

Is Online Learning Better than Offline Learning?

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ABSTRACT

Traditional classroom infrastructure has been completely replaced by digital platforms such as Zoom, Microsoft Teams, Google Meet, and others during the COVID-19 pandemic. The primary objective of this research is to empirically verify the research question "Is online learning providing better academic performance than offline (face-to-face) learning?". Statistical tools and methods such as descriptive analysis, independent t-test, and Analysis of Variance (ANOVA) were used to validate our research question. The research findings show that a marginal positive impact is evidenced in offline learning and there is no gender-based performance differences in online learning. The insights of this research are useful for institutional heads for policy and strategic decision making, to create an interactive learning environment.

Keywords: *Online learning; Offline learning; Gender; Student Academic performance*

INTRODUCTION

The COVID-19 pandemic has changed the world and the educational sector is no exception. Hiremath et. al., (2021), notes that there is an array of learning and development reports such as the UK L&D Report, 2019; Deloitte, 2019; and LinkedIn Workplace Learning Report, 2019 and the "Future of Jobs" Report, 2017 which have all provided evidence to indicate that digital learning is a fast-emerging option for imparting education to students. Online learning platforms and their services have been high priority resources during the COVID-19 pandemic. Online learning is a way of connecting with students and it has proven to be unavoidable during crisis situations (Dhawan 2020). Online learning provides anytime, anywhere resources with strong search capabilities and rich interaction for effective learning. Some striking differences between online and offline lectures are psychological significance and potential relevance to learning (Paul & Jefferson 2019). Further, Wolverson & Tanner (2019) proposed the use of synchronous online discussions to develop the important skill of effective online professional communication and ameliorate students' fear of digital public speaking. In another earlier study, small groups elicited the highest student satisfaction and scored highest in critical thinking, and online discussions provided the best forum to express thoughts (Hamann et al., 2012).

Higher education institutions have continued to expand their offering of online degrees, thereby encouraging students to enrol in online courses (Tabatabaei et al., 2012). A historical review of research by Lee (2017) highlighted the importance of accessibility in online higher education. These reviews revealed that online learning provides on-demand and just-in-time education, providing information to learner's timely request, and learning is embedded into the flow of everyday activities. Interaction is also controlled by context and learners actively controlling their learning process. Social influence has been found to have a significant influence on behavioural intention and behavioural intention has a significant influence on Moodle Learning Management System usage among business students (Aliyu et al., 2019). On the other hand, Massive Open Online Courses (MOOCs) and Open Educational Resource (OER) initiatives have been intensively discussed in larger educational and social spheres. But there is a scarcity of literature on the empirical methods used to analyse the differences between online and offline learning specifically as it relates to the academic performance of learners. This research contributes by analysing student academic performance in offline and online learning. The outcome of this research will be

useful for decision makers in the delivery of improved and more effective learning services to students. In this paper we present existing literature on online learning platforms in the context of students, faculty, and institutional perspectives during COVID-19. We then discuss the online learning infrastructure that physically spreads over an academic campus, and we explain the research methodology. The research findings and the limitations of the research and conclusions are presented.

LITERATURE REVIEW

In the context of a socio-cultural perspective, important aspects of learning include use of tools and development of artifacts. Teachers are expected to work with student's phonological awareness in a structured way, taking as their starting point the student's experiences, creativity, and interests. There are various communication techniques such as unidirectional, contributed and others used in teaching. In unidirectional communication, teachers dominate the discussions for knowledge transfer and students passively receive it. In contributed communication, interactions between teachers and students take place to share the knowledge. Multimedia and mobile media also accounts for differences giving birth to student experiences in online learning. Social media such as Facebook, Twitter, WhatsApp, LinkedIn, YouTube, and others are harboured for learning and engagement. Researchers have also examined multimedia tools for learning and how media differences entail different student experiences (Crook & Schofield 2017). Earlier studies have also examined digital tools and use of the tablet as a mode of learning, compared with traditional writing tools (Wollscheid et al., 2012).

