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Research Article

Impact of Covid-19 Lockdown on Engineering Education System; A Survey Based Case Study in Pakistan

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Abstract: The education system in Pakistan is suffering a lot of challenges in this modern world of advanced technologies. The engineering and technical education system is implementing modern techniques to improve the quality of education. The current disaster of coronavirus has badly affected the operation of engineering education in Pakistan, and student and faculty members are suffering from several issues in implementing a successful online education of digital semester. Each stakeholder has their own problems to make online education efficient. A questionnaire survey has been conducted with students as well as faculty members of engineering disciplines from different institutions. Different problems and issues are discussed with both stakeholders to observe the flaws which have been suffered by Pakistan's higher education in the engineering sector. The effect of teacher's academic profile, their attitude, professional field experience and advanced skills were discussed with 1000 students randomly. Similarly, 100 faculty members were questioned regarding the problems of the digital education system and pandemic effects on their performance. Various observations are concluded with this short survey-based research, and some suggestions are provided to improve the quality of education in this pandemic situation. The proposed solutions include the training sessions for teachers to get quipped with digital technologies, enforcement of lab sessions by opening all institutions at least one day a week, and professional experience requirements for the eligibility of academic staff.

Keywords: Engineering Education, Digital Semester, Covid-19 Effects.

1. INTRODUCTION

Professional education in engineering and medical has always been treated as scientific education worldwide. A lot of advancement has been seen in these two technologies in the last few decades. The innovation of computer and digital technology has made it possible to deliver education in its best way. Especially in technologically advanced countries like the UK, Germany, USA, and China, the education system has been boosted with digital technologies. With reference to the developing countries like Sri Lanka, Pakistan, Bangladesh and India, they are implementing such techniques to improve their education system, but off course, financial aspects are the primary constraint. With reference to Pakistan, Higher Education Commission (HEC) was launched in 1974 which was previously working as University Grants Commission (UGC). HEC Pakistan has taken several steps to update the education system according to the rest of the world. It is continuously providing teachers training, funding for research projects, scholarships for teachers and students, and digital technologies.

The current scenario of coronavirus (COVID-19) has affected almost all Pakistan's economy and operational systems. There is a lack of medical and infrastructural advancement observed in corona pandemic and a disastrous has been created. This article describes the difficulties academia faces in Pakistan and the flaws observed in the engineering education system during this corona pandemic.

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1.1 Overview & Background

In Pakistan, Pakistan Engineering Council (PEC) was established in 1976 to monitor and regulate the engineering profession in the country [1]. In total, there are ninety universities in Pakistan offering engineering education under the regulations of PEC. To date, there are more than 25 disciplines of engineering education regulated under PEC laws and offered by different institutions. As Pakistan is not advanced enough with modern technologies, many flaws have been observed in its technical education of the engineering sector. Several critical analyses have been done by researchers in this context.

Iqbal *et al*. (2014) have critically studied Pakistan's higher education system and observed many pitfalls in it [2]. He highlighted thirteen main reasons for an education system, that are the main barriers to modernization and advancement in Pakistan's technology and literacy system. Mian (2019) has concluded his research with nine obstacles faced by Pakistan's higher education system, and he also suggested their appropriate solutions for improving it [3]. The scenario of coronavirus has been a recent challenge faced by HEC Pakistan, and they have directed all the institutions to engage faculty and develops online courses [4]. Qazi *et al*. (2013) has studied the modern techniques implemented by engineering departments of major institutions in Pakistan to improve the professional education level [5]. Channa *et al*. (2018) has compared the engineering education system of fourteen countries including Pakistan, China, the USA, the UK and some European Countries. He observed the gross domestic product (GDP) and education budget of all the studied countries and found Pakistan's lowest education budget and engineering advancement [6]. Garcia & Weiss (2020) has analyzed the education infrastructure of USA in this pandemic and concluded it with the family time disturbance of academic staff in addition to the catastrophic loss of students learning abilities [7]. Gül Özüdoğru (2021) has concluded his research with the determination of problem as a critical step toward the implanting of solutions in such pandemic crises in the context of education infrastructure [8].

