

Applying Learning Analytics for Designing Effective Pedagogy for Online Courses: Analysis and Recommendations

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Abstract—The countrywide lockdown since March 2020 due to COVID 19 pandemic has brought drastic changes in the Indian education system. Today, many higher education institutions offer online delivery as an alternative and/or addition to provide more flexibility to learners, specifically in the current COVID 19 Pandemic. The conventional teaching method to the technology-driven virtual mode of teaching provided opportunities with challenges to academic stakeholders. Now with the new session, discussions on the reopening of educational institutions are going on. Hence, it is time to review the learning that took place during this pandemic situation. Learners being confronted with such services come with different expectations of what that means to their learning paths and behaviors. Learning Analytics is a relatively new and innovative way of making learner behavior and performances explicit by analyzing significant learners' feedback data. In this study, we take the case of online courses offered by various educational institutions all over India, and the analysis encompasses the population of learners of the online courses during the COVID 19 Pandemic period. Primary data has been collected using Google form when journals, reports, and websites are secondary data collection sources. We classified the data into distinctive parts: the overall learning experience of this course, the fulfillment of the learners' objectives, the difficulty of the assignments, the quality of the material supplied, the difficulty level of the course, the quality of the live session, opinion about the virtual approach of teaching, opinion about the contribution of virtual academic programs on knowledge building, opinion about the impact of virtual mode of teaching on performance, and opinion about the causes affecting students' performance in the virtual mode of learning. The analysis outcomes will guide the host institutions and other similar institutions to design their pedagogy for future online courses more effectively, influencing learner engagement and retention.

Keywords—online learning, online teaching, online courses, feedback data, learning experience, COVID 19, learner behavior, quality of online course, pedagogy, learner engagement, and retention

1 Introduction

The coronavirus pandemic has changed the teaching-learning process at higher education institutions and affected teachers' and students' relationships. Due to the pandemic, universities and colleges can only perform activities online with students [1]. In this regard, many governments have taken measures to ensure the continuity of the education process, and nationally colleges have embraced online learning [2]. Online learning has become an essential part of sustained university/college activity [3]. The paradigm shift could shift students' understanding of the problem, and their perceptions could be different from those observed in past studies.

Online learning has many advantages because it requires student-centeredness; it is more flexible [4]. E-mail, video conferencing, forum discussion, and chat can also enhance learning [5], [6]. Internet technologies have enabled many users to share material simultaneously and have enabled online learning platforms to provide controlled content, controlled time, and controlled processes that respond to learners' needs and learning goals [7]. This can improve students' learning experience, despite some inherent difficulties brought on by this crisis period.

There may be challenges with some online learning platforms that affect motivation and input and may prevent people from feeling as if they are being “plugged in” to a community [8]. Allowing students to adjust to their learning goals, educators can adapt to their needs. Teaching experience and knowledge of online teaching are needed to do so. Since the educational process is mainly done online, these drawbacks might be more common [9]. Teachers may have had to adapt their teaching style because of the online nature of the learning and the time available to adapt. Students are not adequately prepared for an online experience. Therefore, problems have occurred in the institution and among students [10].

We felt it necessary, essential, and necessary to examine whether students are getting used to online learning and whether they are satisfied. This study aims to identify the effectiveness of the online learning experience during the Coronavirus pandemic so that institutions can design effective pedagogy for online courses. As this analysis shows, the transition to online learning will significantly affect students' educational process and understanding of the online environment. Thus, our research can contribute to the effective design and development of future online learning courses.

2 Learning analytics to assess the effectiveness of online courses

Learning Analytics is an evolving area of technology-enhanced learning research. It is based on the idea that online student experiences and other data sources (student feedback) use broad instructional datasets to recognize behaviors, attitudes, learning paths, and patterns that can illustrate potential challenges and areas for improvement in terms of student learning design, delivery, and administration [11]. Learning Analytics refers to data collection and analysis, which is then analyzed to determine learners' success and judge their past and predicted future results [12].

