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Prioritizing Methods and Strategy for e-Learning in Higher Education to Improve Effectiveness

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ABSTRACT

E-initiative is the need of the hour resulted in many initiatives, which has transformed all sectors and higher education is no exception to this due its advantage. In this respect many initiatives has been initiated by Government and private sectors, specially UGC, AICTE etc through NMEICT project for stake holder under its preparedness. But its relevance and its effective utilization needs to be felt and improved as it was an optional earlier. But during the recent lock down, students, teacher across discipline felt its need. Students and teachers are forced to go for these initiatives across India. They have also faced many problems like mindset, digital divide, content, connectivity etc. on the other hand lockdown has also given lesson to how to survive in these situation leads to less travel, less pollution, etc. so there is a need to study the effective utilization of E-initiatives in Higher education during Lock Down, which will highlight Problems and Prospective from different stake holders from larger society prospective. In this paper AHP and Game Theory is being used to prioritize and suggest the best strategy needs to be adopted for e-learning for increasing effectiveness of the system.

Keywords: e-Learning, Priority, AHP, Strategy, Game Theory, effectiveness.

Introduction

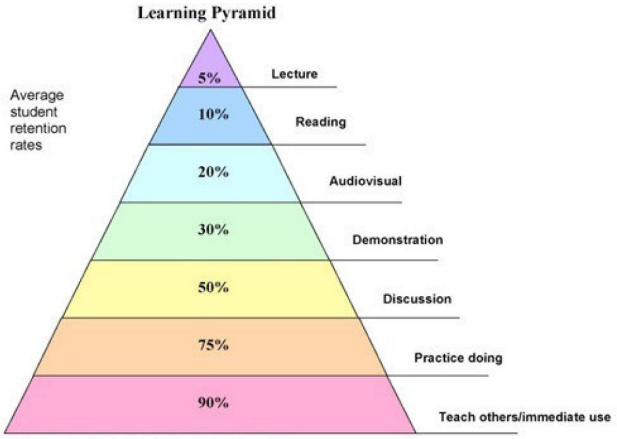
E-education is not new to the society. Organization across the Globe has development suitable e-application to ensure education through online and Government in India is no exception to this. Many such applications have already been development like NPTEL, MOOCs, Swayam to name a few, which were earlier an optional for many. But due to recent Lockdown due to COVID pandemic, all stake holders are being forced by the Agency like UGC, AICTE, MHRD etc to use these initiatives. During this lock down, where all institutions are closed the institution are being directed to continue their education through online and use the various initiatives, so that there will not be any discontinue of education and its related services. As reported by government official the response to this is overwhelming and all institution across the country are using some form of e-learning to ensure continue education. As reported by the ministry various platforms have been developed and used on continuous basis, Diksha education through satellite, e-pathasala open online content for higher education, NROER (National Repository of Open Educational Resources), NIOS (National Institute of Open Schooling), e-yantra a robotics education initiatives for robotic education), FOSSEE (open source software for education, where students can use various software online, virtual labs for using laboratory facilities for various science related subjects, NPTEL portal for online technical education in various subjects and spoken learning programmes for skill development. No doubt the use of these resources has increased in many folds. But many stake holders across the society are facing certain limitation of these initiatives reason for these may be many. On contradictory to this the success is questionable due to non availability suitable devices, like computer and other peripheral and either no or limited internet connectivity have computer with net link. The Covid-19 pandemic has given information about the gap between rural and

urban, male and female, rich and poor in term of availability of various digital facilities and access facilities for the interconnected digital world. So there is a need for extensive study and its effectiveness etc from larger prospective to make it more relevant and effective.

As per literature the e-learning can be broadly classify into computer-based e-learning and internet-based e-learning categories, further (e-students.org) has classified the learning methods into various sub category depending upon its requirement and management like the learning process is completely managed by computer is termed as "Computer Managed Learning (CML)", where as Computer Assisted Instruction (CAI) helps the learner in case of need depending upon uses interaction. In case Synchronous Online Learning both the learner and instructor needs online presence simultaneously and in case of Asynchronous Online Learning this presence is not required simultaneously the learner can take the advantage of own pace, time etc. Author also categories based on its content like in case of Fixed E-Learning the content are fixed irrespective of the learner and leaves no space for learner adaptability, where as in case of Adaptive E-Learning, content are filtered based on learners adaptability. In case the learning behaves Linearly based on the learner and its understanding termed as Linear E-Learning, Interactive Online Learning is similar to the online class room teaching having advantages of interactive learning in presence of group of students but in case Individual Online Learning the online presences is limited to only one learner and teacher, and in Collaborative Online Learning a group of learners and instructor learn together exchanging ideas and methods.

