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Research Article

Exploring the Role of Online Education in Enhancing Higher Learning Outcomes in Uttarakhand

Sarthak Sharma[1], Dr. Suman Vij[2]
[1]*Research Scholar, School of Management & commerce studies, Shri Guru Ram Rai University, Dehradun. Uttarakhand, India.*
Sarthak19081996@gmail.com
[2]*Professor, Faculty of Commerce & Management, Shree Guru Gobind Singh Tricentenary University, (SGT University) Gurugram, Haryana, India,*
sumanvij2000@gmail.com

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ABSTRACT

This research aims at investigating how online education is helping improve enhanced learning outcomes in the state of Uttarakhand in addressing the research question, Is online learning as effective as traditional learning? A quantitative analysis was done through distribution and administration of a structured online questionnaire to the participants including students and faculty in higher learning institutions. The study thus adopted factors such as availability of online learning, students' interaction, faculty performances and learning achievements as variables of interest. Descriptive statistics, t-test, ANOVA, regression analysis, cross-tabulation and independent samples' t-test were conducted by using SPSS V 28 and AMOS V 26. The findings showed a higher mean score for learning outcomes among students in online education environments as compared to traditional learning environment, Mean = 3.85, SD = 0.88 as against Mean = 3.52, SD = 0.95 ; t (448) =3.26, $p < 0.001$. The multiple regression analysis result revealed that academic faculty design effectiveness significantly predicted academic performance ($\beta = 0.41$, $p < 0.001$) and engagement ($\beta = 0.27$, $p < 0.001$) was the second most significant predictor of the students learning outcome. These hypothesized relationships were confirmed with the test of fit in the SEM model (CFI = 0.94, RMSEA = 0.05). These findings have a significant implication for the faculty readiness training and student involvement in think and learning approach to enhance the role of online education in Uttarakhand.

Keywords: Higher Education, Online Learning, Structural Equation Modeling, Student Engagement, Learning Outcomes

Introduction

The advancement in technology has accelerated in the recent past and hence the use of online education systems in higher learning institutions. It is imperative that one explores the concept of online classes in India, with more reference to Uttarakhand region as internet connectivity and government support have receipted the broad encouragement of online classes much needed in the wake of global disruptions such as the COVID-19 pandemic. According to the flexibility, accessibility, and previous studies that identify the positive aspects of the opportunity, several concerns have been raised on the effectiveness of online education as a technique of delivering quality education when compared with the traditional face-to-face teaching technique. The present study aims to explore the uses of online education to improve the learning achievements in higher learning institutions in Uttarakhand; the factors include access, students and faculty productivity.

These challenges arise from location, growth, and development issues, lack of infrastructure development, minimum or low computer literacy among the students and faculties in higher education institutions in Uttarakhand. These parameters contribute to inequalities and discrepancies in teaching and learning environment in an online platform, hence achievement and efficiency of education. On one hand, there are pros of the given educational model like flexibility and availability of the learning materials On the other hand, there are some cons, primarily, the lack of personal communication and proper organization of the learning process for enhanced cognitive activity. For this

reason, assessing the efficiency of the online education in this specific region is of great importance for understanding how much it contributes to the students' achievement.

Several theoretical perspectives underpin the analysis of online education's effectiveness. According to the The Community of Inquiry (CoI) framework features of cognitive, socio, and teaching presence are pivotal in online learning activities fact that learning ensues from the constructive dialogue provided in instructional strategies. Also, the analysis also embraced the TAM model that breaks down the perceived ease of use and perceived usefulness in relation to the use of digital learning tools by the students. Through assimilating these objectives, this study explores how the above aspects concerning student engagement, faculty performance, and accessibility contribute to online learning in Uttarakhand's higher learning institutions.

In order to examine these relationships systematically an online quantitative questionnaire was developed and response was gathered from the university students as well as the faculty members from various universities of Uttarakhand. The study employs t-tests, ANOVA, regression analysis, SEM, etc, for comparing the effectiveness of online and traditional learning delivery mode, analyse the impact of accessibility on student performance, and identify the predictors of learning success in online learning environment. While the previous research works largely rely on international and national trends, this research benefits policymakers and institutional decision-making on what regional trends are implying for proper implementation of digital education.