In the scenario of covid-19, the first time, a digital semester has been launched by HEC in all Universities of medical, engineering, applied and social sciences. All academicians are allowed to work from home [9]. Sobia *et al*. (2021) has conducted a survey based research on the effects of a pandemic on Pakistan's educational system and concluded that most of the students don't even have an access to the internet facilities, laptops, power supply and android phones at their homes which ultimately caused the learning difficulties [10]. In his research, Aziz Ur Rehman (2020) has presented some critical issues with distance learning in Pakistan and their respective mitigating policies [11]. The problem arises with medical and engineering sciences as most of their subject's deal with practical learning in laboratories. Especially, in undergraduate-level courses, approximately 50% of education is based on experimental work thus, the advent of the digital semester in Pakistan has been reported to go toward its failure in the mentioned disciplines. Furthermore, there are other main reasons which have to be improvised. In this context, short survey-based research has been conducted to observe and propose some solutions for the difficulties faced by the technical education system of Pakistan.

2. MATERIALS AND METHODS

A questionnaire survey has been conducted with 1000 students and 100 faculty members of different disciplines, including medical sciences, humanities, administration and engineering departments in various universities. These faculty members include both senior and junior academic staff. Since all the institutions have been closed in the pandemic of covid-19, this survey has been conducted online using the google form technique. The students have been asked for the difficulties they are facing in the understanding of subject matter in digital techniques of online education, while faculty members have been inquired about the issues they are reporting about the implementation of the digital semester. All the results have been presented in graphical form and are described in the following section of the results. Table 1 shows the detailed description of interviewed personnel for this questionnaire survey.

Where U.G refers to undergraduate studies and P.G mean postgraduate studies. Engineering studies

Table 1. Details of interviewed personnel

Discipline	No. of Students		No. of Teachers	
	U.G	P.G	Non PhD	PhD
Engineering	430	70	25	10
Medical	170	30	20	8
Humanities	135	65	12	12
Administration	50	50	8	5

includes all the taught disciplines in Pakistan, and Medical include MBBS and D.Pharm, whereas, Humanities include arts, commerce while administration business, public, general management education.

3. RESULTS AND DISCUSSION

3.1 Survey from Students

The students are asked several questions about the teaching level, how to satisfy them with digital semester and online education, and other difficulties they face in the pandemic of covid-19. In general, a comparison of faculty members has been made with respect to different aspects of their experience, degree level and seniority. Table 2 shows the percentages of students who struggle badly in this pandemic due to the implementation of the online education system. Table 2 shows a discipline wise description of student's satisfaction levels. Engineering students are suffering most among the four interviewed groups while medical stands second. The reason behind it is the practical-based learning that has been affected badly due to the regular closing of institutes. Without practical implementation, these two technical educations are baseless. Contrarily, the humanities and administration education is based on theories and case scenarios learning. Therefore their students remain quite comfortable even with implementing the online education system.

From Table 2, the engineering group has got distinction in the struggling level thus, further analysis and observations have been made for the only engineering education system. Medical education has been categorized as the second most affected group, hence their analysis is highly recommended to evaluate for future prospects. Figure 1 shows how competitive and skillful faculty members are according to different exposure of academic education and different experience types. Almost 290 students understand the lectures with those faculty members having experience in the construction industry, and 210 students are comfortable with experienced academic teachers. Similarly, students are more comfortable in understanding the lectures of Master's degree teachers, and only 200 students are comfortable with teachers having doctorate degrees.

Table 2. Percentage of satisfaction level of students with online semester for each study group

Discipline	Students struggling	Students comfortable
Engineering	69%	31%
Medical	57%	43%
Humanities	38%	62%
Administration	29%	71%