A case study conducted by Zabadi & Alawi (2016) on 371 students from different faculties at a university in Saudi Arabia showed that participants held a positive attitude towards e-learning and their attitude results varied significantly by gender, technology usage and skills. In another study (Agelii Genlot & Gronlund 2016), a group with ICT skills and another group without these skills were compared to check their mathematical literacy. Both boys and girls were found to lack mathematical skills, but ICT enabled written communication skills, peer skills and social interaction leading to mathematics learning. Mobile device effects were analysed in teaching, and learning (Sung et al., 2016) and were found helpful in learning with great potential, irrespective of whether students were in the classroom. Mobile technology has also been found to have a positive effect on student perceptions of collaborative learning, but during class they were found disengaged (Heflin et al., 2017). Using an instructional design perspective, Ouyang & Scharber (2017) found that students had the ability to progressively form an interactive online learning community.

Chen-Chung Liu et al. (2017) investigated free teaming and found that among students there was a positive impact on their engagement, with no gender differences (in-degree centrality) and degree of activity (out-degree centrality) in their social network. Lee et al., (2017) studied the use of YouTube videos in the learning process and noted that it can facilitate online self-directed learning (SDL). According to Gvili & Levi (2018) Electronic Word of Mouth communication (eWOM) channels drive social capital and credibility in online learning, a view also developed by Dahl et al., (2018) whose research focused on omni channel touch points for better learning. In earlier studies that examined differences in attitudes toward e-learning Sebnmen (2015) and Churi et al., (2014) noted that the mean score on female student attitudes toward e-learning was higher than the mean score for male students but was not statistically significant. Further, factors such as ease of use, perceived usefulness, users' competencies, and facilitating conditions have been found to predict the behavioural intention of faculty and students to use e-resources. Inaccessibility of subscription e-resources, inadequacy of computers and information literacies and poor Internet connectivity have also been found to limit the usage of e-resources and learning therefrom (Mollel et al., 2019).

Online Learning on Student Perspectives during the COVID-19 pandemic

Eslamian et al., (2019) showed that variables such as digital technology acceptance, attitudes toward technology, cloud-based services and capacity of IT-based systems significantly influenced students' productivity. The tools such as Microsoft Team, ZOOM, Google Meet, and other platforms were used for online learning during the pandemic. However, Almahasees & Qassem (2021) noted that the efficacy of online learning platforms such as Zoom, and Microsoft Teams is less when compared with face-to-face learning. This finding contrast with student observations and experiences of online learning in New Zealand during the pandemic where Perera et al., (2021) found that online learning had a positive impact on student course success rates and course ratings when compared to the rates achieved from face-to-face delivery. The research has also included societal aspects, for example, Social Construction of Technology (SCOT) theory was used to examine the relationship between gender differences and Internet use among Indian students and the results revealed a significant gender difference among tertiary education students in using the Internet for learning potential (Singh & Sandhu 2021). Learning outcomes of online classes has also been found to be greater or equal to the physical classroom settings (Maini et al., 2021) and flipped classrooms are beneficial, and useful for the future of student learning (Latorre-Coscolluela et al., 2021). Looking at comparative groups, Churi et al., (2021) found no effect between online learning and traditional learning among Indian and Turkan students. A quality difference was found between the online and traditional learning perceived by Indonesian and Jordan students (Istijanto 2021) and there is a significant difference on student's satisfaction in online education (Hamdan et al., 2021). Ho et al., (2021) in a recent analysis of student acceptance of e-learning using the Technology Acceptance Model found that students who have an academic coach perform better than those who do not have a coach. In regard to student evaluations, Baldo et al., (2020) noted no difference between the online and paper-based formats in student teaching evaluations but acknowledged that there can be difference in quality.

