Original Article

# Medical Students & e-Learning during COVID-19 Crisis: A Structural Equation Modeling Based Study

**Sana Ali[1], Atiqa Khalid[2], Tabinda Khan[2], Aasha Ijaz[2] , Hina Gul[2], Samreen Shahid[3]**

Department of Mass Communication, Allama Iqbal Open University[1], Islamabad, Sahiwal Medical College, Sahiwal[2], King Edward Medical University, Lahore[3].

## Abstract

**Background:** COVID-19 crisis affected the medical education throughout the world. During the infectious outbreak, closure of universities was the only solution to prevent the spread of virus. However, adoption of e-Learning helped in sustaining the medical educational activities.

**Objective:** The current study focus on e-Learning acceptance among medical students during the COVID-19 crisis in Pakistan.

**Study type, settings & duration:** This cross-sectional study was conducted at the four different medical institutes of Punjab from January 2021 to March 2021.

**Methodology:** The random sample technique was used to include 314 medical students by using the sample section criteria suggested by Krejcie and Morgan. We also proposed a self-proposed conceptual model supported by Media System Dependency Theory.

**Results:** Findings indicated that despite e-Learning has some limitations for the medical students, still we found a strong significant relationship between students' positive perceptions towards e-Learning during the Covid-19. i.e., the significance for H1, e-Learning and its Impact was ($\beta = 0.266$, $p < 0.011$), for H2, e-Learning as a Substitute, ($\beta = 0.144$, $p < 0.00$), and the H3, the Perceptions of students towards e-Learning was ($\beta = 0.2121$, $p < 0.000$).

**Conclusion:** We concluded that, e-Learning is a potential solution to sustain the educational activities and balance the cessation of ward rotations during the lockdown. Using e-Learning during the COVID-19 not only depicted the role of internet-based learning, it also highlighted the greater dependence on new media technology.

**Key words:** e-Learning, COVID-19, medical students, digital system, academic performance.

## Introduction

T he Government of Pakistan adopted nationwide lock down strategy to prevent infection transmission during the COVID-19 crisis. According to the healthcare stakeholders, social distancing was an important step to hamper the virus transmission in a better possible way.[1] Also, the countries that earlier implemented this strategy had low incidence of COVID-19 cases. Thus, on March 18, 2020, the United Nations Educational, Scientific and Cultural Organization declared that 107 countries throughout the globe, had to implement institutional closure strategies during the COVID-19 crisis. As result, 862 million children and young people faced institutional closure including 16 million in central Asia.[2] To counteract against the educational crisis, UNESCO urged on devising improved digital educational platforms, teacher's competency to use online software and high-quality digital content regarding online education.[1] In this regard, e-Learning increased its acceptability as a flexible, convenient, feasible source of education during the lockdown Today, e-Learning is successfully adopted in both developed and developing regions worldwide.[3]

**Corresponding Author:**

**Atiqa Khalid**
Sahiwal Medical College
Sahiwal.
Email: atiqakkhalid@gmail.com

**Authors Contribution**

AK & SA conceptualized the project and did the statistical analysis. AK, SA, TK & SS did the data collection. SA, AK, AI & HG performed the literature search. Drafting, revision & writing of manuscript were done by SA, AK, SS & TK.

Likewise, e-Learning adoption was only choice for the students in Pakistan. Consequently, along-with other disciplines, medical students also switched to e-Learning to sustain their educational activities as the Higher Education Commission Pakistan also emphasized on continuing medical education through online lectures and courses.[4] Today, almost every existing medical institution is relying on digital platforms to resume their academic journey. Moreover, medical institutes have devised effective methods to implement online learning in Pakistan to balance the cessation of learning activities.[5] Due to the characteristics such as ease of use and perceived usefulness, students depend on e-Learning as a source of education and information. Similarly, Mousavi A[6] proposed e-Learning educational atmosphere measure as a source of adding more benefits for the students during the COVID-19 outbreak. As noted, worldwide institutions need to upgrade their existing digital learning patterns. Despite we acknowledge the role of e-Learning in sustain education, there is still much more needed to improve digital learning for the students. Here it is worth mentioning that, e-Learning was not much effective previously in Pakistan. Students preferred to rely more on conventional learning patterns and considered e-Learning as an option or a supplementary benefit regarding their educational performance.[6] Today, due to COVID-19, e-Learning is more acceptable for the students as it is providing them with major educational benefits.[7]

Therefore, by keeping in view the importance of e-Learning, this study also aims to explore the effectiveness of e-Learning implementation among the medical students during COVID-19 lockdown. For this purpose, we have discussed e-Learning in a broader context by addressing the following areas: Student's perception, e-Learning as a substitute of formal education and its impact on students' academic performance. This study seems timely as HEC is in the process of implementing and establishing online classes and e-Learning across all universities in Pakistan to balance academic loss. Hence, our findings will not only help in taking steps to smooth out the bumps faced by the medical education but also highlight the challenges faced by medical students regarding e-Learning in general.

