A LITERATURE REVIEW ON EFFECTIVENESS OF LMS, SPATIAL COMPUTING AND OPEN SOURCE TECHNOLOGIES IN HIGHER EDUCATION IN INDIA

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Abstract:

Advancement in technology in the recent times has brought us to the doorsteps of seamless integration of the physical space and the virtual space through Spatial Computing. The use of Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR) as mode of lecture delivery is taking shape. Learning Management Systems (LMS) such as Moodle, Wordpress LMS and Blackboard has already created the required virtual classroom platform. The next generation LMS will require seamless integration of LMS and Spatial Computing technology, for delivering virtual content to learners. This integration will become the new interface of colleges and Universities in India. Further, integration of Open Source technologies can enable proactive student care system and student evaluation system in the LMS, transforming it into a Learning Experience Platform (LXP). This paper will report on the potential advantages in the use of LMS, Spatial Computing and Open Source technologies in Higher Education in India, on the basis of a survey on the scientific literature from the last two years (2017-19). This paper concludes with outlining strategy that can be carried out for implementing a Learning Experience Platform (LXP) in Indian Higher Education scenario.

Keywords: Learning Management System, Spatial Computing, Education, Virtual Reality, Open Source technology, Learning Experience Platform

INTRODUCTION

Learning Management Systems meant for the administration, documentation, tracking and delivery of educational courses, makes up the largest segment in learning systems market today.
Higher Education is in dire needs for innovation to increase learning effectiveness many-folds. LMS has been evolving ever since 1990s, to cater the growing needs of education industry. Now, with the advent of "Spatial Computing" , seamless integration of technology into our physical and virtual spaces can happen.

Spatial Computing technology includes Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR). All these are used to generate immersive contents - that reacts to the user's "touch", "hold", "click", "swipe", etc. in virtual/augmented/mixed reality. There are differences in each of them. Augmented Reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real-world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory. Virtual Reality (VR), on the other hand completely replaces the user's real-world environment with a simulated one. Third one, Mixed Reality (MR) ,sometimes referred to as hybrid reality combines the best of the best aspects of both VR and AR.

So, with Immersive contents, LMSes are going to be more interactive by allowing practical exposure to the study object in an augmented reality environment.

Further, Artificial Intelligence (AI) enabled LMSes would improve evaluating and tracking features many folds. LMSes would be capable of evaluating a learner's understanding of a concept, and adjusting their learning pathway to suit that level of understanding. AI would transform LMSes into an automated version of a great teacher by evaluating the mastery level of each individual and giving them relevant content based on that.

Blockchain is another technology advancement that is set to revolutionize higher education. Blockchain is a list of records, which can be continuously enhanced with more records. These records, so called blocks, are linked together like a chain by cryptographic technologies. That's why this technology is called blockchain. Each block includes a secured hash which links to the previous block, the data of the transaction and the timestamp.

The blockchain is not stored on a single central server. It is deposited on many different computers, so called nodes, and will permanently be updated. This storage method ensures that verification of the information is possible at any time. Also the manipulation of data is very difficult. For manipulation of a record at least 51% of all nodes which store these information need to be changed. Only in this case the verification of that manipulated record will be successful and it will be tagged as correct.[1]

Documentation in LMSes would be

[1] (2018, January 28). Usage Of Blockchain Technology In eLearning - eLearning Industry. Retrieved May 8, 2019, from https://elearningindustry.com/blockchain-technology-in-elearning-usage

built on top of a blockchain chain-script, linking student credentials to potential employers in a real-time using a mobile trusted framework. LMSes
would seamlessly establish trust and transparency. Thus, leveraging blockchain technology,
LMSes can help universities and colleges to cut/reduce overheads incurred towards storage ,
printing, certifying and authenticating the credentials of a student.

OUR LITERATURE SURVEY

On the basis of scientific/statistical literature available in the internet domain from (2015-2018), this paper reports on the education system in India, the learning trends in Higher Education and technological trends. Putting all the facts and figures into perspective, we can draw the inference as to whether:

1. LMS stands any chance of being adopted with reference to the education system
2. Penetration and feasibility of LMS exists in current scenario and in the years to come.
3. Technological advancements will graduates LMS to that of an LXP and its impact on higher education

Higher Education System in India : State of Affairs

India has a multi-layered formal education system with ~ 39,000 colleges catering to 27.5 million undergraduate and four million postgraduate students.[2]

India has one of the largest higher education systems in the world, primarily dominated by
private sectors. Higher education in India though governed by UGC has a 3- tier structure comprising the university, college and course. Different regulatory bodies such as Medical
Council of India (MCI), All India Council for Technical Education (AICTE) and the Bar Council India (BCI), among others, manage different professional courses.[3]

Modernization and expansion of education system, raise educational attainment levels is must for Indian Higher Education, if it is to provide skills to the youth to gain a significant competitive advantage over swiftly aging countries like China.[4] As various literatures point out, the challenges faced by Indian Higher Education is many, for example,