2.1 How learning analytics improves your online teaching

Some of the reasons why learning analytics improves online teaching include the following [13]:

- **Predicts Learner Outcomes:** There is no end to the process of learning. Learners' progress can be tracked using learning analytics, but educators can use this data to predict how well their students will perform. Educators can compare students to other students and historical data to determine if intervention is necessary. Educators can help students succeed by providing extra resources like videos and readings or one-on-one assistance. They can also break up the class into smaller groups to help students work better together. Instead of waiting for students to fail, the ultimate goal should be to aid in their success. In order to make informed decisions, teachers can use learning analytics to get a glimpse of what might happen in the future.
- **Increases Teacher/Trainer Effectiveness & Lesson Plans:** "It is not you; it is me." As teachers, we must constantly evaluate our performance. When students complete an online course, we typically ask for feedback in the form of a survey. This feedback is precious to identify areas for improvement by sifting through the data. As a result, some topics may have been overlooked or spent too much time on others. Learning analytics helps us better understand how to improve the effectiveness of our learning. Real-time data is also a benefit. We can learn how to improve as the course progresses, which is fantastic!
- **Improves eLearning Content and Courses:** Learner and educator performance can be analyzed using data and online courses and content. Even if our video courses are visually stunning, we may need to revisit the content if most students fail to grasp the essential concepts. The presentation of some content may detract from its overall purpose. The inverse is also possible: We might discover that providing extra help for struggling students leads to excellent results. We can then ensure that the content is included in the course for the benefit of all students. Learning analytics allows us to get down to the nitty-gritty of how our content is performing. If they do not work, try something else. Make sure the content is available to as many students as possible if it is effective.
- **Tailored Learner Experience:** Every learner has unique characteristics. They each bring a unique set of skills to the table because of their unique perspectives and personal experiences. Learning analytics can help us tailor learning experiences to suit the needs of different students. It is possible to tailor instruction to student's individual needs rather than imposing a rigid model on them all. Using microlearning activities or mobile learning, we may find that certain groups of students can retain information when delivered in small, bite-sized chunks. We know that some students prefer to learn in real-time, while others prefer to learn at their own pace and on their schedule. Learning analytics can help us better understand what our learners need, creating more personalized learning experiences that lead to better outcomes.

2.2 How can learning analytics data improve online courses?

In the process of evaluating your online course, it is critical to determine what is most important to your institution in terms of outcomes for your students and learners. Your online courses can be improved by using learning analytics. Analytics data can assist trainers in implementing measures that can help learners who fall short of the standards established to succeed in achieving the course objectives. Data from analytics reports can be used to determine whether or not an online course has achieved its stated goals, such as [14]:

- Make your online courses a success by highlighting the positive outcomes achieved by your students in terms of productivity, efficiency, and enhanced job performance (essentially showing an ROI)
- In order to help learners and employees fill in the gaps in their skill sets and knowledge, improve the design and development of your online training courses.
- Looking for better resources and topics that are relevant and interesting in order to increase student involvement
- Automated and timed delivery of reports and dashboards saves time and effort.
- Access to all of your eLearning course data in a safe and secure environment
- Spending more time analyzing your online course's data and looking at the overall picture

In terms of various variables, evaluating learners in this manner may be, such as their overall learning experience, the fulfillment of their learning objectives, the difficulty of assignments, quality of the material supplied, difficulty level of the course, quality of the live session might help the universities/colleges design effective pedagogies for their future online courses.

3 Objectives and methodology

The main objectives of the study are as follows.

- To assess the overall learning experience of students on online learning.
- To identify the fulfillment of the learners' objectives.
- To identify the difficulty of the assignments.
- To check the quality of the material supplied.
- To identify the difficulty level of the course, and
- To analyze the overall quality of the live session
- To analyze the virtual approach of teaching
- To analyze the contribution of virtual academic programs on knowledge building
- To analyze the impact of virtual mode of teaching on performance
- To analyze the causes affecting students' performance in the virtual mode of learning

The data is collected through a self-administered, online circulated, structured questionnaire, fetched 228 responses from 19 states of India. The study was conducted in December 2020, i.e., this online survey was done after completing almost one semester

of online teaching for all undergraduate students’ batches. The respondents were the students who are attending online learning courses to complete their regular courses. The simple learning analytics tool Microsoft Excel has been used to record and analyze the collected data.

4 Findings from the online survey

The total collected responses were 228 in number. The findings are presented in the study’s sequence to examine students’ experiences concerning online learning and determine the answers to stated study objectives.

4.1 Overall learning experience of students on online learning

The participants were asked to share their opinion on “How would you rate the overall learning experience of this course?” The question utilized a 5-point Likert scale (5-Excellent, 4-Good, 3-Average, 2-Poor, 1-Very poor). The responses are tabulated in Table 1.

Table 1. Overall learning experience of the students

| | 5 | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|---------------|---------------|---------------|--------------|-------|
| No. of Respondents | 37 (16.22) | 66 (28.94) | 91 (39.91) | 23 (10.08) | 11 (4.82) | 228 |

4.2 Fulfilment of the learners’ objectives

The participants were asked to share their opinion on “Did the course fulfill your professional/personal objectives?” The question utilized a 4-point Likert scale (4-Highly Fulfilled, 3- Fulfilled, 2-Average, 1-Unfulfilled). The responses are tabulated in Table 2.