As noted by[8] online education has enhanced the collaboration and communication among both teachers and students during the lockdown and also improved the student's learning skills. Additionally,[1] further scrutinized the acceptance of e-Learning among teachers of higher education institutions in Pakistan by selecting n = 30 university teachers and found that the teachers considered e-Learning effective in crisis management during the COVID-19. One of the fundamental reasons for e-Learning acceptance and integration is also a modified educational system. It has helped students in achieving better academic grades in the exams conducted after implementation of e-Learning due to closure of Medical Colleges and Universities. Both students and teachers have benefited from this online learning module.[9] Consequently, e-Learning acceptance in educational arena has increased and it has brought out fruitful results in not only improving the academic grades but also critical thinking capabilities.[10]

An increased dependency, availability of information, and its usefulness, students consider digital platforms as an important source of sustaining education.[11] A study conducted [12] also affirmed the e-Learning as a substitute of traditional learning. The role of educational stakeholders, policymakers, and government is also of greater significance. In this regard when government makes effective policies, and ensure their strategic implementation, people also accept them and integrate them with their daily life activities.[13] Thus, despite conventional learning gained much acceptance due to certain features like face-to-face learning, direct student-teacher interaction; yet the feasibility offered by e-Learning makes it distinguished from the conventional learning. Students also acknowledge digital platforms as an important source of gathering information and resume their educational journal.[14]

The role of teachers and government is important to motivate the students towards e-Learning adoption and provide a strong infrastructure that may facilitate integration and usage in general.[7] A study conducted by Buzzetto-More N,[16] also examined the students perception about e-Learning in the Maryland University, USA. Data gathered by using structured questionnaires revealed that, students positively perceive e-Learning as a part of their academic journey. These positive perceptions are due to most available features such as ease of communication, online assignment submission, and even online examination process as well. Despite many of students also faced with several uncertainties regarding e-Learning; but eventually they have accepted and perceive e-Learning a significant as conventional learning.[6]

There is a significant relationship between e-Learning and students' positive perceptions (Figure)
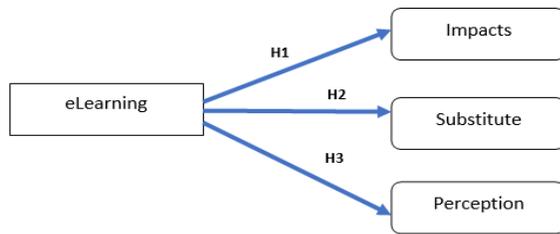
**Figure: Conceptual framework.**

## Methodology

The current study consists of experimental approach with cross-sectional study design. The sample size was (n=314) and respondents were from Sahiwal Medical College, King Edward Medical University, Allama Iqbal Medical College and Nishtar Medical University. We selected the relevant sample size by using the sample selection method suggested by Krejcie and Morgan (s =X2NP(1-P)/d2 (N-1)+X2P(1-P). As there are total n =15 medical colleges and institutions in Punjab and the enrolment ranges from 20,000 to 30,00 students, according to the formula the selection criteria for the relevant population will be above n =300 individuals. We selected n =314 respondents accordingly.

The structured questionnaire was designed on five-point Likert scale. Notably, we also adopted the research scales items from different resources to further affirm the validation of the items in the research questionnaire. Table-1 below summarizes the scales and their resources.

**Table 1: Sources of questionnaires scales.**

| Variables | Source | Cronbach Alpha Value |
|---|---|---|
| Impacts of e-Learning | 1 | .799 |
| Substitute of formal education | 17 | .844 |
| Perception about e-Learning | 1 | .728 |

As we executed structure equation modeling, we also affirmed the validity and reliability of the research tool.[18] Table-1a, 1b & 1c below provide an overview of the convergent and discriminant reliability. The Cronbach Alpha values are ranging from .728 to .844 and the Composite Reliability values are ranging from .738 to .828, which indicates successfully surpassing the threshold value of 7. Besides, all the Factor Loading and Average Variance Extracted values are surpassing the threshold value of .5, indicating that the convergent validity is established. Moreover, we can also observe the Forner-Larcker values are

higher than the correlation matrix, and we also found the also HTMT 0.697 value which is lower than the threshold value of .85. Thus, here we found that convergent reliability, convergent validity, and discriminant validity are successfully established.

