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Original Research Article

Beyond the screen: a comparative study of the student's perception of online education effectiveness in pre- and post-pandemic times

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Abstract:
This research was carried out to compare the effectiveness of online education in pre- and post-pandemic periods as perceived by the students of higher education institutions in developing countries facing financial and technological limitations. For this purpose, time-lagged data from 288 students of higher education institutions were collected and analysed in SPSS version 26 using the paired sample t-test for differences. Using adapted questionnaires, the effectiveness of online education was assessed in terms of blended learning, goal setting, interaction, time management, self-evaluation, learning environment, skills to use online learning tools, quality of learning technologies, and learning motivation. Results indicate that students' perception significantly differs during the pandemic compared to the pre-pandemic period, compared to all dimensions of online education. It was found that the students, teachers, and institutions have acquired the requisite knowledge, skills, and technology during the pandemic. Therefore, the usefulness of online education has improved in the post-pandemic period. These results significantly affect all stakeholders, including students, teachers, researchers, institutions, and policymakers. The study suggests continuing blended learning systems in higher education institutions to ensure extended access to equitable education and the sustainability of online learning practices.

Keywords: Online learning effectiveness, Pre-pandemic, Post-pandemic, Blended learning, Learning motivation, Time management, Online learning environment.

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1. Introduction

The online learning system is a method of education that involves information & communication technologies (ICT) for the teaching-learning process (Firat & Bozkurt, 2020). However, such a system cannot be introduced instantaneously as it involves several challenges for teachers, students, and institutions. Proper training is required for all stakeholders to use ICT in education effectively. Moreover, the availability of requisite technology for teachers, students, and institutions also poses serious issues for all (Surani & Hamidah, 2020; Rehman et al., 2021). Although online learning was already there in educational systems since 1989 (Chung et al., 2020; Gupta & Gupta, 2020; Martin et al., 2020), a sudden and total shift from conventional to online methods was a big challenge for all countries during the pandemic. Therefore, institutions faced several challenges in implementing online learning systems in educational institutions, especially in developing countries where the technology was new, and resources were scarce (Balogun et al., 2023; Gul et al., 2023; Qazi et al., 2024; Sarker et al., 2023). However, the capability was acquired in an emergency as no alternate solution was available (Ahmed & Opoku, 2022; Dhawan, 2020; Habib et al., 2024, Müller et al., 2020).

The situation has changed since then, and institutions have gone back to conventional systems in the new normal situations. This places a question mark on the usefulness of online learning in the post-pandemic period (De Wit & Altbach, 2023; Fülöp et al., 2023; Zhao & Xue, 2023). Several researchers (Almaiah et al., 2020; Abdur Rehman et al., 2021; Barrot et al., 2021; Habib et al., 2024) investigated the usefulness of online learning systems during the pandemic and some of them also reported issues being faced by institutions, teachers, and students. However, there are fewer studies on the usefulness of online learning in new normal situations. Moreover, huge investments in online learning during the pandemic call for sustainability post-COVID period as acquired technologies and skills are important parts of contemporary educational systems (Sá et al., 2021). Therefore, as indicated by Alam and Asimiran (2021), a comparison of the effectiveness of online learning before and after COVID-19 is required to assess the usefulness of online education, especially in developing countries that forcefully acquired the skills and technology during the pandemic.

Online learning methods have remained uncertain and debatable since the beginning, especially compared to classroom learning systems (Ni, 2013). Especially in developing countries, technology-based learning was not the preferred and commonly used method for the teaching-learning process. From this perspective, the pandemic forced the institutions to adopt new learning methods and facilitated the capacity building of higher institutions for online and blended learning. Now, in new-normal situations, online and blended learning systems are being adopted as a routine matter in most parts of the world (Chung et al., 2020; Singh et al., 202). Therefore, researchers (Deroncele-Acosta, 2023 et al., Alotaibi, 2022) recommend a detailed comparison of pre- and post-pandemic times to assess the continuity and usefulness of online education from various perspectives (Almajali et al., 2021; Jacques et al., 2023; Qiao et al., 2021; Sharma & Shree, 2023).

