Effectiveness of Hybrid Learning Tools: Analysis of Engineering Colleges in India

Komal Chopra [1]**, Jaya Chitranshi** [2]

[1] Symbiosis Institute of Management Studies, Symbiosis International (Deemed University), Pune, India
[2] Symbiosis Institute of Management Studies, Symbiosis International (Deemed University), Pune, India
[1] chopra.k@sims.edu,
[2] jaya.chitranshi@sims.edu

Abstract : The study examines the tools of learning and their effectiveness used for teaching in hybrid mode in engineering colleges of India. The study was conducted in ten engineering colleges across different cities of India spread across east, west, north and south regions. The respondents for the study were students of third and final year belonging to five different streams of Engineering such as mechanical, electrical, information technology, production and electronics & telecommunication. The collection of responses was done through survey method using a structured questionnaire. The data underwent statistical analysis using SPSS software. The inferences show that gamification is the most effective tool of learning in online mode while classroom instruction is most effective in offline mode. A good combination of the two can make learning effective in hybrid mode. The study has implications for National Education Policy 2020 which is focused on technology based learning.

Keywords : hybrid; learning; technology; effectiveness; teaching

Komal Chopra

Symbiosis Institute of Management Studies,
Symbiosis International (Deemed University), Pune, India
chopra.k@sims.edu,

1. Introduction

The hybrid mode of learning is a combination of online and offline method of learning where some aspects of student learning happen through face-to-face interaction while some aspects of learning are supported by online technology (Raes, 2022). The National Education Policy (2020) by Government of India has promoted the implementation of hybrid models of learning so that there is greater usage of technology and education becomes more accessible, affordable and efficient (Das & Das, 2021). Hybrid learning, as compared to face-to-face learning helps in optimization of the learning process and resources (Miranda et al., 2021). Lev and Bezalel (2008) have found that teacher and student interaction in hybrid mode was more effective method of learning compared to face-to-face learning.

Kunin et al., (2014) used both offline and online ways of teaching for their effectiveness in terms of participant learning and observed that blended or hybrid mode was a more effective methodology of learning. Rehman and Fatima (2021) highlighted the importance of 'pre-reading material' for a class, 'in-class activity' during the class and 'guidance received' from the instructor post the tests which can be captured through hybrid mode. Yamagata-Lynch (2014) observed that 'small-group meetings' help in building peer-to-peer and peer to instructor connections stronger. The researcher also recognized the need to combine 'structure' with 'flexibility' for

successful online learning. Giesbers et al., (2014) concluded that online methodology gives more time for 'reflection', and offline supports 'engagement' and therefore 'better quality of learning' can be achieved on combination. The researchers supported a combination of offline and online methodologies for effectiveness. While the teaching fraternity supports hybrid learning mode, it is important to understand student experience. The current study evaluates student experience with hybrid mode of learning and its effectiveness.

2   Review Of Literature

Shahabadi and Uplane (2015) conducted research to study learning preferences. Beyth-Marom et al., (2005) found that preference for online or offline tutorial mode depends on students' 'learning-habit inclinations. Mabrito (2006) studied the 'interactions' and 'attitude to communicate' in online and offline learning environments and recommended online environment for 'interactions' and offline for 'content'.

Peterson et al., (2018) highlighted the role of 'positive affect', 'cognitive processes' and 'belongingness' in synchrony. Lim (2017) indicated that 'communication' is a very important tool in education. Ogbonna et al., (2019) concluded that hybrid mode of teaching helps in building 'higher cognitive achievement' while synchronous methodology displays 'improved skill-acquisition'. Careaga-Butter et al., (2020), studied pandemic effects as 'disruptions' in the educational context and highlighted the relevance of 'adaptations' to online and offline modes of learning.

Coogle et al., (2015) concluded that online and offline, both pedagogies have their separate benefits and hence should be used in combination which could be a hybrid mode. Karaaslan et al., (2018) proposed a 'hybrid' teaching pedagogy using online and offline methods. The researchers also highlighted the use of 'digital games' and 'activities' to enhance effective assimilation of online and offline teaching-content. Maheshkar and Sharma (2021) were of the view that instructors undergo during Covid, so instructor-readiness is also found to play a role in the process.

Oztok et al., (2013) observed that 'private-messages' support discussions happening in offline mode. Frank (2008) discussed the 'organizational and pedagogical aspects' crucial for distance learning. Malik and Fatima (2017) in their study observed that

male-students preferred hybrid pedagogical tools more, as compared to female-students in higher education. Chattopadhyay and Dalal (2021) observed a spectacular-awareness of online-education among students and recognized the role of instructors as enablers. While Tripathi et al., (2021) found students facing stress during Covid which is to be noted by instructors.