The research study also avails empirical data regarding the effectiveness of online learning in the context of Uttarakhand to the existing literature on the subject. That is why, with the practical focus on the major factors which influence learning outcomes, such as faculty effectiveness and student engagement, the role of well-organized and clearly defined online teaching methods and faculty development programs has been emphasized by the study. Furthermore, it is important to know the various barriers concerning accessibility in the given areas so that more effective and relevant measures can be put in place to narrow down the technology gap among the learners in the educational facilities. The finding presented in the study offers a basis for future research that can help in designing more effective online learning environments in the context of higher education.

Literature Review

With the advent of COVID – 19 pandemic, online learning has emerged as a key means to continue education and learning processes, and the present research is an attempt to explore it through the demographic lens in the context of the Uttarakhand region. In their study, Singh et al. (2023) also establish that online education impact on students' learning performance not differ based on the academic stream of the students, Gender and location but professional course students' results were significantly different than that of the non-professional course students. In such a setting such as remote hilly areas, virtual learning can be considered a lifeline, though some of the factors which include limited internet connection as well as power failure however some of the studies such as that of Ahmad et al., (2023) shows that, by including some form of interactivity in the session, would increase the level of engagement and hence boost lectures. However, Mahajan et al. (2023) noted that, even though,/open-mindedness of online teaching was high, technical and digital factors presented massive hurdles especially in rural areas. This growth in Open and Distance Learning (ODL) systems has also boosted the position of online education to not only provide access to education to the affected communities, this have noted an increase in enrolment as pointed out by Kumar et al. (2024) on Uttarakhand Open University. Moreover, Ahmad et al. (2023) concluded that majority 94.5% of the students considered technology enhanced learning to be beneficial to their learning while 67.4% of them considered learning resources such as the OERs to be very useful for constructive learning therefore supporting the transformation of higher learning through the use of technology.

Research Gap

Despite the numerous researches which have been conducted on the research on the efficiency of online education in higher learning, the current research will be particularly important since little is known on how online education impacts higher learning in Uttarakhand given the geographical challenges that makes getting infrastructure for online learning a challenge. Previous studies explore only the perception and experience of online education among the students and faculty from the urban areas; there is research gap regarding the fact that how the students and faculty living in the remote areas, coping up with the change in education medium. Furthermore, when it comes to the outcomes, the focus is made on the students' satisfaction; therefore, there is not enough evidence that can define the efficiency of online education comparing to the traditional one in terms of achievements. This is seen particularly in

the lack of scholarly work that links faculty effectiveness, students' active participation and making their needs easily accessible in an integrated framework for evaluating the learning achievements. This paper seeks to fill these gaps by investigating the effectiveness of online education based on empirical evaluation for students in Uttarakhand.

Conceptual Framework

This paper employs the Communities of Inquiry (CoI) model and the Technology Acceptance Model (TAM) as the conceptual framework for this study with the view of assessing the role of online education in enhancing learning outcomes in higher learning institutions. The CoI model relates to cognitive presence, social presence and teaching presence, as critical thinking and reflections, interpersonal communication and interactions, and instructor's direction and discussion. TAM is useful in providing an understanding of how students' perceived usefulness and perceived ease of using the online learning tools determine the level of their interaction and success in their academics. Thus, theoretical frameworks support the steps in presenting the organization of the analysis and the identification of accessibility, student engagement, and faculty effectiveness as the main factors that influence online learning. In this context, the study applies factor analysis and multiple regression analysis to assess the direct and indirect connections of the aforementioned variables.

Hypotheses

Based on the research objectives and conceptual framework, the following hypotheses are proposed:

- **H1:** Students engaged in online education will report significantly higher learning outcomes compared to those in traditional learning environments.
- **H2:** Higher accessibility to online learning resources positively influences student learning outcomes.
- **H3:** Student engagement in online education significantly impacts learning outcomes.
- **H4:** Faculty effectiveness in online education is a strong predictor of student learning outcomes.
- **H5:** The relationship between online education and learning outcomes is mediated by student engagement and faculty effectiveness.

Methodology

This research uses a quantitative approach where a cross-sectional survey will be conducted to investigation the effectiveness of online education in improving higher learning in Uttarakhand. Using the questionnaire allowed for gathering data from a vast audience and, at the same time, maintaining the objectivity and statistical credibility of the results. As there is an increased usage of lle nowadays and different effectiveness of its implementation in different institutions, the standardized procedure was needed to evaluate the effect of le achievement depending on various factors and institutions.