**Table 1a: Convergent validity & reliability analysis.**

| Variables | Items | FL | AVE | CA | CR |
|---|---|---|---|---|---|
| e-Learning | EL1 | .819 | .614 | .811 | .738 |
| | EL2 | .777 | | | |
| | EL3 | .741 | | | |
| Impact | IMP1 | .850 | .723 | .799 | .975 |
| | IMP2 | .731 | | | |
| | IMP3 | .846 | | | |
| Substitute | SUB1 | .884 | .766 | .844 | .828 |
| | SUB2 | .836 | | | |
| | SUB3 | .783 | | | |
| Perception | PER1 | .834 | .861 | .728 | .864 |
| | PER2 | .871 | | | |
| | PER3 | .878 | | | |

**Table 1b: Fornell-larcker scale (discriminant validity).**

| | EL | IMP | SUB | PER |
|---|---|---|---|---|
| EL | .782 | | | |
| IMP | -.159 | .650 | | |
| SUB | .612 | -.171 | .789 | |
| PER | .515 | -.038 | .705 | .927 |

**Table 1c: Heterotrait-monotrait ratio scale (discriminant validity).**

| | EL | IMP | SUB | PER |
|---|---|---|---|---|
| EL | | | | |
| IMP | -.157[**] | | | |
| SUB | .609[**] | -.172[**] | | |
| PER | .515[**] | -.038 | .705[**] | |

The Ethical approval was obtained from Ethical Review Committee of Sahiwal Medical College and Allied Hospital, Sahiwal.

## Results

The questionnaire was sent to n =450 students out of which n =314 students responded. Hence, response rate was 69.7%. Thus, after calculating the frequency of demographical statistics, we found that 106 (33.7%) of respondents were males, and 208 (66.0%) were females 1.13±346. Similarly, 18.1% of participants were in the first year of their medical school years, 28.6% belong to $2^{nd}$ year, and 16.2% of $3^{rd}$ year, 30.5% belong to Fourth year and only 6.3% from final year. Students from rural areas were less, i.e., 81 (34.2%) and respondents from urban areas were 233

*Sana Ali, Atiqa Khalid, Tabinda Khan, Aasha Ijaz , Hina Gul, Samreen Shahid*

(85.7%). Moreover, to determine any potential differences based on demographical characteristics, we conducted ANOVA (one-way Analysis of Variance).[19] As visible in the Table-2, based on gender and residence of the respondents, there are no mean differences. However, with the value of $p \geq .630$, we found strong discrepancies between the gathered responses.

**Table 2: Demographical characteristics & ANOVA.**

| Variable | Items | F | % | F | Sign |
|----------|-------|-----|------|-------|------|
| Gender | Male | 106 | 33.7 | | |
| | Female | 208 | 66.0 | 1.410 | .000 |
| | 1st Year | 57 | 18.1 | | |
| | 2nd Year | 90 | 28.6 | | |
| Year of Study | 3rd Year | 51 | 16.2 | .717 | .630 |
| | 4th Year | 96 | 30.5 | | |
| | Final Year | 20 | 6.3 | | |
| Residence | Urban | 81 | 25.7 | | |
| | Rural | 233 | 74.2 | .810 | .000 |

To check the predictive value of the study model and proposed relationship between variables, we examined coefficients of determination $R^2$ and Path Analysis). As visible that, the $R^2$ values are ranging from .700 to .824, indicating a strong predictive value of the study model (Table-3). Furthermore, we also found strong significant relationship between e-Learning, Impacts ($\beta = 0.266$, $p < 0.011$), Substitute ($\beta = 0.144$, $p < 0.00$), and Perceptions ($\beta = 0.2121$, $p < 0.000$). Thus, here we conclude that all of the three hypotheses are significantly validated.

**Table 3: Path analysis, linear regression analysis.**

| S/R | Relation | $R^2$ Value | Path | t-value | f-value | Sign. |
|-----|----------|-------------|------|---------|---------|-------|
| H1 | EL>IMP | .824 | .311 | 16.076 | 7.890 | .011 |
| H2 | EL>SUB | .797 | .644 | 6.468 | 184.21 | .000 |
| H5 | EL>PER | .700 | .983 | 5.196 | 112.17 | .000 |