Although the findings of many studies have been published on different dimensions of online learning, there is limited research that compares the online and offline learning platforms in the context of student's academic performance.

Online Learning on Faculty Perspectives during COVID-19

Most faculty perceptions of online courses are positive, but more preparedness is required to implement online pedagogy (Valsaraj et al., 2021, Zizka & Probst 2021). In addition, the literature shows that sufficient levels of support are required from teachers to students for comfortable online classes (Kulal & Nayak 2020). Factors such as user-friendliness, convenience and performance are noted for encouraging university teachers to adopt e-learning systems (Patra et al., 2021), and the findings of a study in Kuwait has noted an important proactive role for head teachers and the principal (Alsaleh 2021) in their leadership on issues of learning loss, memory loss and communication loss. The research suggests that head teachers and principals should take proactive roles to facilitate learning and diminish any negative consequences. Conversely, barriers encountered during the COVID-19 pandemic such as lack of basic facilities, family interruption during teaching, external distraction, and conducting assessments were faced by teachers (Joshi et al., 2021) in online learning. Nevertheless, the literature posits small group learning, community building, cloud-based learning, accessible technologies, and different methodologies that could promote flexible, productive opportunities for learning and at the same time support the organization.

Despite these opportunities there is a gap from a holistic angle when taking all the parameters into account for e-Learning.

Online Learning on Institutional Perspectives during COVID-19

A holistic perspective of online learning at the institutional level is important for policy makers. The barriers and facilitators of adoption and implementation of online learning is highlighted in the literature in the face of challenges (Cassar et al., 2020, Brahmkar et al., 2021). Further, the importance of digital community (Mbambo-Thata 2021), cloud-based e-learning system (Teng et al., 2021), instruction planning for primary schools (Ho et al., 2021) and pedagogical differences between online and face-to-face teaching (Cohen 2021) have been discussed specific to the COVID-19 situations. The impact of connectivism-based key ideas such as community-building, heutagogy or self-determined learning, and motivation on creation of online learning environments are discussed by Syme-Smith et al., (2021), during a period in which the COVID-19 public health crisis demonstrated the unprecedented capability to embrace rapid and profound change as noted in the European cross-border multi-campus context (Pucciarelli & Kaplan 2021). Academic libraries help learners in the online space to become both information rich and digitally competent (Martzoukou 2021), while the flexibility, productivity, social connectedness, organization culture, technology support and leadership have been posited as important for virtual collaboration success (Mitchell 2021). In a bibliometric and descriptive review of literature on instruction planning of e-learning and use of the platforms such as augmented reality (AR) and virtual reality (VR) and artificial intelligence (AI) it was noted that these are important resources in corporative training. The important elements that should be considered for e-learning are - control of the self-learning process, classification of cultural profiles, learner's feedback, content, and delivery mode of instruction (Kaizer et al., 2020). Through the lenses of technological, pedagogical, and content knowledge, strategies such as clear and consistent design, developing a detailed syllabus, creating a learning community, instructor presence, and prioritizing free educational materials (Mucundanyi 2021) can be driven. Higher Education Institutions and the Massive Open Online Course (MOOC) providers play a crucial role in developing intellectual human assets for flexible and cost-effective learning facilities (Anand Shankar Raja, & Kallarakal 2021). In addition, cloud-based m-learning offers a positive self-reported impact on students' learning and can be effectively implemented to enhance learning in higher education institutions with a paucity of resources (Okai-Ugbaje et al., 2020). The knowledge and attitudes of digital citizens as well as their perceptions on sensitivity training taking into consideration the technological aspects in online learning are no less important (Karaatmaca et al., 2021). A case study by Tang & Lam (2014) highlighted the key factors that lead to sustainable online learning community. Institutional perspectives of online learning are important for strategic budgeting, policy making and helpful for future directions of educational services.