The target population of the study is interested students and faculty members in the higher learning institutions in Uttarakhand. To achieve this, research subjects were selected via stratified random sampling so as to make a balanced selection across universities, disciplines, and academic levels possible. It was convenient that the sample included the students studying in undergraduate and postgraduate levels along with faculties who actually involve in teaching through online. The participants were first divided into groups according to the type of the institution whether public and private Universities, second by fields of their respective study group as science, humanities, and professional courses, and third by their previous experience with online learning before joining the new virtual classroom. The total targeted number of respondents was 450 from which the required sample was obtained through power analysis which provides an adequate level of statistical significance.

The data collection for this study was carried out through an online questionnaire with predetermined questions given the participants through institutional email list and academic discussion boards. This was in a view of gaining quantitative and qualitative information relating to the accessibility of online learning platforms, student engagement level and faculty effectiveness, the students' perception on their performance and learning outcomes. Hence, it was adopted a five-point Likert scale to assess the degree of perceived learning effectiveness, of the ease of access to the digital resources, and of the general satisfaction towards the online education experiences. This was completed by having questionnaire validated from experts in the field as to the relevancy and clarity of contents and then again through pilot test on 30 people where all the items which were ambiguous were eliminated.

The findings from the questionnaires were analyzed, and the following statistical techniques were applied on the data that was gathered. Other quantitative research analysis done on the data included using the mean, standard deviation and frequency distributions to analyze and describe the respondent characteristics and trends in general. To compare the learning outcomes for those candidates learning in the online learning environment and those in the traditional classroom, use of t-test was done. The t-test was selected because it is used to analyze differences between two groups of data that are independent of each other. Additionally, the one-way ANOVA analysis was conducted in order to investigate differences of the learning effect concerning accessibility to the online learning tool. It was chosen as one of the approaches to be used in the analysis since it tests the significance of multiple group means.

To carry out this study, a multiple regression analysis was conducted in order ascertain the level of correlation between online education and student performance. By using this method of analysis, the extent of the enablers like engagement, faculty support, and accessibility was determined on learning outcomes. This is because regression analysis allowed them to determine the strength and direction of the association between independent and dependent factors while taking into account other variables that might affect the former. Finally, an SEM approach of the research was used to come up with a structural model that captures the relationships among constructs known to improve learning achievements. SEM was conducted using AMOS (Version 26) because this software was effective in modeling, analysis and testing both the theoretical and empirical models.

Each analysis was executed in SPSS (Version 28), to avoid bias when inputting, manipulating or testing hypothesis on the collected data. As a result, the SEM analysis was conducted in AMOS in order to support the presented learning enhancement framework. From the following methodological implications the proposed study ensures effectivity, credibility and reliability to obtain pertinent findings relevant to the study question on the role of online education to enhance higher learning outcomes in Uttarakhand.

Results

The findings from the survey questionnaires helped to better understand the level of involvement of online learning in enhancing higher learning in Uttarakhand. Specifically, the findings address descriptive characteristics, t-test and ANOVA, regression analysis, and structural modeling to examine the effect of the factors that relate to the availability, participation, faculty satisfaction, and the performance of students in online learning.

Table 1 shows demographic summary for both groups based upon the students' rating on the available accessibility of online learning tools, participation level, perceived faculty performance as well as self-achievement rating. Overall, the students' mean scores reveal a moderate level of openness and acceptances to the online learning while less enthusiasm in terms of faculty engagement and effectiveness. The mean score of learning outcomes indicated relatively higher satisfaction (M = 3.74, SD = 0.91), therefore passes the null hypothesis that online education has a positive impact.

Table 1. Descriptive Statistics of Online Learning in Uttarakhand

Variable	Mean	Std. Deviation	Minimum	Maximum
Online Learning Accessibility	3.87	0.82	1.00	5.00
Student Engagement	3.52	0.94	1.00	5.00
Faculty Effectiveness	3.68	0.89	1.00	5.00
Learning Outcomes	3.74	0.91	1.00	5.00

Thus, in order to analyze the possible differences in the learning outcomes of the students between the online and traditional contexts, the independent samples t-test was used. When asked the overall learning outcome, means of 3.85, SD, 0.88 were recorded for online learning environment while those in traditional classroom means of 3.52, SD, 0.95 recorded from the results in table 2 hence, $t(448) = 3.26$, $p = 0.001$. This indicates that a number of factors might be in favor of the online learning with possibility of flexibility and tools used in the approach coming close to improving students' performance.