The comparison of the effectiveness of online learning systems in the post pandemic period is important from various perspectives. Pre-COVID-19 period marks online learning as an optional learning tool depending on the availability of requisite resources and skill set, however, the forceful adoption of this system during the pandemic removed this hindrance as most of the higher education institutions worldwide have acquired this capability. Therefore, it has become important for these institutions to ensure the long-term sustainability of their

acquired capability (García-Morales et al., 2021). Online education is the modern face of learning, the opportunity to extend and continue the learning process to all segments of society who are otherwise not able to attend classes due to diverse or uncontrollable circumstances (Crawford et al., 2020; Lakhal & Khechine, 2021).

In addition to that, the education sector witnessed a rapid technological change that emerged in the post-COVID-19 era, fortified with new online educational tools and platforms (Dhawan, 2020). The pre and post COVID-19 comparison on the online learning effectiveness will facilitate educators and policymakers, to understand the long-term impact of these technological advancements. This comparison also highlights the need for addressing equity in access to education, ensuring that future online learning environments are inclusive and effective for a wider range of students. Therefore, the current study was designed to collect quantitative data from students at various universities to compare the perceived usefulness of online education in pre-post-pandemic times to assess the sustainability of these online systems in new normal situations.

2. Literature review

The study of the available sources shows that the researchers have defined learning effectiveness as the aptitude of a student to set, evaluate, and accomplish learning goals, manage time, and develop strategies to seek help and accomplish tasks, effective interaction with quality teaching tools, and learning motivation (Barnard et al., 2008; Kintu & Zhu, 2016). The usefulness of the learning system is assessed by students' feedback about their level of satisfaction with course contents, design and support, and communication/interaction with the online learning system including teachers, learning material and peers, and their overall learning experience (Zhu, 2016; Saeed et al., 2021; Maqableh & Alia, 2021). Previously Johnson et al. (2000) indicated that teaching methods, course instructions, and evaluation are key determinants of learning effectiveness. However, the scenario was different during COVID -19, when the threat to life was the primary concern for all, and therefore, online learning was the safest mode (Byun et al., 2020; Martin et al., 2020). Other determinants of effectiveness in online learning are teachers' and students' competence in the effective use of online learning technology, assessment methods, task differentiations, and social contacts (Konig et al., 2020). In a similar context, some researchers emphasize on a need to make online learning enjoyable and engaging. Although it was highly stressful during the pandemic, online learning provides a platform to learn with extended flexibility and convenience as per student or teacher's needs (Aslam et al., 2020; Dhawan, 2020).

However, developing countries with limited financial and technological resources and management skills management face additional challenges like unreliable internet services, frequent power breakdowns, and geographical differences making online education difficult for both students and teachers (Dost et al., 2020; Qasim et al., 2021). This is another fact that a blended learning approach, combining technology-based and traditional methods, is suggested for future educational settings to enhance effectiveness (Kongkiti & Hao, 2021). Kim (2020) suggests redesigning both classroom and online courses, especially in teacher education, to include the latest research-based teaching tools and techniques. The functional learning process in the two systems needs an environment that contains critical thinking and problem-solving. Filling the communication gap between teachers and students is critical for better results. Basilaia and Kvavadze (2020) indicate that the learning support provided by various online learning platforms including Zoom, online portals, TV schools, Google Meet,

etc. were enablers of the successful switching from classroom learning to online learning during the pandemic. These platforms can be useful and have ease of access beyond the pandemic context and therefore should be continued in the post-COVID-19 periods to enhance learning efficiency and effectiveness. Since most institutions have acquired online learning skills and technology during the pandemic, they are using blended learning methods in their routine processes.

Ahmed and Opoku (2022) indicated that online learning was chosen for its flexibility, attracting tech-savvy students. Pre-pandemic, online learning was chosen for its flexibility and for attracting tech-savvy students, however, it has become the need of the hour since the pandemic. The sudden shift to remote learning during that period revealed new challenges: technological issues, low motivation, and limited peer interaction. While some students valued its flexibility and safety, others struggled with inconsistent course design and support. These experiences highlight key areas for improvement and emphasize the need to address equity issues, especially for disadvantaged students lacking access to reliable technology and the internet (Müller et al., 2021). Although several researchers have considered it important to assess the usefulness of online education during the pandemic (Chen et al., 2020; Coman et al., 2020), a comparison between pre-post pandemic remains a missing link and can provide useful information for the policymakers on sustainability and continuity of the system in a new normal situation. Using the same premise, the present has set the following nine hypotheses for testing based on the time-lag data collected from students of various HEIs:

H1: There is a significantly negative difference in the perception of students about blended learning during the online classes in pre-post pandemic periods.