Paulus and Phipps (2008) compared studies in online and offline environment and analysed both methodologies for their effectiveness. Gisondi et al., (2010) found that online and offline, both methodologies result in similar transfer of knowledge. Johnson (2008) conducted a survey which showed that online or offline styles of teaching did not show any marked difference in terms of student-test-performance, proving the effectiveness of both methodologies. Hence hybrid mode needs to be introduced. Amiti (2020) propagated a right combination of offline and online methodologies for effective e-learning. Chen et al., (2005) suggested to plan the hybrid sessions as per individual requirements of participants. A thorough literature review highlighted that the research gap to identify the tools that would to effective learning in hybrid mode. These tools can be incorporated in the teaching pedagogy to create an effective student learning.

Research objectives

1. To identify the most effective learning tool in hybrid teaching mode

2. To identify the difference in learning effectiveness based on gender and level of student in hybrid mode.

Based on the review of literature and research objective, the following hypothesis were framed:

Hypothesis 1: Is there a significant difference in the learning effectiveness in hybrid mode based on gender?

Hypothesis 2: Is there a significant difference in the learning effectiveness in hybrid mode based on graduation level of students (third year students and final year students have been considered)?

3. Research Methodology

Quantitative research method was employed since the objective of the study was to measure employee

experience in using different tools in hybrid teaching mode. Survey was done across ten engineering colleges in India belonging to north, south, east and west zones. The respondents were engineering students selected from third and final year since it was a drastic change in learning for them. The sample size was 136 students. 44.9 % of students were from third year while 55.1 % were from final year. 72.1 % of students were males while 27.9 % were females. The break up of sample is shown in Table 1.

Table 1

Male	Female	Total
98	38	136
Third year	**Final year**	**Total**
73	63	136

The data was collected through a structured questionnaire, which had objective type questions on a measurement scale of 1 – 5 which indicates 1 = least preferred and 5 = most preferred score. The questionnaire (in Appendix) had questions relating to gender, year of graduation, and questions relating to the tools of learning in hybrid mode. Since hybrid mode of learning is a mix of offline and online learning tools, the questionnaire had questions relating to offline learning such as classroom instruction, classroom interaction, within classroom presentations and online learning such as simulation, gamification and videos. The learning tools were identified from review of literature were as follows:

1. Online simulation – It relates to learning through simulation software that supports engineering experiments (Deshpande & Huang, 2011)

2. Online videos – It relates to learning through educational videos relating to application of engineering concepts (Brame, 2016)

3. Classroom interaction – It relates to engagement of students through classroom interaction leading to learning (Dharmawati, 2020)

4. Online gamification – Gamification is the usage of software games where engineering knowledge can be applied to achieve learning (Kim et al, 2018)

5. Classroom presentation – Students make classroom presentations on topics and get feedback leading to effective learning (Anderson et al., 2005)

6. Classroom instruction – It relates to classroom instruction by professors and experts leading to effective learning (Cheng et al., 2019).

Convenient method of sampling was adopted since it was based on permissions from the colleges and availability of students. The researchers visited the colleges personally at Delhi, Patiala and Chandigarh in north, Chennai, Vellore and Bangalore in south, Kolkata and Guwahati in east and Pune, Mumbai and Nagpur in the west. These cities are the hub of engineering colleges and hence they were selected for study. After obtaining permissions from the principals of these colleges, the authors made a visit and collected the data from students using a physical questionnaire. The questionnaire data was later fed into the SPSS software and statistical tests were done to test the hypothesis. Independent sample t-test was carried out to test the hypothesis.

Independent sample t-test

Independent sample t-test is a statistical test between two independent data sets. It is used to test the hypothesis whether the mean values between two independent data sets at a level of significance, i.e. less that 0.05 is significantly different. We test whether the null hypothesis (Ho) (i.e. no significant difference) or alternate hypothesis (H1) (i.e. there is a significant difference) is accepted. The t- value gives the statistical difference between mean values of two data sets at a significant value of less than 0.05. The t-value can be positive or negative. If the t-value is obtained at significance value of less than 0.05, the alternate hypothesis is accepted while if the t-value is obtained at significance value of more than 0.05, the null hypothesis is accepted.