## Discussion

Healthcare emergencies like COVID-19 demand extra-ordinary risk management strategies. The current study aimed to highlight the medical students' perception towards e-Learning as an only educational option during the current healthcare crisis. We employed cross-sectional study design and gathered data by using close-ended structured questionnaires from the students of $n=4$ prominent medical institutions in Punjab, Pakistan. We found significant relationship between our proposed study variables, indicating students' positive attitude towards digital learning. However, many students

also mentioned their uncertainty regarding the practicality of education through online resource as medical education also consists of practical ward demonstrations. Rapid transition towards e-Learning also demands to ensure its practical value especially for the medical students. Majority of students (58%) declared that COVID-19 has affected their studies. Majority (80.3%) of the participants of the survey agreed on the fact that these vacations have wasted a lot of time. It can be attributable to the fact that students were mentally exhausted because of the phobia created by COVID-19. Many students (85.7%) also showed their concern about their professional examination. Many medical universities and colleges across the country arranged the online classes within their own domains and 38.6% students agreed that e-Learning have created a positive impact on their studies as it was feasible to continue learning during lockdown (59.6%). Hence, emergencies like COVID-19 demand extra-ordinary risk management strategies.[19,20] The results of this study are strongly consistent with the study conducted by *Alghizzwi* as there as significant relationship between e-Learning and its acceptance.[21] The participants of this survey indicated a positive opinion regarding e-Learning acceptance, especially during the COVID-19 crisis ($p \leq 0.000$). Similarly, students also declared that they consider e-Learning as a substitute for traditional learning, which also highlights the broader acceptance of e-Learning among the young generation. The results are also consistent with the study conducted by *(Khadija Alhumaid, 2020)*, as the participants showed a positive *(p ≤0.000)* opinion towards e-Learning during the healthcare crisis.[17] As noted by *Mukhtar et al*, both teachers and students considered e-Learning as the only way to continue their education during the current healthcare crisis.[22]

The closure of educational institutions has adversely impacted the medical education in a developing country like Pakistan. The essentials of medical education including patient-based learning, bedside teaching and clinical skills seems to be compromised. Hence, in such a critical situation, it is an optimistic approach to consider the other alternative approaches under consideration in context of positive attitude of students towards e-Learning.[23] If the COVID-19 lockdown stays for long, it demands an organized system of online learning to manage the academic loss.[5] Moreover, today every student is aware of the modern trends in education and learning. They greatly resort to virtual systems to learn new things and modify their educational capabilities. The convergence of classical learning to modern, technology-based learning also constituted that, the e-Learning has devised new ways to cope with the challenges of medical education and due to

sudden disruption caused by COVID-19, it has become an integral part of the modern educational system. But there was a great worry among students that their ward rotations have been severely affected. However, many students reverted towards online educational platforms to sustain their academic activities and enhancing their learning abilities and professional skills. Additionally, students don't have to rely on traditional classrooms to gain knowledge during this crisis.[24] During COVID-19 lockdown, though complete impact would take some time to be established, medical education is being affected at different levels. There is uncertainty with conduction of online assessments and achieving learning outcomes. Additionally, due to lack of face-to-face interaction, clinical skills are also compromised. Significantly, in a developing country like Pakistan, where e-Learning was merely a concept, the rise of COVID-19 also affirmed its significance as an essential part of education.[5]

The results of our study are consistent with the studies conducted by *Alqahtani AY*,[23] as the participants also showed a positive opinion towards e-Learning during the healthcare crisis.

E-Learning is a panacea during these COVID-19 crisis, to sustain the educational activities and partially balance the cessation of ward rotations and bedside learning during the lockdown.

We have made much effort to conduct this study, yet it contains some limitations as well. First, the students are selected only from the medical colleges situated in Punjab province that further questions its generalizability. Second, we only utilized impact, perception, and substitution as the dependent variable; however, there are many other variables that can further conduct an in-depth analysis of the medical students' opinion about e-Learning. Yet, we recommend more studies, especially assessing the medical schools' instructors' opinion regarding e-Learning to gather diverse opinions during crisis situations.