Generally right mixer determines the success of e-learning in Higher education. Researches have development various implementation models for adaptability of the e-learning environment in higher education this can be: Analysis, Design, Develop, Implementation, and Evaluation. In order to improve the effectiveness of the e-learning experience the content needs to be improved and should be need based. In the analysis phase the needs need to be determined. The learning pyramid development by National Training Laboratories Betel, Maine, discussed The Learning Pyramid**,** Designing Learning Contents also depends upon the type of eLearning methods which we choose on the analysis phase.

The learning Pyramid is developed based on the effectiveness of various methods of learning and learner's ability to keep recall and its effective's delivery in case need. Lecture is one ways teaching process having the least effective rate i.e 5%, where as in case of self online



Source: National Training Laboratories, Bethel, Maine.

reading the rate is 10%, audiovisual where both audio and video are present having rate of effectiveness 20% and online demonstration of learning is 30% are the passive learning methods where the learners participation is least. In contrast, the bottom three levels i.e discussion group, practice by doing and teach others are online interaction is an active learning methods having better effective rate. The Learning Pyramid helps the students and the teacher to identify the right methods. The methods also discussed two important types of learning i.e Synchronous and Asynchronous Learning. In synchronous both the stake holder the teacher and students needs to be present for a effective teaching. Synchronous events take place in real time. Synchronous communication between two people requires them to both be present at a given time like chat and IM, video and audio conference, live webcasting, application sharing, whiteboard, polling, and virtual classrooms. Whereas Asynchronous Learning, the presence are not simultaneous but as per convenience and the pace etc depends on learner, which is time independent, like E-mail or discussion forums, Self-paced (SCORM), Audio/Video, E-mail, Discussion forum, Wiki/Blog, Webcasting/Conferencing, CBT and WBT, Simulations, Game-based learning.

Literature Review

e-Learning is the use of information and communication technology to send learning content to the intended user to replicate and increase learning outcome. In the present era with wide presence of internet and intranet there is increase use as this method are having numerous advantage over the traditional method of learning. The learning process involves developing content, storage and enabling retrieval mechanism and its effectiveness also depend upon the individual active involvement

and ability, with many other learning environments to have better outcome. Due to the advantage of own place, pace the e-learning is becoming popular in particular in higher education. However, Guri-Rosenblit (2005) and Robertson (2003) propose that higher learning should rethink their decision on the use due to various reason like cost and its effectiveness. Henry (2001) have found that total e-learning solution have three main components like content, technology and services. Laurillard (2001) and Butson (2003) have found that teaching approach is important then technology medium, similarly Butson (2003) discussed the limitation of e-learnig as it is lack in the area of understand how to think. Initial investments in e-learning are costly, hence the performance, quality, usage, effectiveness and efficiency as a learning solution is of interest to many. However, there is a research gap on the various dimension of e-learning like eavlution and its effective use with its return.

In today's era e-learning has created a new dimension in the learning process and researchers have described it to be learners' learning strategies (Adam et al., 2017; Broadbent, 2017; Littlejohn, Hood, Milligan, & Mustain, 2016; Şahin, Keskin, Özgür, & Yurdugül, 2017). Researcher also described various enablers for effective e-learning environment like online readiness (Park, Lee, & Bae, 2010; Ramli, Muljono, & Afendi, 2018; Yurdugül & Demir, 2017) and motivation (Cull, Reed, & Kirk, 2010; Najafi, Rolheiser, Harrison, & Heikoop, 2018). Different research gap has been pointed out by researcher like absences of student preference, individual factors affecting these preferences (e.g. Butler & Pinto-Zipp, 2005; Tsai, 2005; Yang, & Tsai, 2008). As per literature various factors like Purpose of learning, Availability of e-learning tools, connectivity, content, motivation and adaptability of students, teacher's confidence, way of teaching, availability of other related materials, quality of internet, costing, synchronous and Asynchronous teaching, subjects, E-learning readiness are also the factors for increasing effectiveness of e-learning.

Keeping in view the present situation and increase use of e-learning methods, there is a need to identify effective tool to increase the effectiveness of e-learning or factors affecting the outcome, which in turn can be a help to the manager for improving various e-learning initiatives. This will help them to evaluate and improve the current situation of e-learning. Since the evaluation and decision making process is having many criteria in decision making, Multi-criteria decision-making (MCDM) techniques can be used for Performance Evaluation. This MCDM technique gives better result in the presence of wide range of data and decision criteria decision makers (DMs). Many studies have been conducted on Performance Evaluation based on MCDM techniques including Analytical Hierarchy Process (AHP) Ajami S., Ketabi S., 2012, Gholamzadeh et al., Data Envelopment Analysis (DEA) Ersoy K et al., Yawe B., 2010, Chen Y. et al., and best–worst method (BWM) Liao B. et al., 2019, Haghighi S.M., Torabi S.A., 2018, and many more. Presence of many methods and its wide range of application for performance measurement and there critique, organization are using performance measurement and benchmarking for their improvement in process and to identify better practices for its improvement (Butson 2003).