Table 2. Fulfillment of learners’ objectives

| | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|----------------|---------------|--------------|-------|
| No. of Respondents | 75 (32.89) | 101 (44.30) | 33 (14.47) | 19 (8.34) | 228 |

4.3 Difficulty of assignments

The participants were asked to share their opinion on “Rate the difficulty of the assignments.” The question utilized a 5-point Likert scale (5-Very Difficult, 4-Difficult, 3-Moderate, 2-Easy, 1-Very Easy). The responses are tabulated in Table 3.

Table 3. Difficulty of assignments

| | 5 | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|---------------|---------------|---------------|--------------|-------|
| No. of Respondents | 48 (21.05) | 98 (42.98) | 39 (17.10) | 32 (14.03) | 11 (4.82) | 228 |

4.4 Quality of the material supplied

The participants were asked to share their opinion on “How would you rate the quality of the material supplied?” The question utilized a 4-point Likert scale (4-Very Good, 3-Good, 2-Fair, 1-Poor). The responses are tabulated in Table 4.

Table 4. Quality of the material supplied

| | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|----------------|---------------|---------------|-------|
| No. of Respondents | 54 (23.68) | 108 (47.36) | 43 (18.85) | 23 (10.08) | 228 |

4.5 Difficulty level of the course

The participants were asked to share their opinion on “Rate the difficulty level of the course.” The question utilized a 5-point Likert scale (5-Very Difficult, 4-Difficult, 3-Moderate, 2-Easy, 1-Very Easy). The responses are tabulated in Table 5.

Table 5. Difficulty level of the course

| | 5 | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|---------------|---------------|---------------|--------------|-------|
| No. of Respondents | 56 (24.56) | 85 (37.28) | 34 (14.91) | 38 (16.67) | 15 (6.57) | 228 |

4.6 Quality of the live session

The participants were asked to share their opinion on “Rate the LIVE session.” The question utilized a 5-point Likert scale (5-Excellent, 4-Good, 3-Average, 2-Poor, 1-Very poor). The responses are tabulated in Table 6.

Table 6. Quality of live session

| | 5 | 4 | 3 | 2 | 1 | Total |
|--------------------|---------------|---------------|---------------|---------------|---------------|-------|
| No. of Respondents | 34 (14.91) | 77 (33.77) | 30 (13.15) | 48 (21.05) | 39 (17.10) | 228 |

4.7 Opinion about the contribution of virtual academic programs on knowledge building

The participants were asked to share their opinion about the contribution of academic programs (Webinars, lecture series, conferences, and training programs) attended by

them in virtual mode on their knowledge building. Responses indicated that online academic programs have a very significant contribution to knowledge building (Table 7).

Table 7. Contribution of virtual academic programs on knowledge building

| Contribution of Virtual Academic Programs on Knowledge Building | Number of Respondents (N=228) | Percentage (%) |
|---|-------------------------------|----------------|
| Very Significant | 109 | 47.8 |
| Significant | 63 | 27.6 |
| Average | 21 | 9.2 |
| Minor | 19 | 8.3 |
| Minimal | 16 | 7.0 |
| Total | 228 | 100.0 |

4.8 Opinion about the impact of virtual mode of teaching on performance

The participants who have been attending virtual classes were asked to share opinions about their academic performance based on the built knowledge to understand the impact of virtual teaching on the students' performance. A cross-tabulation result indicated that the majority of male (40.21%) and female (58.04%) students thought that the virtual mode of teaching was somewhat affecting their performance (Table 8).

Table 8. Impact of virtual mode of teaching on performance

| Gender | NIL | Somewhat | Very Little | Very Much | Total |
|--------|----------------|----------------|---------------|---------------|-------|
| Female | 12 (10.08%) | 68 (57.14) | 26 (21.84) | 13 (10.92) | 119 |
| Male | 18 (16.51) | 42 (38.53) | 26 (23.85) | 23 (21.10) | 109 |
| Total | 30 (13.15) | 110 (48.24) | 52 (22.80) | 36 (15.78) | 228 |

4.9 Opinion about the causes affecting students' performance in the virtual mode of learning

The participants were asked to mention the possible causes affecting performance in the online learning process. The response (Table 9) indicates that most participants (69.4%) shared that the internet connectivity issue is one of the major causes affecting students' performance.