The advantages of using online learning includes the large number of available tutorials which are diverse, well-organized, and inexpensive to obtain. As noted by Mbaeze et al., (2010) there is no statistically significant relationship between ICT and students' academic performance and most of the research in this area suggest that services offered by online learning provide tremendous benefits, but the controversies of online learning services are also widely researched. This study is investigating the effectiveness of online learning platforms specific to academic performance of postgraduate students. Quantitative analysis is important to measure the effectiveness, which is helpful for the decision makers of any academic institute.

Based on the literature review and on our own intuition, we propose the following research questions: *how does online learning affect the academic performance of postgraduate students in comparison to offline learning? Are there any gender-based performance differences in online learning?*

RESEARCH METHODOLOGY

Most of the researchers have approached online learning as a summative endeavour, that is, researchers used quantitative methods to examine the instructor's frequency of interactions with

students. Other studies used qualitative methods to explore students perceived sense of community during online learning. But there is limited literature supporting the impact of online learning in academic performance of students. This research is an attempt to empirically analyse students' academic performance via the Zoom online platform. Zoom is a proprietary video teleconferencing software program and is one of the most popular online learning platforms in use since the start of the pandemic. Features of Zoom include one-on-one meetings, browser extensions, group video conferences, screen sharing, ability to record classroom interactions and all these can be automatically transcribed. We used the paid version of Zoom for all the sample courses for seamless connectivity. The mode of learning via zoom can be further subdivided into one-to-one meetings, conferences, recordings, screen sharing and others. To explore and understand students' academic performance systematically, we used *descriptive statistics, independent t-test, and ANOVA*. SPSS software for data analysis and hypothesis testing is undertaken to evaluate the significance of each factor.

A popular Indian university has been considered for our research as a case study. Table 1 below shows the indicative list of online learning facilities and services available to all students (undergraduate, postgraduate, and doctoral) studying in this university. The video lectures are delivered in synchronous and asynchronous formats since the advent of COVID-19. Students can listen to the live lectures and ask questions to the professor simultaneously in synchronous online classes. But in asynchronous classes, pre-recorded lectures with voice-over power point slides are shared to students and questions are texted using message boards and emails. Feedback can reduce students cognitive load and are important for those who are novices or are struggling, so, we used synchronous online learning platform for our research analysis.

Table 1: Infrastructure facilities for Learners in Online environment

<p>Online learning Hardware - Servers, Desktop clients, Laptop clients, Mobile Phones, Printers, Network (Wired and Wireless), Router, Firewall, WiFi Devices, Backup Storage, Video Conferencing System, LED Television, Projectors, Closed-Circuit Television, Video and Rally Cameras, Interactive Display, Visualizer-Documents Camera, Scanners, Audio Mixer Amplifier, Wireless Handheld microphone and Speakers.</p>
<p>Online learning software (Licensed and open sourced) - Learning Management System (Moodle, MOOC, Coursera), Statistical Packages (SPSS, E-Views, R), Anti-Plagiarism Software, Industry Databases (CMIE-Prowess, Bloomberg), Video Interaction System (ZOOM, Google Meet, WebEx), Content Creation System (Microsoft Power Point, Adobe PDF, YouTube Edu), Chatting System (WhatsApp, WeChat, Slack), Website Management System (PHP, WordPress, Drupal), Online Proctoring software and others.</p>

Sample Description

Students from postgraduate (Master of Business Administration, Post Graduate Diploma in Management) disciplines enrolled in elective courses comprised the respondents for our research analysis. Each elective course carries 3 credits, delivered over 24 sessions with a session duration of 75 minutes. A total of 409 students were selected as the sample for our study. These students were enrolled in five different courses and each course was taught by a different member of the faculty. The course content and delivery methods are same for online and offline students. The disengaged behaviour such as unresponsiveness, lack of eye contact, sleeping during classes,