4. Result

Table 2: Most Effective Learning Tool

Tools of hybrid learning	N	Mean
online simulation	136	3.6176
online videos	136	3.4485
classroom interaction	136	3.1985
online gamification	136	4.2059
classroom presentation	136	3.1691
classroom instruction	136	4.0662
TOTAL	136	
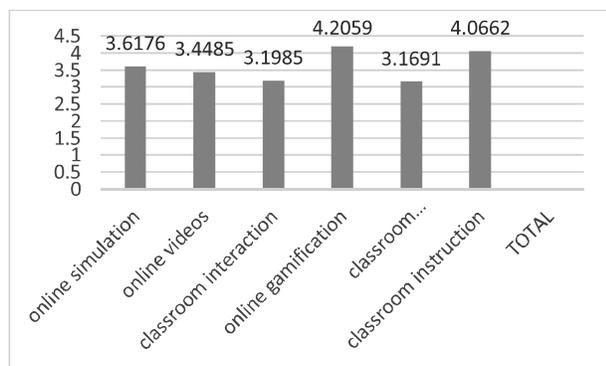
Fig. 1 : Mean values of effective learning tools

Table 3: Results of Hypothesis 1

Tools of hybrid learning	t	df	Sig. (2-tailed)
online simulation	-0.706	134	0.481
online videos	-1.123	134	0.264
classroom interaction	-0.505	134	0.614
online gamification	-0.519	134	0.605
classroom presentation	-0.685	134	0.495
classroom instruction	-1.606	134	0.111

Interpretation of Results

There are three columns in table II. The first column highlights the different tools of learning in hybrid mode. The second column indicates the number of respondents. The third column highlights the mean rating given by the respondents on a scale of 1 to 5 for the hybrid learning tools under study where 1= lowest rating and 5 = highest rating. The third column indicates highest mean value for gamification followed by classroom-based instructions. The least mean rating is for classroom presentation. Hence the results indicate that in hybrid mode of learning, students prefer gamification in online mode and classroom instruction in offline mode.

Testing of Hypothesis 1

Hypothesis 1: Is there a significant difference in the learning effectiveness for different learning tools based on gender at a significance level of less than 0.05?

Null hypothesis (H0): There is no significant difference in learning effectiveness for different learning tools based on gender at a significance level of less than 0.05

Alternate hypothesis (H1): There is a significant difference in learning effectiveness for different learning tools based on gender at a significance level of less than 0.05

Independent sample t-test was used to test the hypothesis since the purpose was to compare between the male and female response towards tools of effective learning.

Interpretation of Results

The results in Table III indicate the t-value, degrees of freedom (df) and level of significance (Sig). The t-values are negative and have the range between 0.5 to 1.6. The low level of t-values indicate that there is very less difference between the mean responses of males and females. The same is evident from the Sig values which are more than 0.05 for all the variables. Hence the null hypothesis is accepted that there is no significant difference between male and female responses towards learning effectiveness. This means that learning effectiveness does not depend on the gender of the student. The negative t-value indicates difference between the data sets in reverse direction while df represents the number of independent values that are free to vary during the analysis.

Testing of Hypothesis 2

Hypothesis 2: Is there a significant difference in the learning effectiveness in hybrid mode based on graduation level of students at a significance level of less than 0.05?

Null hypothesis (H0): There is no significant difference in learning effectiveness for different learning tools based on graduation level of students at a significance level of less than 0.05

Alternate hypothesis (H1): There is a significant difference in learning effectiveness for atleast one tool based on graduation level of students at a significance level of less than 0.05

Independent sample t-test was used to test the hypothesis since the purpose was to compare between the responses of third and final year engineering students towards tools of effective learning.

Interpretation of Results

The results in Table IV indicate the t-value, degrees of freedom (df) and level of significance (Sig). The t-values are negative and have a range between 0.5 to 2.5. The low level of t-values (below 2) indicate that there is very less difference between the mean responses of third and final year students. The high t-value of 2.5 for classroom instruction indicates a significant difference between responses of third and final year students. The same is evident from the Sig values which are more than 0.05 for all the variables except classroom instruction where it is less than 0.05. Hence the alternate hypothesis is accepted that there is a significant difference between mean responses towards learning effectiveness for one tool i.e. classroom instruction. The final year students have a higher response for classroom instruction compared to third year students. The negative t-value indicates difference between the data sets in reverse direction while df represents the number of independent values that are free to vary during the analysis.