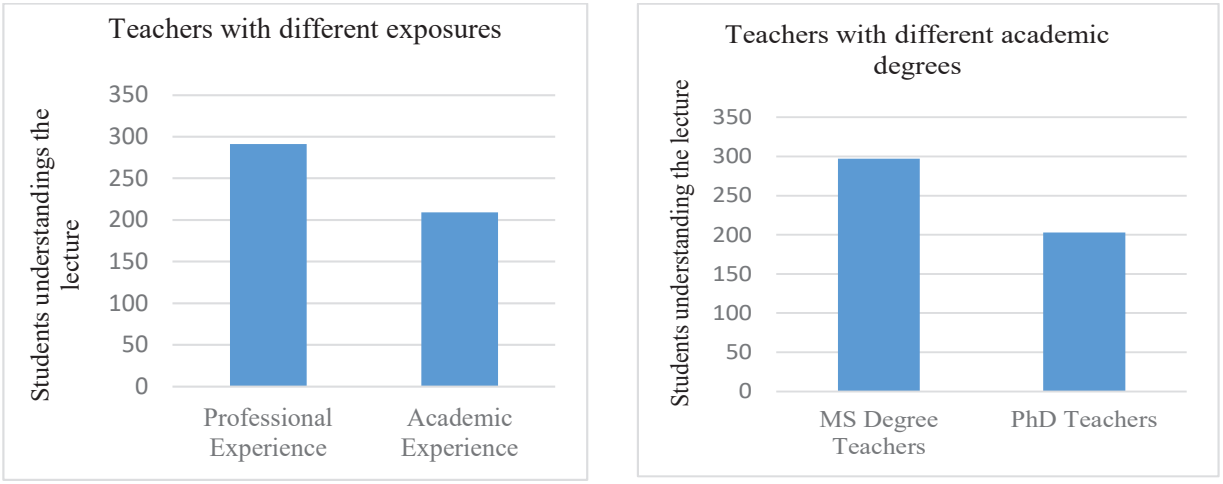
Figure 2 shows the results of the success of lecture understanding during the covid-19 and online education system. The survey shows that students understand better with junior faculty members than senior staff. Moreover, the major barrier in understanding the engineering concept and lectures is found to be the zero lab work during pandemic and universities are closed by order of government in lockdown. The least important factor in barriers of understanding is the unavailability of teachers, which is a good sign as teachers are replying to students on Emails and WhatsApp whenever they have been questioned.

It is to be noted that the majority of students came to the big cities of Lahore, Karachi, Islamabad from rural areas of Pakistan. Upon implementing a complete lockdown, they went back to their homes where there were no sufficient technologies of high-speed internet access and telephone connections were available. This is why 21% of students are lacking with while unavailability of online books

and research papers also negatively influenced the education system in Pakistan. In a comparison of junior and senior faculty members styles of teaching, it has been found that the majority of senior members are not fully trained for giving lectures online via digital technologies. Similarly, in Pakistan, the majority of PhD faculty members are old enough to learn these technologies quickly, thus affecting their lecture deliveries badly. The young PhDs are active and fully equipped with internet and online software programs that's why they are more successful in delivering their lectures efficiently.

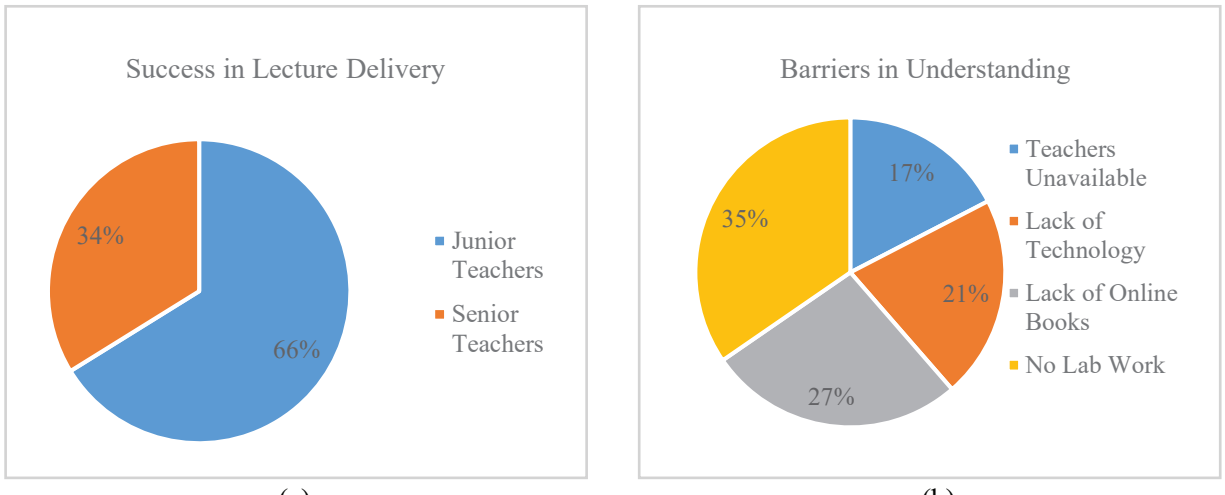
3.2 Survey from Academic Staff

Faculty members from different disciplines of engineering academia are inquired about the difficulties they face in successfully implementing the online education system. Figure 3 compares difficulties faced by senior and junior faculty members in digital semester of online education. The primary issue with senior faculty members is to learn software for delivering lectures and get in contact with students while junior staff complain about the lack of material available online from the internet using at home. Faculty members can search many books and research papers from the internet provided at their respective institutions, but this is not the case at home. Senior teachers are not well aware of digital technologies hence it became very difficult for them to learn it quickly and implement it in their lectures. In both the cases, lab work is found to be the second most sensitive parameter, and