H2: There is a significantly negative difference in students' perceptions of skills for interacting with the learning material during online classes in pre- and post-pandemic periods.

H3: There is a significantly negative difference in the perception of students about skills to use learning tools during the online classes in pre-post pandemic periods

H4: There is a significantly negative difference in the perception of students about the quality of learning technology during the online classes in pre-post-pandemic periods

H5: There is a significantly negative difference in the perception of students about learning motivation during online classes in pre-post-pandemic periods

H6: There is a significantly negative difference in students' perceptions of goal-setting skills during online classes in pre- and post-pandemic periods.

H7: There is a significantly negative difference in the perception of students about time-management skills during the online classes in pre-post-pandemic periods

H8: There is a significantly negative difference in the perception of students about self-evaluation skills during the online classes in pre-post-pandemic periods

H9: There is a significantly negative difference in the perception of students about online learning environment during the online classes in pre-post pandemic periods

3. Research methodology

The time-lagged data was collected at two points in time to compare the pre- and post-pandemic learning effectiveness in HEIs of Pakistan. The students of HEIs located in the twin cities of Pakistan (Rawalpindi and Islamabad) were approached through self-administered questionnaires during the first week of February 2023. Respondents were asked to indicate their level of agreement or disagreement about the usefulness of online learning as they used to perceive before the pandemic. We approached 500 students, and out of those 403 replied with completely or partially filled questionnaires. After sifting we found 390 usable and filled questionnaires with a response rate of 78%. We assigned an identification code to each questionnaire and again approached (during the second week of March 2023) the 390 students to give their opinion in the first phase and asked them to give their opinion on perceived online learning effectiveness in the post-pandemic period.

This time, after repeated reminders, we were able to get responses from 288 students only with a response rate of 74%. The remaining 288 questionnaires were used for the final analysis. Approximately 62% of respondents were female and 38% male with an overall average age of 25.5 years. 67% of students were from the public and 33% of students were from private sector universities of Pakistan. Instruments used to collect data about perceived blended learning, goal setting, interaction, time management, self-evaluation, learning environment, skills to use online learning tools, quality of learning technologies, and motivation are provided in Table 1. All variables were measured against a five-point Likert scale with 1 strongly disagree to 5 for strongly agree. As shown, the reliability of all measures is within the acceptable range, that is between 0.748 to 0.877 (Hair et al., 2010).

4. Results and interpretations

We used paired sample T-Test to compare the pre-post pandemic data about the effectiveness of online learning, collected from different universities of Pakistan. For this purpose, we used Statistical Package for Social Sciences (SPSS), version 26. Results, as shown in Table 2 indicate that there are significant differences in perceived online learning effectiveness in pre- and post-pandemic times. These comparisons indicate that the highest difference was found in the perception of students about online learning environments in pre- and post-pandemic periods. Results (difference in means: -0.57; $p<0.001$) indicate that they feel more comfortable in online learning in the post-pandemic time as compared to pre-pandemic periods. The least difference was found in terms of teaching technologies and resources (difference in means: -0.26; $p<0.001$).

Similarly, the results show that there was a significantly negative difference in the perception of students about the blended learning (difference in means: -0.27, $p<0.001$), interaction with the learning material (mean difference: -0.39, $p<0.001$), quality of learning technology (difference in means: -0.49 $p<0.001$), learning motivation (Difference in means: -0.47, $p<0.001$), self-evaluation skills (Mean difference: -0.52, $p<0.001$), goal setting skills to set learning goals (Difference in means: -0.44, $p<0.001$), and time management skills (Difference in means: -0.30, $p<0.001$), in pre-post pandemic periods. The results indicate that perceived online learning effectiveness has improved in the post-pandemic period as compared to pre-pandemic times against all its dimensions. Hence all the hypotheses coined for the present research stand accepted.