5. Inference

Post Covid 19, engineering colleges are preferring hybrid mode of learning since it saves time and cost. The National Education Policy 2020 have also endorsed the hybrid mode of learning through usage of technology. The current study was to understand the learning effectiveness of hybrid tools. The results clearly indicate that gamification is the most effective tool in online mode while classroom instruction-based training is the most effective mode in offline mode. A combination of the two will give an effective hybrid learning experience. The hybrid mode is a combination of both online and offline learning where combination of gamification and classroom instruction can give an effective learning experience. The results also indicate that effectiveness of learning tool is not dependent on gender but depends on the year of graduation. Since final year engineering students prefer classroom instruction as more effective compared to third year engineering students, more emphasis can be given to offline mode compared to online mode in the final year.

6. Implications

In the post Covid 19 situation, hybrid learning was the way forward in India. The study will help colleges in India to understand learner expectations better. They will then be able to decide on the right mix of pedagogical tools to engage students with hybrid mode of learning leading to effective learning outcomes. This will also result in higher satisfaction towards learning amongst the students. De Guzman (2020) showed that effective learning outcomes result in development of skills.

Implications for New Education Policy: Engineering colleges are encouraging the use of resources in order to encourage hybrid learning to save time and money. The study will help them to design "quality assurance" parameters for hybrid learning based on expectations. It will enable them to conduct learning more effectively. In future, engineering colleges can explore the usage of artificial intelligence for enhancing the learning experience of students.

References

[1] Amiti F 2020. Synchronous and asynchronous E-learning. European Journal of Open Education and E-learning Studies 5(2): 60-70.

[2] Anderson, R., Anderson, R., McDowell, L., & Simon, B. (2005, October). Use of classroom presenter in engineering courses. In Proceedings Frontiers in Education 35th Annual Conference (pp. T2G-13). IEEE.

[3] Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. CBE—Life Sciences Education, 15(4), es6.

[4] Beyth-Marom R, Saporta K, and Caspi A 2005. Synchronous vs. asynchronous tutorials: Factors affecting students' preferences and choices. Journal of Research on Technology in Education 37(3): 245-262.

[5] Bordoloi, R., Das, P., & Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: an academic analytics in the Indian context. Asian Association of Open Universities Journal, 16(1), 41-60.

[6] Careaga-Butter M, Quintana M G B and Fuentes-Henríquez, C 2020. Critical and prospective analysis of online education in pandemic and post-pandemic contexts: Digital

tools and resources to support teaching in synchronous and asynchronous learning modalities. Aloma: revista de psicologia, ciències de l'educació i de l'esport Blanquerna 38(2): 23-32.

[7] Cheng, L., Ritzhaupt, A. D., & Antonenko, P. (2019). Effects of the flipped classroom instructional strategy on students' learning outcomes: A meta-analysis. Educational Technology Research and Development, 67, 793-824.

[8] Chattopadhyay S and Dalal A 2021. A Study of the Adaptation to Innovative Online Teaching Learning Pedagogy by Stakeholders in Covid Times. Indian Journal of Ecology 48(spl): 89-93.

[9] Chen N S, Ko H C, Kinshuk and Lin T 2005. A model for synchronous learning using the Internet. Innovations in Education and Teaching International 42(2): 181-194.

[10] Coogle C, Floyd K, Cole A W, Timmerman C E, Holbeck R, Greenberger S and Becker-Lindenthal H 2015. Synchronous and asynchronous learning environments of rural graduate early childhood special educators utilizing Wimba© and Ecampus. MERLOT Journal of Online Learning and Teaching 11(2): 173-187.

[11] Corbin, J M, and Strauss, A 1990. Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology 13(1): 3-21.

[12] Deshpande, A. A., & Huang, S. H. (2011). Simulation games in engineering education: A state-of-the-art review. Computer applications in engineering education, 19(3), 399-410.

[13] Dharmawati, D. (2020). Classroom Interaction in Teaching English for Mechanical Engineering Students. IDEAS: Journal on English Language Teaching and Learning, Linguistics and Literature, 8(1), 105-115.

[14] Frank M 2008. Synchronous and asynchronous learning environments. Encyclopedia of information technology curriculum integration: 815-822.

[15] Giesbers B, Rienties B, Tempelaar D and Gijselaers W 2014. A dynamic analysis of the interplay between asynchronous and synchronous communication in online learning: The impact of motivation. Journal of Computer Assisted Learning 30(1): 30-50.

[16] Gisondi M A, Lu D W, Yen M, Norris R, Courtney D M, Tanabe P and Quest T E 2010. Adaptation of EPEC-EM™ curriculum in a residency with asynchronous learning. Western Journal of Emergency Medicine 11(5):491-499.