Table 9. Causes affecting students’ performance in the virtual mode of learning

| Casual Factors | Frequency | Percentage (%) |
|-----------------------------------|-----------|----------------|
| Excess academic assignment | 56 | 26.8 |
| Fear of passing exams | 51 | 24.4 |
| Career-related worries | 27 | 12.9 |
| Default learning | 50 | 23.9 |
| Internet Connectivity | 145 | 69.4 |
| Absence of group learning | 64 | 30.6 |
| Personalized approach to learning | 38 | 18.2 |
| Technical know-how about gadgets | 50 | 23.9 |

4.10 Opinion about the virtual approach of teaching

The question was asked to understand the perception of the students about the virtual approach of teaching. The participants were asked to share their opinion about the virtual teaching-learning approach. The participants' responses indicated that a virtual teaching-learning approach is helpful in higher education, followed by convenience, time-saving, and cost-effectiveness (Figure 1.).

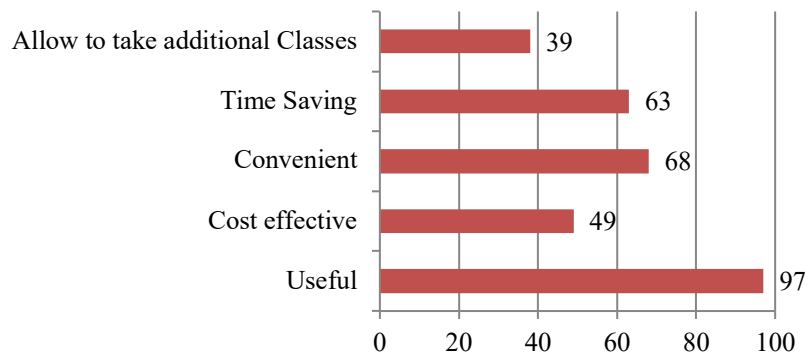


Fig. 1. Opinion about the virtual approach of teaching

5 Discussion

We helped facilitate two significant changes in the higher education system during the Coronavirus crisis: digitization and online learning. It depends on many factors, including the factors analyzed in this study. From the analysis performed, it can be identified that 45.17 percentage students are satisfied with the overall learning experience of online learning and 14.91 percentage of students are dissatisfied; 77.44 percentage of students stated that their learning objectives are achieved, and 8.34 percent of students stated that their learning objectives are not achieved; 64.03 percentage of students stated that the assignments are challenging and 18.85 percent of students stated

that the assignment is easy; 71.05 students stated that the quality of the material supplied is good and 10.08 percentage stated that the quality of the material supplied is low; 61.84 stated the course is challenging and 23.24 stated that the course is easy; 48.68 stated that the quality of live session is suitable and 38.15 stated that the live session is poor.

6 Recommendations

Our rapid study results highlight several factors that can affect the kind of pedagogy that can be developed to improve future online courses' quality. However, it is crucial to highlight the several limitations of this study, starting with the sample size and, most importantly, the fact that it was conducted online, thus excluding the most vulnerable population who is not interested in participating in the survey.

Thus, there is a need for further in-depth research into COVID 19 on online learning. Based on the survey results and the discussions over the lockdown period amongst educationalists and policymakers, we put together the following recommendations. We do not claim that these results are conclusive, but they help identify alarming trends that need further research.

6.1 For policy makers

- Conduct a detailed review of university/college leadership perspectives, teachers, students, and parents to draw up educated post-COVID19 policies and strategies.
- Establish preparedness and recovery policies and procedures due to the lockdown and missed learning.
- Conduct professional training for teachers and students and the administrative staff on online learning/teaching platforms.
- Conduct technical training on the internet, smartphones, laptops, and tablets to teachers and students.
- Strengthen public, private, and non-formal education alliances and collaborations by establishing inter-institutional networks to exchange experiences with private, public, and deemed universities/colleges, students, teachers, and parents' associations.
- The need to enter into arrangements with private internet providers to provide internet to universities/colleges with concessions.
- Electricity is a crucial necessity for online learning and, thus, education ministries need to work on this issue before such a fundamental right is achieved.
- Guidelines and techniques need to be formulated concerning summative and formative assessments.
- Learn from other organizations' experiences, such as those in other countries that have undergone crises/conflicts and natural disasters, and have built programs to provide emergency education.
- Ensure that the right to quality education, particularly for students in rural and remote areas, is fulfilled by offering alternative solutions that do not rely solely on high technology or access to the internet/electricity and high equipment costs.

- Establish online platforms that are open to a wide range of clients.