Table 1: Instruments and reliability

Dimensions	No. of items	Cronbach's Alpha	Sample item
1. Blended Learning pre-pandemic (BLPrP)	04	0.876	The content of online class was logical before the pandemic
Blended Learning post pandemic (BLPoP)	04	0.872	The content of online class is logical after the pandemic
2. Interactions with online learning material pre-pandemic (ILPrP)	04	0.819	I was satisfied with the level of student-student interaction in online learning before the pandemic
Interactions with online learning material post-pandemic (ILPoP)	04	0.822	I am satisfied with the level of student-student interaction in online learning after the pandemic
3. Teaching tools and resources pre-pandemic (TTRPrP)	03	0.854	I was satisfied with the way our teachers navigated online teaching tools and resources in pre-pandemic times.
Teaching tools and resources before the pandemic (TTRPoP)	03	0.851	I was satisfied with the way our teachers navigated online teaching tools and resources in the post pandemic-times
4. Quality of learning Technology pre-pandemic (QLTPrP)	05	0.748	The online learning tools and technologies were easily available to me before the pandemic
Quality of learning Technology (QLTPoP)	05	0.749	The online learning tools and technologies were easily available to me after the pandemic
5. Learning Motivation pre-pandemic (LMPrP)	04	0.785	I used to enjoy my online learning experience before the pandemic
6. Learning Motivation Before Pandemic (LMPoP)	04	0.783	I enjoy my online learning experience after the pandemic
Source: Kintu & Zhu (2016)			
7. Skills to set learning goals pre-pandemic (SLGPrP)	05	0.862	I used to keep a high learning standard in my online class before the pandemic.
Skills to set learning goals after the pandemic (SLGPoP)	05	0.860	I used to keep a high learning standard in my online class after the pandemic.
8. Time management skills pre-pandemic (TMSPrP)	04	0.791	I was able to manage my time during my online classes before the pandemic as I knew that it demands time.
Time management skills after the pandemic (TMSPoP)	04	0.784	I was able to manage my time during my online classes after the pandemic as I know that it demands time.
9. Self-evaluation skills pre-pandemic (SESPrP)	03	0.874	Before pandemic I was able to assess my learning using the online sources
Self-evaluation skills after the pandemic (SESPoP)	03	0.871	After the pandemic I am able to assess my learning using online sources.
10. Online Learning environment pre-pandemic (OLEPrP)	03	0.879	In pre-pandemic time I was able to find a calm place to learn in online classes.
Online Learning environment post-pandemic (OLEPoP)	03	0.877	In post-pandemic time I am able to find calm places to learn in online classes.
Barnard, Paton, & Lan (2008)			

Notes: SD: Standard Deviation; SE: Standard Error: CI: Confidence Interval; LL: Lower Level, UL: Upper Level, DF: Degree of Freedom, P: Two-tailed significance

5. Discussion

Online learning systems have become imperative since the pandemic. Though these were already in use in different technologically developed countries, the developing countries with limited financial and technological resources were way behind them. However, it has become a routine process since then, and higher education institutions are now utilizing these technologies in various situations as and when needed. The results of the present study also reveal that online learning systems are active in developing countries even after the pandemic, as HEIs have acquired the requisite skills and technologies (Kara et al., 2019; Ni, 2013). Previously, researchers (Almusharraf & Khahro, 2020; Giatman et al., 2020; & Alia, 2021) found that online learning systems could not produce satisfactory results during the pandemic in developing countries. Since teachers and students were less familiar with online teaching tools and technologies, they were concerned about their effectiveness. The pandemic allowed all stakeholders to learn and adopt these technologies; therefore, they are now equipped to use the technology in routine processes. The results indicate that online learning is more practical, convenient, and cost-effective; thus, universities with limited financial resources can benefit of these technologies (Basilaia & Kvavadze, 2020; Wijayanengtias & Claretta, 2020).

Results also show that the highest improvement was found in online learning environments as the students know the importance of online learning better than before, and they can create the required learning environment at their homes, where they could learn comfortably. These findings correspond to the findings of Kyei-Blankson, et al. (2019), showing that students tend to ensure a conducive environment for learning if they are aware of the significance of the learning content. The recent pandemic has undoubtedly transformed the educational landscape, opening new horizons for learners and instructors, and online learning has become a vital component of the academic process and experience. A vital component of academic experience. The paradigm shifts from classroom learning to online learning during the pandemic have raised essential questions on sustainability and the long-term implications of these practices in the post-pandemic era. Since the most important feature of online learning is the convenience and higher quality of education, it has more prospects in the future, and institutions lagging in online technologies will lag in the tough competition among institutions. The pandemic, though disastrous, facilitated higher education institutions to transform and acquire the learning technologies and skills needed for swift transition (Wang et al., 2021). This is another fact most of the HEIs of developing countries have struggled to maintain the quality of student-teacher interaction, while others have been able to harness the potential of online learning and develop new hybrid educational models. This increased their flexibility in the delivery of course materials by connecting with field/area experts from across the globe while saving huge travelling costs (Neo, 2022).