posture, and facial expressions are addressed with the help of *video and screen sharing* facility available in the Zoom software. The course faculty could randomly select a student to share his/her screen to monitor the engagement. Chen-Chung Liu et al., (2017) revealed that networked learning had a positive effect on student engagement in terms of their perception and increased student motivation to learn. To achieve this, course faculty adopted the *breakout room* facility available in Zoom which provides peer-based learning. All the enrolled students in the sample have already studied the basic core courses as prescribed in their first-year curriculum and elective course enrolment is purely on a student's interest. So, we assume that students are self-motivated and willing to learn with high interest for their skill development. The studies by Heflin et al., (2017), Sung et al., (2016) and Mbaeze et al., (2010) that were reviewed in the literature lend support for testing the following hypotheses H_0 , and H_1 .

H_0 : Mode of learning does not have a significant impact on student's academic performance.

H_1 : Mode of learning has a significant impact on student's academic performance.

DATA ANALYSIS AND FINDINGS

Descriptive Statistical Analysis

Each of the sample course contains many components (quizzes, assignments, mid-term examinations, team presentations and end of term evaluations) for evaluating a student's academic performance. The final total score gained (out of 100) by the students includes all the above specified components. Table 2 shows the sample results of descriptive statistics where the mean academic performance for online learning is 71 and for offline learning is 73. The results are also depicted as a boxplot in Figure 1. We infer that students' academic performance through offline learning is slightly better (positive difference of 2%) than the performance in online learning. Also, we analysed the gender-based academic performance in online and offline learning and we found that female students' academic performance is the same in both modes of learning, but male students' academic performance has slightly decreased in the online learning mode.

Table 2: Descriptive Statistics

Dependent Variable: Academic performance

Mode of teaching	Gender	Mean	Std. Deviation	N
Offline	Female	72.125887	7.4590240	47
	Male	73.854406	8.7889059	87
	Total	73.248134	8.3591984	134
Online	Female	72.282627	7.0620794	118
	Male	70.651603	9.3891400	156
	Total	71.354015	8.4900352	274
Total	Female	72.237980	7.1547641	165
	Male	71.798285	9.2887910	243
	Total	71.976103	8.4838945	408