[17] Johnson G 2008. The relative learning benefits of synchronous and asynchronous text-based discussion. British Journal of Educational Technology 39(1): 166-169.

[18] Karaaslan H, Kilic N, Guven-Yalcin G and Gullu A (2018). Students' reflections on vocabulary learning through synchronous and asynchronous games and activities. Turkish Online Journal of Distance Education 19(3): 53-70.

[19] Kim, E., Rothrock, L., & Freivalds, A. (2018). An empirical study on the impact of lab gamification on engineering students' satisfaction and learning. International Journal of Engineering Education, 34(1), 201-216.

[20] Kunin M, Julliard K N and Rodriguez T E 2014. Comparing face-to-face, synchronous, and asynchronous learning: postgraduate dental resident preferences. Journal of Dental Education 78(6): 856-866.

[21] Lim F P 2017. An analysis of synchronous and asynchronous communication tools in e-learning. Advanced Science and Technology Letters 143(46): 230-234.

[22] Mabrito M 2006. A study of synchronous versus asynchronous collaboration in an online business writing class. The American Journal of Distance Education 20(2): 93-107.

[23] Maheshkar C and Sharma V 2021. Occupational Stress: A Pre and Post COVID-19 Perspective on Teaching Personnel in Higher Education Institutions of India. Indian Journal of Ecology 48(spl): 64-69.

[24] Malik M and Fatima G 2017. E-Learning: Students' Perspectives about Asynchronous and Synchronous Resources at Higher Education Level. Bulletin of Education and Research 39(2): 183-195.

[25] Miranda, J., Navarrete, C., Noguez, J., Molina-Espinosa, J. M., Ramírez-Montoya, M. S., Navarro-Tuch, S. A., ... & Molina, A. (2021). The core components of education 4.0 in higher education: Three case studies in engineering education. Computers & Electrical Engineering, 93, 107278.

[26] Offir B, Lev Y and Bezalel R 2008. Surface and deep learning processes in distance education: Synchronous versus asynchronous systems. Computers & Education 51(3): 1172-1183.

[27] Ogbonna C G, Ibezim N E and Obi C A 2019. Synchronous versus asynchronous e-learning in teaching word processing: An experimental approach. South African Journal of Education 39(2): 1-15.

[28] Oztok M, Zingaro D, Brett C and Hewitt J 2013. Exploring asynchronous and synchronous tool use in online courses. Computers & Education 60(1): 87-94.

[29] Paulus T M and Phipps G 2008. Approaches to case analyses in synchronous and asynchronous environments. Journal of Computer-Mediated Communication 13(2): 459-484.

[30] Peterson A T, Beymer P N and Putnam R T 2018. Synchronous and asynchronous discussions: Effects on cooperation, belonging, and affect. Online Learning 22(4): 7-25.

[31] Raes, A. (2022). Exploring student and teacher experiences in hybrid learning environments: Does presence matter?. Postdigital Science and Education, 4(1), 138-159.

[32] Rehman R and Fatima S S 2021. An innovation in Flipped Class Room: A teaching model to facilitate synchronous and asynchronous learning during a pandemic. Pakistan Journal of Medical Sciences 37(1): 131–136.

[33] Shahabadi M M and Uplane M 2015. Synchronous and asynchronous e-learning styles and academic performance of e-learners. Procedia-Social and Behavioral Sciences 176: 129-138.

[34] Tripathi R, Niharika and Khan A A 2021. Study on Academics and Stress during Covid-19 Outbreak, Indian Journal of Ecology 48(spl): 94-98.

[35] Yamagata-Lynch L C 2014. Blending online asynchronous and synchronous learning. International Review of Research in Open and Distributed Learning 15(2): 189-212.

APPENDIX

QUESTIONNAIRE

1. Name_____
2. Gender Male _____ Female_____
3. Year of Engineering
4. Branch of Engineering_____
5. Name of Engineering College_____
6. Location of Engineering College_____

Please answer the following questions on a scale of 1 to 5 where 1 = lowest rating and 5 = highest rating:

Tools of learning	Provide rating from 1 to 5
Learning through simulation software that supports engineering experiments enables effective learning (online simulation)	
Learning through educational videos relating to applicati on of engineering concepts enables effective learning (online videos)	
Engagement of students through classroom interaction leading to effective learning (classroom interaction)	
Gamification is the usage of software games where engineering knowledge can be applied to achieve learning (online gamification)	
Students make classroom presentations on topics and get feedback leading to effective learning (classroom presentation)	
Classroom instruction by professors and experts leading to effective learning (classroom instruction)	