Methodology

In our study we have taken one subjects of management i.e Operations Research and asked the 20 no of students to rate their mode of preferences (for e-learning) in order of preference separately for Synchronous and asynchronous in the likert scale date. We have used Analytic Hierarchy Process to prioritize the different method of e-learning, the data is being run in the online mode of AHP software available at https://bpmsg.com/ahp/ahp-calc.php. The results for the same are given below. The feedback of the students are recorded in the Table1 and Table 2 for synchronous and asynchronous learning.

Table 1: Decision Matrix for synchronous learning

	1	2	3	4	5
1	1	2.00	4.00	2.00	6.00
2	0.50	1	3.00	4.00	5.00
3	0.25	0.33	1	3.00	5.00
4	0.50	0.25	0.33	1	3.00
5	0.17	0.20	0.20	0.33	1

Results

Priorities

The resulting weights are based on the principal eigenvector of the decision matrix:

	Cat	Priority	Rank	(+)	(–)
1	L1	39.0%	1	18.4%	18.4%
2	L2	29.9%	2	11.8%	11.8%
3	L3	16.4%	3	8.2%	8.2%
4	L4	10.3%	4	5.1%	5.1%
5	L5	4.4%	5	1.4%	1.4%

Consistency Ratio CR = 9.1%

Decision Matrix

Table-2: Decision Matrix for Asynchronous learning

	1	2	3	4	5
1	1	0.50	4.00	2.00	6.00
2	2.00	1	4.00	4.00	5.00
3	0.25	0.25	1	3.00	5.00
4	0.50	0.25	0.33	1	3.00
5	0.17	0.20	0.20	0.33	1

Priorities

These are the resulting weights for the criteria based on pairwise comparisons, the resulting weights are based on the principal eigenvector of the decision matrix

	Cat	Priority	Rank	(+)	(–)
1	L1	29.1%	2	16.3%	16.3%
2	L2	41.1%	1	15.0%	15.0%
3	L3	15.6%	3	8.2%	8.2%
4	L4	9.8%	4	3.3%	3.3%
5	L5	4.4%	5	1.9%	1.9%

Consistency Ratio CR = 9.1%
Principal Eigen value = 5.412, Eigenvector solution: 6 iterations, delta = 2.3E-8

The Consistency Ratio is calculated by dividing the consistency index with random index, If ratio exceeds 0.1, there is a inconsistency in the judgment and CR less than 10 % are accepted and reliable. Since in both the cases the CR are less than 10%, we can accept the result. The result shows that in synchronous mode the method are Live class with Interactive board, Live application sharing, Live video and audio, Live Discussion and QA and Online chat are in order of priority, where as In Asynchronous the Priority list are Computer Assisted training, Simulations Game-based learning, Audio/Video Webcasting/like Youtube, E-mail, Discussion forum, Wiki/Blog

As the effectiveness of e-learning depend upon the mixture of Synchronous and Asynchronous Learning. Finding the right mixture will increase the effectiveness of eLearning. The above problem can be considered as a mixed strategy problem as the effectiveness of the matrix is based on the expected payoff, which may be achieved by combination of the one or more strategy adopted by the e-learning methods. This paper uses Game theory, to so consider the mixed strategy problem and suggested a strategy to be adopted for increasing the effectiveness of the e-learning. Further the students have given the value based on the different strategy is represented in Table-1. In order to find the strategy for the effective utilization of e-learning method, Game Theory was used via online tool https://www.math.ucla.edu/~tom/gamesolve.html.

The value is 7.28. An optimal strategy for Synchronous is: (0.71429,0,0,0,0.28571) and optimal strategy for Asynchronous is: (0,0.85714,0.14286,0,0) The value, 7.28, gives indication that synchronous is better than Asynchronous learning.

Conclusion

It can be concluded that students preferred on line synchronous classes then the Asynchronous classes for the management subject and in order to be more effective there should be only two features in both synchronous and Asynchronous to be more effective.

Competing Interest Statement

The author has read and approved the manuscript and takes full responsibility for its contents. No potential conflict of interest was reported by the author.

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Asynchronous synchronous	Computer Assisted training	Simulations Game-based learning	Audio/Video Webcasting/ like YouTube	E-mail, Discussion forum	Wiki/ Blog
Live class with Interactive board	8	7	9	11	11
Live application sharing	5	2	6	3	9
Live video and audio	1	4	7	8	8
Live Discussion and QA	3	5	9	4	5
Online chat	9	8	3	4	7

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