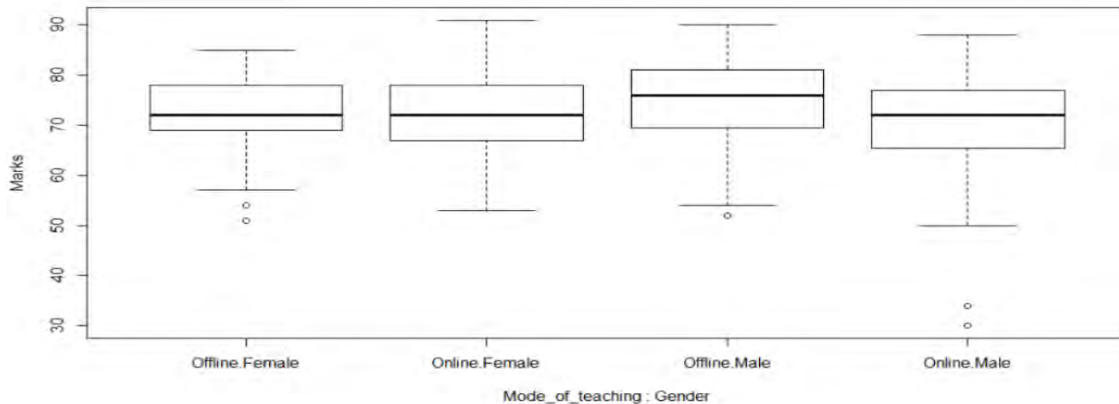


Figure 1: Boxplot of Academic performance in online and offline learning

Independent t-test: With an independent-samples t-test, each case must have scores on two variables. In our study the grouping (independent) variable is the mode of teaching, and the test (dependent) variable is the academic performance score. The t-test evaluates whether the mean value of test variable (academic performance score) for one group (online) differs significantly from the mean value for the second group (offline). The observations are random samples and are independent of each other. Table 3 shows the results of the independent t-test, and we note that the p-value is less than the significant level ($\alpha = 0.05$), so, we reject the null hypothesis and infer that the mode of learning (online or offline) does have a significant impact on students' academic performance. *Homoscedasticity* is important because it is a formal requirement for statistical analyses such as ANOVA. Levene's test is used to test if k samples have equal variances. Equal variance across samples is called homogeneity of variance. We tested the hypothesis that group variances are equal, and we reject the null hypothesis at the 0.05 significance level (H_1 is supported).

Table 3: Independent samples test results

		t-test for Equality of Means						
		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Marks	Equal variances assumed	-2.13	406	.034	-1.89	.89	-3.65	-.14
	Equal variances not assumed	-2.14	267.83	.033	-1.89	.89	-3.64	-.15

Analysis of Variance

One-way ANOVA compares means of groups to make inferences about the population means. The null hypothesis (H_0) was tested using One-way ANOVA to test if the samples selected are equal (or group means are equal). That is, $H_0: \mu_1 = \mu_2 = \dots = \mu_K$, where K is the number of levels of the independent variable. The dependent variable is academic performance (scores in elective subjects), and the independent variable is the learning mode (online, offline). As shown in Table 4, the p-value of the ANOVA test is 0.034, which is less than the significance level ($\alpha = 0.05$). The

mean differences are shown in Figure 2. So, we reject the null hypothesis (H_0), ($\mu_{\text{online}} = \mu_{\text{offline}}$), and we infer that the mode of learning (online, offline) does have a significant impact on academic performance (H_1 is supported).

Table 4: ANOVA to measure the academic performance

Marks	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	322.857	1	322.857	4.524	.034
Within Groups	28971.565	406	71.359		
Total	29294.422	407			