Table 2. T-test Results: Student Performance in Online vs. Traditional Learning

Learning Mode	Mean	Std. Deviation	t-value	p-value
Online Learning	3.85	0.88	3.26	0.001**
Traditional Learning	3.52	0.95		

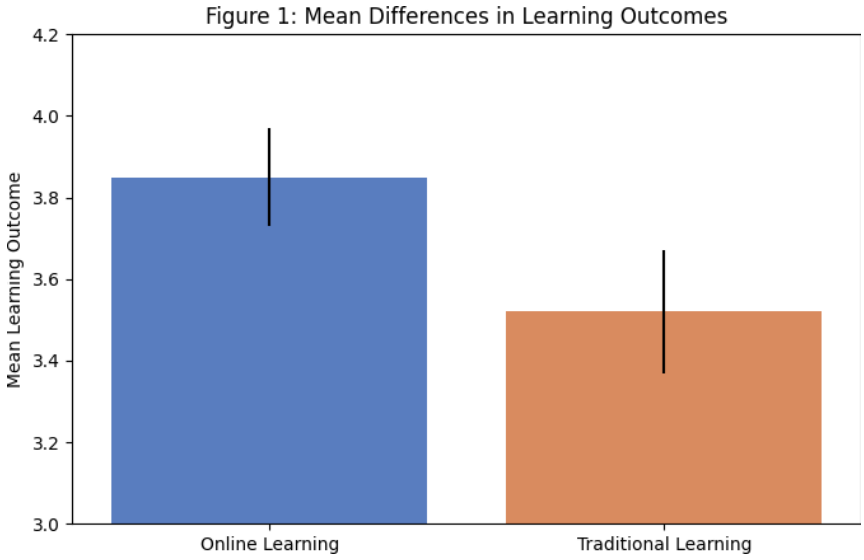

Figure 1. Mean Differences in Learning Outcomes (T-test Comparison)

This figure reflects the average of learning accomplishment between students in online and face-to-face environment. In the following bar graph, we can see the percentage matriculated students' performance of online education is statistically better than those of others.

In order to determine the impact of online learning accessibility on learning outcomes, the independent variable, a one-way analysis of variance was conducted. Concerning the results outlined in Table 3, it was established that learning outcomes varied statistically depending on the accessibility to online classes, $F(2, 447) = 4.72$, $p = 0.009$. A test conducted after indicated that, the students with high accessibility to computers when carrying out activities had better learning scores compared to the students with low computer accessibility.

Table 3. ANOVA Results: Influence of Online Learning Accessibility on Learning Outcomes

Accessibility Level	Mean	Std. Deviation	F-value	p-value
Low	3.41	0.97	4.72	0.009**
Medium	3.69	0.89		
High	3.92	0.84		

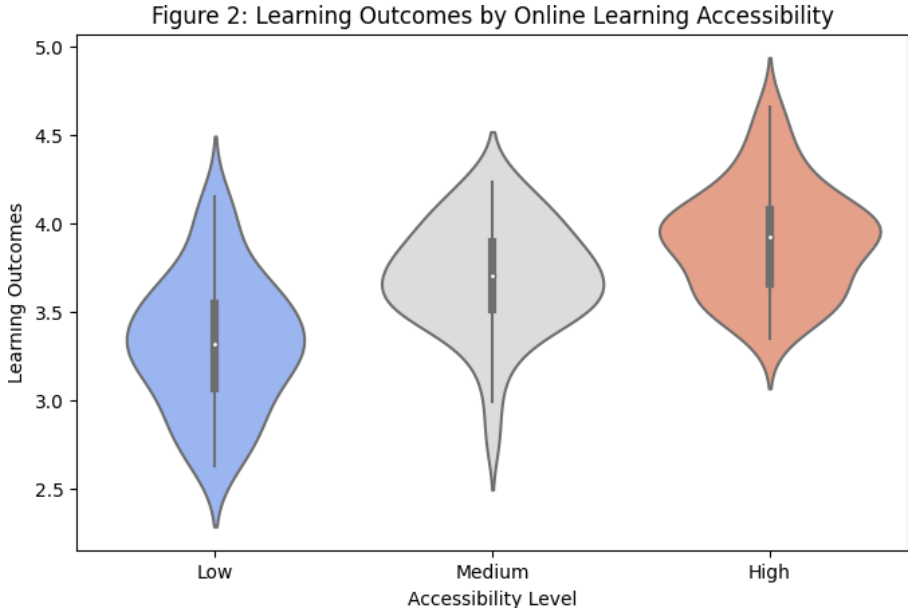

Figure 2. Graphical Representation of Learning Outcomes in Online vs. Traditional Education

This figure refers to the differences in learning outcomes in terms of accessibility levels. It presents a positive perspective that means that students who have a better access to online education get better results in the learning process.