6.2 For school leadership, administration, and teachers

- Supporting teachers, students, and parents to deal with the technical and psychological lockdown
- Provide online learning with career development
- Involve the students in planning and assessment
- Provide teachers and students with tablets and laptops and cover any extra expenses incurred by teachers and students due to online teaching and learning.
- Create self-administered online education platforms.

7 Conclusions

Our study's observations and conclusions contribute to two types of implications: practical and theoretical consequences. In a time of abrupt and multiple shifts in the higher education system, the study examines how the educational process took place. A set of valuable recommendations can be outlined to improve the educational process's efficiency in the online learning environment practically. Thus, after a long time of adaptation and familiarization of students and teachers with the online learning environment, it is likely that the educational process's consistency will increase and that the view of students about online learning will be more positive and compatible with the goals of online learning. On a theoretical level, another consequence of our results can be found. A Technology Transformation Model (TTM) regarding the plan to use online learning platforms could be built and improved, starting from the conclusions of the studies conducted before the pandemic. A variety of external variables could also be included in the model and evaluated in the sense of exclusive online teaching and learning.

8 References

- [1] A. E. E. Sobaih, A. M. Hasanein, and A. E. Abu Elnasr, "Responses to COVID-19 in Higher Education: Social Media Usage for Sustaining Formal Academic Communication in Developing Countries," *Sustainability*, 2020. <https://doi.org/10.3390/su12166520>
- [2] W. Ali, "Online and Remote Learning in Higher Education Institutes: A Necessity in light of COVID-19 Pandemic," *High. Educ. Stud.*, vol. 10, no. 3, pp. 16–25, 2020. <https://doi.org/10.5539/hes.v10n3p16>
- [3] S. A. El-seoud, I. Taj-eddin, and M. Mohamed, "E-Learning and Students ' Motivation : A Research Study on the Effect of E-Learning on Higher Education," *Int. J. Emerg. Technol. Learn.*, no. August, 2014. <https://doi.org/10.3991/ijet.v9i4.3465>
- [4] S. Dhawan, "Online Learning: A Panacea in the Time of COVID-19 Crisis," *J. Educ. Technol. Syst.*, vol. 49, no. 1, pp. 5–22, 2020. <https://doi.org/10.1177/0047239520934018>
- [5] G. Marinoni, H. Van't Land, and T. Jensen, "The impact of Covid-19 on higher education around the world.IAU Global Survey Report," 2020.

- [6] D. S. Bestiantono, P. Z. R. Agustina, and T.-H. Cheng, "How Students' Perspectives about Online Learning Amid the COVID-19 Pandemic?," *J. Pedagog. Sociol. Psychol.*, vol. 2, no. 1, pp. 45–51, 2020. <https://doi.org/10.46627/silet.v1i3.46>
- [7] M. Suresh, V. Vishnu Priya, and R. Gayathri, "Effect of e-learning on academic performance of undergraduate students," *Drug Invent. Today*, vol. 10, no. 9, pp. 1797–1800, 2018.
- [8] N. Yusuf and N. Al-Banawi, "The Impact Of Changing Technology: The Case Of E-Learning," *Contemp. Issues Educ. Res.*, vol. 6, no. 2, pp. 173–180, 2013. <https://doi.org/10.19030/cier.v6i2.7726>
- [9] OECD, "Education Responses to COVID-19: Embracing Digital Learning and Online Collaboration," 2020.
- [10] E. Aboagye, J. A. Yawson, and K. N. Appiah, "COVID-19 and E-Learning: the Challenges of Students in Tertiary Institutions," *Soc. Educ. Res.*, vol. 2, no. 1, pp. 109–115, 2021. <https://doi.org/10.37256/ser.122020422>
- [11] W. Greller and H. Drachsler, "Translating learning into numbers: A generic framework for learning analytics," *Educ. Technol. Soc.*, vol. 15, no. 3, pp. 42–57, 2012.
- [12] S. KG and M. Kurni, *A Beginner's Guide to Learning Analytics*, vol. 1, no. April. 2021. https://doi.org/10.1007/978-3-030-70258-8_1
- [13] Sam Thompson, "How Learning Analytics Can Significantly Improve Your Online Teaching," *Newrow KALTURA*, 2019. [Online]. Available: <https://www.newrow.com/how-learning-analytics-improve-teaching/>
- [14] Lambda Solutions, "Utilizing Learning Analytics to Assess and Improve eLearning Programs," *Lambda Solutions*, 2021. [Online]. Available: <https://www.lambdasolutions.net/blog/utilizing-learning-analytics-to-assess-and-improve-elearning-programs>

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