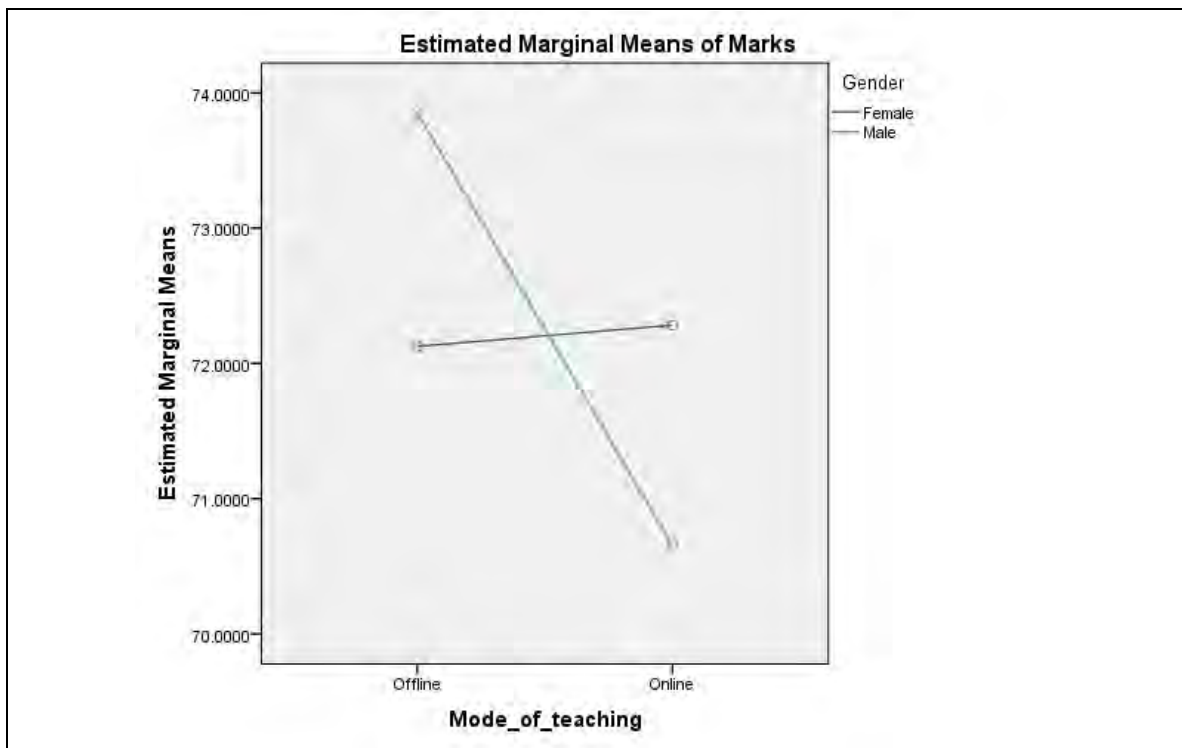


Figure 2: Estimated mean difference between Gender and Mode of Learning with Academic performance

DISCUSSION

The literature review indicates that students showed interest in e-learning and believed that virtual educational space makes professional education better. Online learning has vexing problems such as fatigue, emotional wellbeing, and stress (Zizka & Probst, 2021) and the barriers of online teaching are family interruption during teaching, budget for purchasing advanced technologies, conducting assessments, lack of technical support and training. The most significant influencing factor for teacher's mobile learning adoption is "usefulness" (Dolawattha et al., 2019). In our study,

we analysed the mode of learning (online or offline) and its impact on academic performance during the COVID-19 pandemic. An Indian academic university campus was used as a case study for better understanding of the situation. Descriptive statistics, independent samples t-test and ANOVA tests were used for analysis. Based on the research findings, H_1 is supported, that is, *Mode of learning has a significant impact on student's academic performance.*

The insights from our findings can help institutional heads to deal with any crisis scenario in the future where the institution may be required to change the mode of learning to meet the current need. Results by Churi et al., (2021) and Gardas & Navimipour (2021) are consistent with our research findings. In addition, we found that gender has no significance for the mode of learning in academic performance. Our research findings will be helpful to the academic heads for their decision making to create performance-oriented learning, infrastructure, and services.

LIMITATIONS

The present research has some limitations. This study only focussed on postgraduate programs, and the findings are generated within the context of one online platform - Zoom. Further, Indian students are culturally different from students in other parts of the world, and culture differentials were not discussed in this study. While many educational institutions across countries are suffering various problems in online learning, and there are countries with limited assets and less advancements in higher education, these factors were not considered in this study. These limitations offer avenues for further research and the findings are open to testing of the generalizability of this study. This research is based on the sample of one institution, and there are other multiple social and political factors, which are overlooked in this research for the possibility of impact on student academic performance.

CONCLUSION

Research in the field of education mostly advocates that long-term teaching interventions are important for obtaining reliable results. But, Sung et al., (2016), found that long-term interventions with online classrooms do not necessarily lead to better effects. Technological determinism is placed into a position when considering the integration of ICTs into education praxis and clearly warrants further investigation (Bardakci & Tugba 2020). High Internet costs and slow Internet connectivity are the main challenges contributing to the slow pace of technology integration in universities in Botswana (Dziva et al., 2021). As digital technologies are under constant development undergoing short product cycles, it is difficult for students, faculty, institutions, and countries to keep up with this product cycle. Student behavioural engagement has been operationalized in many ways, including tracking of gaze, active participation, on-task behaviour, and eye contact, and off-task behaviour which are not fully integrated in the online platform. Our attempt in this study was not to prove which medium is best. Online learning platforms are mushrooming not only during COVID-19 but will likely be a preferable medium in the future also. But our research results show that there is a no significant impact on academic performance in the online mode of learning for post-graduate students. The distinctive features of each medium were seen as constructing different instructional practices and offering students unique learning experiences.

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