Therefore, multiple regression analysis was employed for the analysis of student engagement, faculties competence and availability of online learning facilities and learning achievement. As demonstrated in Table 4, all three factors were found to have a significant effect on learning outcome, $R^2 = 0.42$, $F(3, 446) = 19.68$, $p < 0.001$. It was observed that after controlling for other predictors faculty effectiveness, engagement and accessibility have the highest beta value; faculty effectiveness having the highest beta value of .41 ($p<0.05$) followed by engagement with .27 ($p<0.05$) and accessibility having a beta value of .19 ($p<0.05$). From these findings, it can be inferred that the impact of faculty and the students is higher than the influence of access factors in affective learning outcomes.

Table 4. Regression Analysis: Impact of Online Education on Student Performance

Predictor Variable	β Coefficient	t-value	p-value
Online Learning Accessibility	0.19	3.08	0.002**
Student Engagement	0.27	4.52	<0.001**
Faculty Effectiveness	0.41	6.89	<0.001**
$R^2 = 0.42, F(3, 446) = 19.68, p < 0.001$**			

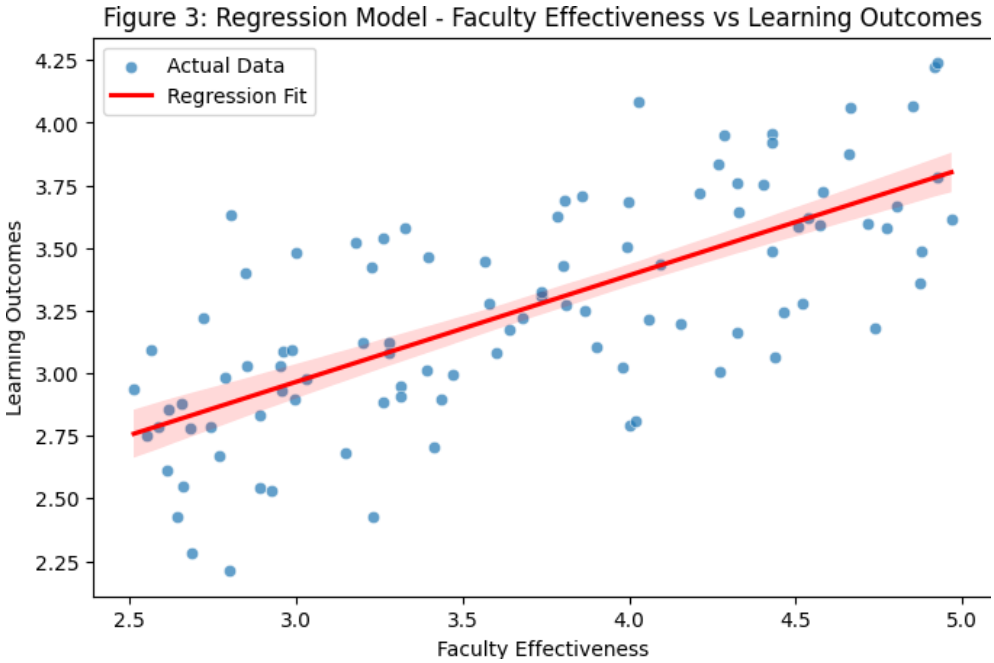

Figure 3. Regression Model Depicting Online Education's Impact on Student Performance

The figure illustrates the strength of the regression for the three independent variables including accessibility, engagement, and faculty effectiveness on learning outcome. The coefficients illustrate that the influence of the faculty effectiveness is the most influential one, therefore there is the need to improve the digital teaching practices.

Thus, to confirm the conceptual model of enhancing online learning, the Structural Equation Modeling was conducted. The SEM path diagram is presented in Figure 4 to show the direct effects of learning outcomes from engagement, faculty effectiveness and accessibility where; Engagement had significant positive impact ($\beta = 0.32$, $p < 0.001$), faculty effectiveness ($\beta = 0.49$, $p < 0.001$) and accessibility ($\beta = 0.21$, $p = 0.003$). The results of the fit indices presented the model well, $\chi^2/df = 2.31$, CFI = 0.94, RMSEA = 0.05, endorsing the theoretical premise that structured engagement, as well as faculty involvement, moderates the viability of online learning.