**Conflict of interest:** None declared.

# References

1. Alhumaid K, Ali S, Waheed A, Zahid E. COVID-19 & E-Learning: Perceptions &Attitudes Of Teachers Towards E-Learning Acceptance in The Developing Countries, 2020. (Accessed on 8th May 2021) Available from URL https://zenodo.org/record/4060121
2. Sahu P. Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. Cureus 2020; 12(4): e7541.
3. Habes M, Ali S, Salloum SA. Digital Media and Students' AP Improvement: An Empirical Investigation of Social TV. International Conference on Innovation and Intelligence for Informatics, Computing and Technologies (3ICT), 2020: 1-6,
4. Higher Education Commission. Why online education? (Chairman, HEC). HEC Announcements, 2020. (Accessed on 26th November 2021) Available from URL https://hec.gov.pk/english/HECAnnouncements/Pages/Why-Online-Education.aspx
5. Khalid A, Ali S. E-Learning: A Panacea during COVID-19 Crisis. Pak J Pub Health 2021; 10(2): 73-6.
6. Mousavi A, Mohammadi A, Mojtahedzadeh R, Shirazi M, Rashidi H. E-learning educational atmosphere measure (EEAM): a new instrument for assessing e-students' perception of educational environment. Res Learn Technol 2020 . (Accessed on 26th November 2021) Available from URL https://journal.alt.ac.uk/index.php/rlt/article/view/2308
7. Tagoe M. Students' perceptions on incorporating e-learning into teaching and learning at the University of Ghana. Int J Edu Develop Infor Comm Technol 2012; 8(1): 91-103.
8. Zare M, Sarikhani, R. The Impact Of E-Learning On University Students' Academic Achievement And Creativity. J Tech Edu Train 2016; 8(1): 25-33.
9. Fayomi O, Ayo C, Ajayi L, Okorie U. The Impacts Of E-Learning In Facilitating Academic Performance Among Private Secondary Schools And Tertiary Institutions In Ota, Ogun State , Nigeria, 2015. (Accessed on 26th November 2021) Available from URL https://www.researchgate.net/publication/273765400_the_impacts_of_e-learning_in_facilitating_academic_performance_among_private_secondary_schools_and_tertiary_institutions_in_ota_ogun_state_nigeria
10. Al-Muhasein O, Habes M. An Empirical Investigation the Use of Information, Communication Technologies to English Language Acquisition : A case study from Jordan. Int J Innov Engin Res Technol 2020; 7(5): 261-9.
11. Yanuschik OV, Pakhomova EG, Batbold K. E-learning as a Way to Improve the Quality of Educational for International Students. Procedia - Soc Behav Sci 2015; 215: 147-55.
12. Conkova M. Analysis of Perceptions of Conventional and E-Learning Education in Corporate Training. J Compet 2013; 5(4): 73-97.
13. Zhang D, Zhao JL, Zhou L, Nunamaker JF. Can e-learning replace classroom learning? Commun ACM 2004; 47(5): 75-9.
14. Hassenburg A. Distance Education Versus The Traditional Classroom. Berkeley Sci J 2009; 13(1): 7-10.
15. Mamattah RS. Students' Perceptions of E-Learning; 2016. Accessed on 26th November 2021) Available from URL https://www.diva-portal.org/smash/get/diva2:925978/FULLTEXT01.pdf
16. Buzzetto-More N. Student Perceptions of Various E-Learning Components. Interdiscip J E-skills Lifelong Learn 2008; 4(1): 113-35.
17. Habes M, Ali S, Khalid A, Haykal HA, Elareshi M, Khan T, et al. E-Learning Acceptance During the Covid-19 Outbreak: A Cross-sectional Study. In: Musleh Al-Sartawi AMA, Razzaque A, Kamal MM, editors. Artificial Intelligence Systems and the Internet of Things in the Digital Era [Internet]. Cham: Springer

International Publishing; 2021. [Accessed on 26th November 2021) Available from URL https://link.springer.com/10.1007/978-3-030-77246-8_7

18. Amin TT. Inferential Statistics; 2019 Accessed on 26th November 2021) Available from URL http://rgdoi.net/10.13140/RG.2.2.26024.62725

19. Khalid A, Ali S. COVID-19 and its Challenges for the Healthcare System in Pakistan. Asian Bioeth Rev 2020; 12(4): 551–64.

20. Gul H, Ijaz A, Khalid A, Khan T. Knowledge, attitude, and perception of University students toward COVID-19 Pandemic. Pak J Surg Med 2020; 1(3): e148.

21. Alghizzawi M, Habes M, Salloum SA, Abd M, Mhamdi C, Shaalan K. The effect of social media usage on students' e- learning acceptance in higher education: A case study from the United Arab Emirates. Int J Inform Technol Lang Stud 2019; 3(3): 13-26.

22. Mukhtar K, Javed K, Arooj M, Sethi A. Advantages, Limitations and Recommendations for online learning during COVID-19 pandemic era. Pak J Med Sci [2020; 36(COVID19-S4): S27-31.

23. Alqahtani AY, Rajkhan AA. E-Learning Critical Success Factors during the COVID-19 Pandemic: A Comprehensive Analysis of E-Learning Managerial Perspectives. Educ Sci 2020; 10(9): 216.

24. Mumtaz N, Saqulain G, Mumtaz N. Online Academics in Pakistan: COVID-19 and Beyond. Pak J Med Sci 2021; 37(1): 283-7.