1. India's Gross Enrolment Ratio (GER) is 25.7% and aiming to attain GER of 30% by 2020, but it is still far behind countries like China with GER of 43.39% and US with 85.8%.
2. Faculty shortage is one of the issues in state and central universities, respectively. 62% of universities and 90%of colleges were average or below average in 2010, on the basis

[2] "Online education in India - KPMG." https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/05/Online-Education-in-India-2021.pdf. Accessed 11 May. 2019.
[3] "Regulatory Structure of Higher Education in India - Centre For Civil ...." https://ccs.in/sites/default/files/research/research-regulatory-structure-of-higher-education-in-india.pdf. Accessed 11 May. 2019.
[4] "Education in India - WENR - World Education Services." 13 Sep. 2018, https://wenr.wes.org/2018/09/education-in-india. Accessed 11 May. 2019.

of their NAAC accreditation. India's relative citation impact is also abouthalf the world average.

3. There is wide disparity in the GER of Higher Education across states and the Gross Attendance Ratio (GAR) in urban and rural areas, and gender-and community-wise.Inter-State Disparity: 47.9% in Delhi v/s. 9% in Assam.[5]

Internet & Devices: Feasibility, Affordability

India has witnessed a significant increase in the total internet user population as on 2016 stands with overall internet penetration of 31 per cent and approximately 409 million internet users are expected to grow to approximately 735 million by 2021[6]

Almost a quarter of India's population is using smartphones, approx. 337 millions as of now. The key factors behind this highest growth are the upsurge in smartphone usage and the demand for more affordable smartphones in urban areas.[7]

The widespread availability and adoption of mobile broadband technology and market penetration of low-cost smartphones also enables the use of mobile technologies for education delivery in India. The Indian ministry of human resources development, introduced "National Program on Technology Enhanced Learning (NPTEL)" to develop curriculum-based video lectures and web courses to enhance the quality of engineering education in India. This programme has been a great success that in turn triggered the setup of several such programmes across India by both public and private parties.[8]

The potential of Information and Communication Technology (ICT) has been envisaged as a Centrally Sponsored Scheme as ICT can be employed in providing high quality personalized and interactive knowledge modules over the internet/intranet for all the learners in Higher Education Institutions in any time any where mode. This is expected to be a major intervention in enhancing the Gross Enrolment Ratio (GER) in Higher Education by 5 percentage points during the XI Five Year Plan period and in ensuring access and equity in Higher Education.

The National Mission on Education, enable ICT's effectiveness and penetration has stated focus on
(a) content generation and (b) connectivity along with provision for access devices for institutions and learners.

The key pedagogy focus is on e-learning, providing facility of performing experiments through virtual laboratories, on-line testing and certification, online availability of teachers to guide and mentor learners, utilization of available Education Satellite (EduSAT) and Direct to Home (DTH) platforms, training and empowerment of teachers to effectively use the new method

[5] "current scenario of higher education in india - International Journal of ...." http://scienceandnature.org/IRJSSH_Vol1(1)J2016/IRJSS-VOL1(1)16-13.pdf. Accessed 16 May. 2019.

[6] "Indian Languages –Defining India's Internet - KPMG." https://assets.kpmg.com/content/dam/kpmg/in/pdf/2017/04/Indian-languages-Defining-Indias-Internet.pdf. Accessed 11 May. 2019.

[7] "Smartphone Users In India 2018: 16% YoY Growth Is The Highest In ...." 7 May. 2018, https://dazeinfo.com/2018/05/07/smartphone-users-in-india-2018-2022-growth/. Accessed 13 May. 2019.

[8] "Mobile learning: Smart education system for India | Forbes India Blog." http://www.forbesindia.com/blog/business-strategy/mobile-learning-smart-education-system-for-india/. Accessed 13 May. 2019.

of teaching learning etc.

Adding the above, the Mission will extend computer infrastructure and connectivity to over 18000 colleges in the country including each of the departments of nearly 400 universities/deemed universities and institutions of national importance. The peer group assisted content development would utilise the Wikipedia type of collaborative platform under the supervision of a content advisory committee responsible for vetting the content. Interactivity and problem solving approach would be addressed through "Talk to a Teacher" segment.[9]

Learning Management System : Where are we today ?

Learning Management System (LMS) is indeed very popular these days and are available in following categories:

1. **Open Source Learning Management System** -These are available under a public free license, providing users the rights to use, to change, to study, to create and to distribute the results, free of charge, to anyone and for any purpose. For example, MOODLE, SAKAY etc.
2. **SAAS/Cloud Based Learning Management System** These come with cloud computing features and deliver the education online to any student, at anytime and anywhere around the world, the only must requirements to be fulfilled being the existence of an Internet connection and of a tool (i.e., computer, tablet, smartphone). For example Digital Chalk, Docebo etc.
3. **Proprietary Learning Management System** -These systems have been licensed by their developers under the legal rights belonging to the copyright owner/s. For example, Design2Learn, ANGEL etc.