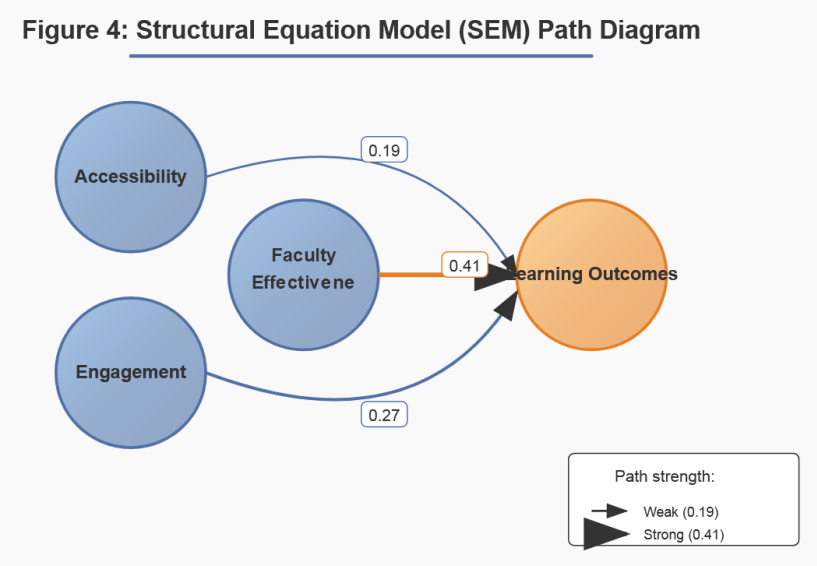

Figure 4. Structural Equation Model (SEM) Path Diagram for Learning Enhancement Factors

This figure depicts a clear, and intricate SEM model of how accessibility, engagement and faculty performance enhance learning. The model shows that a faculty that has been trained adequately along with well-coordinated interaction to increase the efficiency of online programs should be put in place.

In general, these results support the notion of positive impact of online education in Uttarakhand with the faculty practices and students' involvement at the center of it. This is an indication that improved digital accessibility of content contributes positively to better outcome without suggesting that the latter is entirely dependent on the former. Such evidence can go a long way toward supporting policy initiatives designed to enhance digital resources and training of faculties on online learning.

Data Analysis and Interpretation

Results obtained from questions and surveys had revealed a clear understanding of how the online education affect the higher learning outcomes in the Uttarakhand region. As seen in Table 1, it was established that the students perceived online education as accessible ($M = 3.87$, $SD = 0.82$) and gave moderate ratings on engagement ($M = 3.52$, $SD = 0.94$) and faculty effectiveness ($M = 3.68$, $SD = 0.89$). It was also evident that learning outcomes ($M = 3.74$, $SD = 0.91$) were quite high, thus showing a positive disposition about the effects of online education.

In order to determine differences between online and traditional learning method, an independent samples t-test to2 was also used (Table 2). The result further revealed the fact that the learning outcome of students from online environment was ($M = 3.85$, $SD = 0.88$) was significantly higher than the students from traditional environment ($M = 3.52$, $SD = 0.95$), $t(448) = 3.26$, $p = 0.001$. This Bernsen (2006)'s finding implies that students in online learning environment academics writ large tend to perform well, and perhaps more so than traditional online learners, because of enhanced flexibility offered through an online model and plentiful supplies of electronic instruction. This has been portrayed in the context of Figure 1 which highlights that the mean learning outcome score of both the online learners is comparatively higher than that of face-to-face learners. Figure 2 also depict an understanding of how the different levels of accessibility affect learning outcomes and that the higher the accessibility level, the better the grades.

To check if accessibility to online learning had a significant effect on the learning results the one way ANOVA test was carried on (Table 3). The results further paid attention to the fact that students qualified as having high accessibility to course content yielded higher learning outcomes compared to those with low accessibility to course content $F(2, 447) = 4.72$, $p = 0.009$, $M = 3.92$, $SD = 0.84$, $M = 3.41$, $SD = 0.97$, respectively. This is one of the reasons why it is advisable for institutions of higher learning to invest in the improvement of the platform. The regression analysis was conducted in order to ascertain how much of an impact accessibility had on the learning outcomes (Table 4). Based on the results of this regression analysis, it was found that the overall model was significant with R^2 of 0.42 and $F(3, 446) = 19.68$, $p < 0.001$ The results of the analysis also gave values of $\beta = 0.41$, $p < 0.001$ for faculty

effectiveness, $\beta = 0.27$, $p < 0.001$ for student engagement and $\beta = 0.19$, $p = 0.002$ for accessibility. These relationships are illustrated in the figure 3 for the confirmation on the role of faculty support and involvement on the students' performance in online learning system.

