leadership. [14] presents the significance of social network analysis for extracting relational information and its pertinence in the field of education. It also proposes a toolbox named Meerkat-ED to analyze the students' interactions in asynchronous discussion forums. This study helps not only in monitoring of such interactions during the class, but also it creates an environment where students can interact with others.

C. Existing applications

To study the application of virtual worlds, collaborative meeting is conducted by twenty individuals from six different healthcare teams [19]. The qualities of these collaborative tasks were quantified and questionnaires and interviews were

conducted to record each and every participant's experience of conducting tasks with the help of virtual world software. It was observed that participant experienced many advantages through virtual world than face-to-face meeting. However, few disadvantages regarding virtual worlds include people with lack of computer skills. Participants tended to absorb in the tasks inside the virtual environment, although they did not experience as real. Another application of virtual meeting of multidisciplinary teams (MDTs) is studied in [20]. The authors introduced and effectively steered a novel theory of amazing simulated MDT assembly for complicated situations. Additionally, they also proved that a simulated MDT is esteemed by clinicals and patients by taking their feedback using mails. Thus, virtual MDT can improve diagnosis, treatment and discharge planning. However, the usage of virtual MDT is not explored for pediatrics patients and patients with surgery.

D. Social Network Analysis

Social Network Analysis investigates social structures using graph theory and networks. It is mapping the flow and measuring the relationships between people, groups and organizations. The work in [21] explored the consequences of organizational, technical and didactical design adjustments in virtual collaborative learning arrangements on the learning experience of students with the help of SNA. The greater number of connections can be associated to interest of students in collaborating with additional which include external communications. The authors assume that isolated messaging and conversational arrangements could be utilized among groups. Social Network Analysis can also be used for active supervising of the procedure of learning during meeting itself which can give a much greater awareness of participation of actual learners. A theoretical framework is introduced by authors in reference [22] which consists of three elements: sociability, social space and social presence along with their relationships with group members' mental models, learning outcomes and social affordances. Reference [23] presents guidelines and suggestions for the utilization of synergistic collaborating software in constructing and handling farther

association between organizations in Latin America and the Caribbean and Penn state. The study considers Acrobat Connect Professional as technical tool for web conferencing. During the study, different collaboration networks were designed for students during the Fall and Spring of 2005 and 2006. However, the paper doesn't provide specifications of implementations carried out during the study.

V. CLOUD HOSTED DATABASES

Databases are used to store information of teachers, students and other staff who are engaged in eLearning. It enables them sign in to the portal, access the information, add to the information and much more. Reference [15] discusses existing cloud hosted databases, for software applications in cloud environments by pointing out their strengths and weaknesses. It provides detailed insights of Data as a Service (DaaS) technologies such as Amazon RDS, Microsoft SQL Azure, Google Cloud SQL and Heroku Postgres. A set of novel challenges provided in the paper can be used by developers to make an effective and efficient cloud hosted databases. Traditional databases are compared with cloud hosted databases in [16]. The authors provide several advantages of cloud-based databases such as faster deployment, elasticity, scalability and device independency. Additionally, it also compares various applications which provide DaaS such as Amazon RDS, Microsoft SQL Azure, Google datastore and Database.com. Even though cloud computing provides several features that makes it advantageous, it has some challenging issues which have not been solved such as automatic service provisioning, virtual machine migration, server consolidation, improving energy efficiency, data security (as the database is deployed in a cloud provided by third party) and storage technologies and data management [17]. Other challenges include scalability, deployment, diversity in available systems, security and performance. The authors also provide a comparative study of parallel DBMS and MapReduce framework databases and found that:

- In parallel DBMS, upholding productivity is hard as database expands

- MapReduce framework are incapable to function on encoded information
- Parallel databases are suitable only for homogenous system.

However, the work doesn't provide any approach to overcome challenges faced by using DBMS and MapReduce framework. Reference [18] points out three important challenges to be overcome for any database software: efficient multi-tenancy; elastic scalability and database privacy. Efficient multi-tenancy goals to minimize the number of machines required, while meeting performance goals of application-layer. A good DaaS should support workloads and databases of different sizes. In addition, an important barrier to consider while deploying databases in the cloud is perceived lack of privacy. Hence, the authors keeping these things in mind, introduced a new transactional database-as-a-service named Relational cloud. The experiments based on the three requirements for good DaaS for the Relational cloud show that it overcomes all the three challenges without degrading the performance of the database.

In a situation of pandemic, where almost all the institutions use online platforms for collaborative meeting to continue the education, these platforms need to meet the requirements of the users. Along with the requirements they should be user-friendly which enables easiness to use the application for the user. The existing eLearning portals do not account for human factors which become very important for enhancing interactive UI. In addition, these platforms have a problem of not being "real enough" and are not scalable. For eLearning applications to be successful, these aspects have to be kept in mind. Hence, there is a need for a single cloud hosted solution for eLearning-based applications to reduce network connectivity requirements.

VI. CONCLUSIONS

This paper presents different eLearning practices carried out during pandemic. It gives a glimpse of the works and approaches introduced or applied in order to enhance the productivity of online learning tools. It points out the key factors of developing an

application and reviews their guidelines. In addition, it not only summarizes the benefits of cloud hosted databases over traditional databases but also points out serious limitations of cloud hosted databases. An interactive UI can be developed using social network analysis. The paper points out the limitations of existing eLearning portals and summarizes the minimal requirements of such portals.

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