LMS, right from inception has been evolving.[10] Now a days, LMS is gradually making its way out to the Learning Experience Platforms (LXP). Companies like Pathgather, EdCast etc. are pioneers of the next-generation portals and every Learning Management System (LMS) vendor has jumped into this space. Most of the traditional LMS vendors now have add-ons that perform LXP-like features.[11]

What is an LXP ?

LXPs are single-point-of-access, consumer-grade systems composed of integrated technologies for enabling learning. LXPs can do curating and aggregating content, creating learning and career pathways, enabling networking, enhancing skill development, and tracking learning activities delivered via multiple channels and content partners. By delivering on a central platform, LXPs enable businesses to provide an engaging and learning-rich experience and may lessen their reliance on an LMS or talent suite as the learning hub.[12]

[9] "IT & ICT in Education - aicte." https://www.aicte-india.org/education/IT-and-ICT. Accessed 13 May. 2019.

[10] (2016, March 4). (PDF) Learning Management System in Higher Education. Retrieved May 8, 2019, from https://www.researchgate.net/publication/288737185_Learning_Management_System_in_Higher_Education

[11] "The Learning Experience Platform (LXP) Market Expands – JOSH ...." 27 Sep. 2018, https://joshbersin.com/2018/09/the-learning-experience-platform-lxp-market-expands/. Accessed 13 May. 2019.

[12] "What's a Learning Experience Platform? | Pathgather." 25 May. 2018, https://www.pathgather.com/what-is-a-learning-experience-platform/. Accessed 13 May. 2019.

LinkedIn Learning has now opened up its platform to external content. It is a panel-based, highly Artificial Intelligence (AI)-driven learning platform so for many smaller companies it will act as an LXP.

Technological Advancements : What more to be Leveraged, apart from LXP ?

Blockchain, rose to prominence with bitcoin and ethereum, but this technology can also be pretty useful with regards to online certifications. Since any block added to the chain must be approved by other participants, the record cannot be falsified. This prevents people from creating fake certifications to say that they passed or excelled at a particular course. The records are also quite easily checked. The MIT Media Lab is already testing out blockchain for issuing digital degrees and certificates which wasn't available before.

Blockchain tokens can be used to provide incentives to educators for creating high-quality content. This is very similar to what is being done on YouTube: YouTubers create entertaining videos their fans love; the more fans watch their videos, the more YouTubers are paid in royalties.

DISCUSSIONS OF THE RESULT

Taking into account the literature survey, some of the vital higher education issues that needs to be addressed are,

1. Penetrative Expansion is required without compromising on quality. Universities , colleges need to reach out to far flung areas with a strategy of easy access to high quality deliverables. The contents should be rich enough to generate interest in the students such that they refrain from dropping out of higher studies.
2. Pool of rich contents need to be ensured. More and more faculties must be motivated for creating rich quality contents. Incentives and reward mechanism strategy for those developing the best contents.
3. Student academic attainment level needs to be raised. Ongoing monitoring system preferably that uses AI to feeds contents to his/her level of understanding, evaluates and guides for better academic level is required.
4. Citation impact is low, implies qualitative research is on the lower side.
5. Student academic attainment level evaluation and certification in a credible manner such that its valued internationally.
6. Student , faculty and mentor engagement needs to be enhanced.
7. Automation of administrative works like evaluation, credential managements to replace the existing centralised -paper based approach.
8. Drastic upgradation would require enormous funds for universities and colleges. Instead open source technologies can be adopted for reducing the costs to bare minimum and expansion is made across the country.

CONCLUSION

Post literature survey, based on the facts followed by the discussion on result, we infer need for a complete education system that is

1. Learning Experience Platform (LXP) - A tool that incorporates personalised learning, virtual reality and AI-driven chatbots in addition to organisational resources and content, the LXP offers modern, data-driven, self-directed learning that is unique for each individual user.
2. Blockchain Integration For

Certifications & Incentives - provide incentives to educators for creating high-quality content similar to YouTubers. Instructor/ Student works that are cited for research also get cryptocurrency tokens as incentive for doing quality work.

3. Issuing digital certificates on Blockchain to leverage immutability, public record to provide endorsement and validate it accordingly to prevent fraud and mutilation of records by the involved entities. Transparent issual of ownership certificate.[13]
4. Adoption of Open Source Technology that lowers the total cost of ownership (TCO) because the software often comes at no cost or relatively low cost), and shifts the cost center from licensing (an operating expense) to customization and implementation (a capital expense).[14]

[13] "Blockchain and Digital Certificates – The Blockchain Fanatic – Medium." 26 Nov. 2017, https://medium.com/blockchain-fanatic/blockchain-and-digital-certificates-d9d6f6ad9008. Accessed 13 May. 2019.

[14] "6 motivations for consuming or publishing open source software." 9 Dec. 2015, https://opensource.com/life/15/12/why-open-source. Accessed 13 May. 2019.