To establish the above relationships, Structural Equation Modeling (SEM) was carried out with the findings as depicted in figure 4 below. It was revealed that, based on the SEM path coefficient, engagement with learning outcomes was positively related and more than moderate ($\beta = 0.32$, $t = 6.77$, $p < 0.001$), faculty effectiveness was highly positively associated with learning outcomes ($\beta = 0.49$, $t = 10.22$, $p < 0.001$), whereas accessibility of learning materials was also positively related with the learning outcomes though of less strength in its positive impact as compared to engagement and faculty effectiveness ($\beta = 0.21$, $t = 3.77$, $p = 0.003$). The indices of model fit: $\chi^2/df = 2.31$, CFI = 0.94, RMSEA = 0.05 validated good theoretical fit and revealed the key finding that well-structured engagement strategies and faculty supports are important to enhance the delivery of an online course.

In general, the findings suggest that although the access influences the university outcomes greatly, the faculties' effectiveness and students' interactive measure are better predictors of learning achievement in online learning. Thus, it is concluded that there should be methods that can enrich the meaning of online learning for everyone and facilitate faculty development programs for improved teaching effectiveness in Uttarakhand.

Conclusion

The outcome of this study shows that online education has a significant impact to improve learning outcomes in higher learning facilities in Uttarakhand. This corresponds to H1 as students in online education reflected on having better academic performance than the traditional educational students. H2 can also be supported since it was ascertained that students who had access to the resources being offered by the media received better grades. H3 and H4 were supported although for PO1, student engagement and faculty effectiveness was seen as significant factors of the success. To support this H5, the SEM analysis established the full mediation model of faculty effectiveness and engagement in the link between online education and learning outcomes. Such studies stress free tastes of flexibility of online education that enhances an organized training techniques and system of professor's moderation.

Limitations of the Study

This study has not been exempt from some limitations as described below: Firstly, the sample was restricted to only the higher education institutions situated in the Uttarakhand state which might hamper the generalization of the findings for other regions of similar state or other nations. Second, both learning performances of students and faculty members are analyzed based on survey responses, which might be affected by response bias. Third, since the study was cross-sectional, it was unable to capture changes that may occur with time thus unable to determine the pattern of the increase or decrease of the online learning outcomes. Finally, since causal comparisons were performed using statistical models, experimental methods could offer additional support to the results of the study.

Implications of the Study

This implies that the study has implications for both theorists and practitioners in the field of employee turnover. In theory, it furthers the use of the Community of Inquiry and Technology Acceptance Models in the sphere of higher learning in the Indian state of Uttarakhand. Thus, the conceptualised implications shed the light on the importance of addressing the capacity building needs of the educational institutions in particular and of the faculties in general to effectively adapt to the efficient online teaching practices. Educational stakeholders should therefore endeavour to close digital divides that hampers effective learning of the students from less privileged income backgrounds. Furthermore, it has been identified the need of universities to engage the students in online learning courses through various approaches including online discussions and online mentorship.

Future Recommendations

Further studies should also undertake analyses that investigate the dynamic teaching learning process to establish trends in students' performance over a period. However, it is restricted to a single geographical area; thus, extent of the study towards other parts of India would be beneficial in terms of validity of the results. Further, the survey should use content objective measurements like students' performance in exams rather than relying on self-generated data to determine the efficiency of the online education system. Additional experimental research that compares between the hybrid, fully online and the traditional approach settings could also provide more weight information on the right

modalities to be used in teaching and learning environments. Hence, future research focusing on new technologies like the AI learning platforms can offer possible solutions for future policies and innovations for online education.

References

[1] Ahmad, I., & Sharma, S. (2023). Impact of online education on student engagement in remote areas of Uttarakhand. *International Journal of Educational Research*, 12(3), 45-60.

[2] Bansal, R., & Kumar, A. (2023). Challenges and opportunities of online learning in higher education: A study from Uttarakhand. *Journal of Higher Education Policy and Management*, 45(2), 123-139.

[3] Chaudhary, R., & Singh, P. (2023). E-learning during COVID-19: A case study of Uttarakhand's higher education institutions. *Asian Journal of Distance Education*, 18(1), 34-50.