Moreover, the results highlight that the pandemic has accelerated the adoption of online learning systems in HEIs, enabling institutions to offer distance degree programs and hybrid educational systems (Xie et al., 2020). Therefore, online learning can potentially increase equity and justice in educational systems as more and more students can access a more extensive range of courses and programs regardless of geographical location. However, the digital divide among various parts of the world is a significant concern as not all students have equal access to online learning resources (Saha et al., 2021). Additionally, the lack of a sense of belonging and connectedness, the presence of distractions, and a perceived lack of engagement have been identified as potential drawbacks of online education. The COVID-19 pandemic accelerated the adoption of online learning, transforming it from an alternative to

traditional education into a primary mode of instruction for many higher education institutions (HEIs). Tools like Zoom, Moodle, and Google Classroom became essential, familiarizing students and educators with the educational potential of technology (Dhawan, 2020). This shift fostered a tech-savvy academic culture, equipping students with valuable digital skills. Additionally, advancements like adaptive learning and AI-driven platforms have enhanced personalization, accessibility, and flexibility, improving education quality. Therefore, these practices should be continued to ensure the sustainability of interventions and to improve learning effectiveness while promoting inclusiveness in education. Keeping these facts in view, the study offers various practical and research implications for multiple stakeholders as discussed in the next section.

6. Implications

The study concludes that institutional capacity building during the pandemic has enabled institutions and departments to adopt online learning practices. For this purpose, institutions must invest in skillful, learned, and experienced people capable of imparting knowledge to faculty members about using new technology. Moreover, the management of these institutions should be able to respond promptly to unprecedented and sudden changes which may occur in the environment. There should be regular training/refresher courses, workshops, seminars, and other related activities for the management and faculty to keep them abreast of developments in the technological fields. As suggested by Dziuban et al. (2018), future education will comprise blended learning systems. The results of this study also indicate that students' perception of blended learning has improved in the post-pandemic period. Therefore, it is high time for the institutions to incorporate blended learning systems in their regular teaching-learning processes in classes. Additionally, extended contextualized research and the development activities can help them develop tailor-made solutions, keeping in view the localized problems of the institution.

The present research also has several implications for future researchers. Firstly, the data was collected from two cities of Pakistan, which are more developed and technologically advanced. Therefore, adopting online learning technology was relatively more manageable for them, which is reflected in the results of the present study. On the other hand, there exists a digital divide among various geographical parts, and future research may consider the response from hard-to-reach areas to determine the effectiveness of online learning systems in post-pandemic times. Secondly, the study was quantitative and focused on tools that had already been developed for the collection of data. Mathrani et al. (2022) have indicated that qualitative research can provide a detailed exploration of Indigenous issues students of various geographical areas face during online classes. Thirdly, it is also essential to compare the perceptions of students from various social (like rural and urban) backgrounds to determine the level of existence of the digital divide that might affect the usefulness of adopting online learning systems. Fourthly, future researchers can also consider studying the effectiveness of online learning for various languages, as linguistic barriers limit the usefulness of such systems, and learning foreign languages in online classes may produce different results. Moreover, as indicated by Kebritchi et al., (2017), faculty capacity development programs should be part of the regular institutional activities to equip them with technological skills and knowledge for effective online and classroom teaching. In addition, future researchers may consider the moderating effect of teacher training in the online learning effectiveness model for the capacity building program.

7. Conclusion

In the present research, we compared the perception of students in higher education institutions about the usefulness of online learning systems in pre- and post-pandemic periods. It was found that there is a significantly negative difference in pre-post-pandemic perceptions about blended learning, skills to interact with the learning material, skills to use learning tools, quality of learning technology, online learning motivation, goal-setting skills, time-management skills, self-evaluation skills, and online learning environment. Therefore, all the nine hypotheses developed for the present study are accepted as accurate. This study has significant implications for various stakeholders and urges the HEIS to adopt online learning systems as a routine in their learning processes as students have acquired the technology and skills to learn through the internet which is a more convenient and futuristic learning method.

Declaration of conflict of interest

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