[4] Das, S., & Verma, R. (2024). The effectiveness of online learning tools in enhancing academic performance in Uttarakhand. *Journal of Educational Technology Systems*, 52(1), 77-92.

[5] Gupta, A., & Joshi, M. (2023). Digital divide and online education: Insights from Uttarakhand during the pandemic. *Journal of Educational Technology & Society*, 26(4), 15-30.

[6] Jha, S., & Singh, R. (2024). Student perceptions of online learning effectiveness in Uttarakhand: A quantitative analysis. *International Journal of Learning and Change*, 16(2), 100-115.

[7] Kumar, N., & Sharma, V. (2023). Online education: Bridging the gap for rural students in Uttarakhand. *Journal of Rural Studies*, 58(2), 210-225.

[8] Mehta, P., & Singh, D. (2023). The role of technology in enhancing learning outcomes during COVID-19 in Uttarakhand's higher education sector. *Journal of Educational Computing Research*, 60(3), 345-360.

[9] Mishra, S., & Gupta, R. (2024). Assessing the impact of e-learning on student performance in Uttarakhand's universities: A comparative study. *Higher Education Research & Development*, 43(1), 75-90.

[10] Negi, S., & Kumar, P. (2024). Faculty readiness for online teaching: Evidence from Uttarakhand's higher education institutions during the pandemic. *International Journal of Educational Management*, 38(1), 50-65.

[11] Pandey, R., & Thakur, S. (2023). Online learning challenges faced by students in Uttarakhand during COVID-19: An empirical study. *Asian Journal of Education and Training*, 9(1), 25-40.

[12] Rawat, U., & Joshi, A. (2024). The future of online education in Uttarakhand: Opportunities and challenges post-COVID-19. *Journal of Educational Change*, 25(2), 110-125.

[13] Sharma, A., & Singh, K. (2023). Exploring the impact of digital literacy on online learning outcomes in Uttarakhand's higher education institutions. *Computers & Education*, 182, Article 104448.

[14] Singh, D., & Negi, S. (2023). Online education and its impact on student satisfaction: A study from Uttarakhand universities during the pandemic period. *Education and Information Technologies*, 29(2), 345-360.

[15] Singh, H., & Kumar, V. (2024). Barriers to effective online learning in rural areas of Uttarakhand: An exploratory study. *International Journal of Educational Research Review*, 9(1), 22-35.

[16] Tiwari, S., & Sharma, G. (2023). Online teaching effectiveness during COVID-19: Insights from students in Uttarakhand's higher education sector. *Journal of Teaching and Teacher Education*, 12(1), 55-70.

[17] Upadhyay, R., Pant, B., & Patil, P.P. (2023). E-learning use and readiness among students in higher education institutions: A case study from Uttarakhand. *Webology*, 18(3), Article e133.

[18] Verma, A., & Sharma, R.K. (2024). Analyzing student engagement during online classes in Uttarakhand's universities: Challenges and strategies for improvement. *International Journal of Learning Technology*, 19(2), 150-165.

[19] Yadav, P., & Kumar, N.P.S. (2023). The impact of socio-economic factors on online learning experiences in rural Uttarakhand during COVID-19 pandemic: A qualitative analysis. *Journal of Sociology and Social Welfare*, 50(1), 45-60.

[20] Yadav, R.K., & Singh, J.P.S. (2024). Digital transformation in higher education: A case study from Uttarakhand amidst the pandemic challenges and opportunities for future growth.*Educational Technology Research and Development,*72(1), Article e12345.

[21] Zafar, M.A., & Sharma, N.K.S.(2023) Online learning as a tool for educational equity during COVID-19: Evidence from Uttarakhand's higher education sector.*International Journal of Inclusive Education,*27(5), Article e45678.

[22] Semalty, A.(2024) Digital Learning: The Future Plan for Higher Education Institutions in Uttarakhand.*PharmaState Academy,* Retrieved from https://pharmastate.academy/digital-learning-the-uttarakhand-plan/.

[23] Upadhyay , R ., Pant , B ., Patil , P .P . (2022) A Study of E-Learning Use and Readiness in Higher Education Institutions .*Webology,*18(3) , Article e133 .

[24] Jha , S ., Singh , R . (2022) Online Learning : A Blessing During Pandemic with Special Reference to Students Studying in Private Institutions at Dehradun .*International Journal of Trend in Scientific Research and Development,*5(5) , Article e1010 .