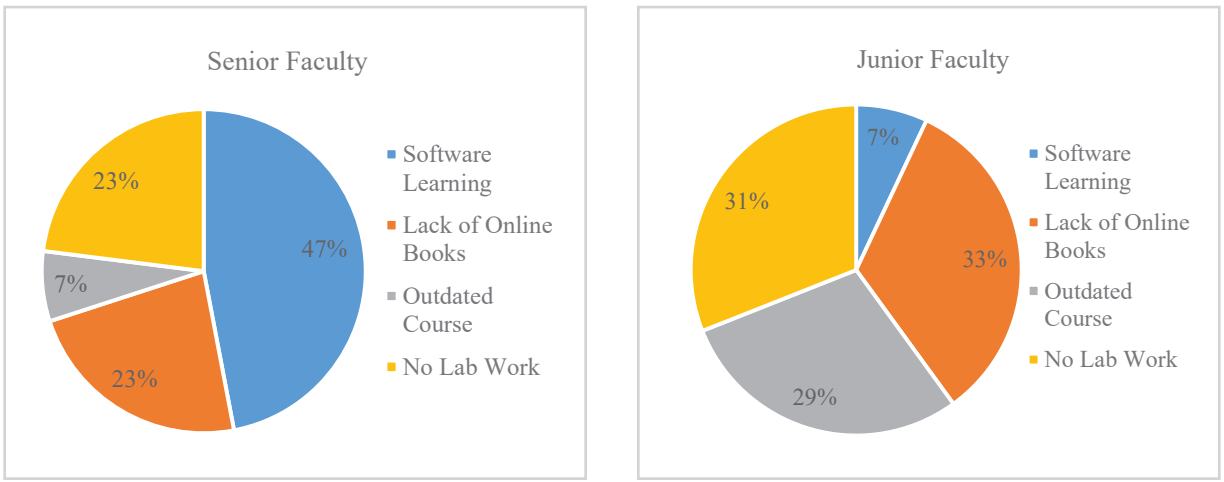
(a) (b)

Fig. 1. Student response for understanding lectures (a) Teachers with different experience type (b) Teachers with different degree type



(a) (b)

Fig. 2. Student response understanding the lectures in covid-19 (a) By seniority experience of Teachers (b) Reasons for communication barriers



(a) (b)

Fig. 3. Difficulty problems face by (a) Senior faculty members (b) Junior faculty members

since there is no lab work offered in such scenarios of covid-19, it affects the efficiency of all faculty members as it is much difficult to deliver the lecture without having practical lab demonstrations.

4. PROPOSED SOLUTIONS

TIn the coronavirus situation, all the major cities are getting lockdown and it has affected the academic sector negatively. But to shut down a city completely is not a genuine way to get rid of a biological disaster. To improve and implement an online education system in Pakistan, some of the solutions are mentioned below, which are derived from the survey and discussion with students and faculty members involved in engineering education.

1. All the student and faculty members are agreed to open universities at least one day a week within prescribed boundaries of SOPs defined by the government. By doing so, students can perform their lab tasks and teachers can demonstrate experimental work in detail, directly related to theoretical lectures. Similarly, as it has been noted that online study stuff is not available in bulk using the internet from home, teachers can have an opportunity to search and get some literature and research material to strengthen their lectures. Furthermore, many books and articles can be downloaded easily as every institute has certain books and articles in its digital library.

2. HEC Pakistan and University administration should conduct teachers training, especially for senior faculty members, as they lack digital technologies. It has also been observed that faculty members use no specific online program and everybody is using a different program to conduct a lecture session online. HEC and University administrations must agree on two or three standard software for implementing an online education system. It will create harmony in the education system of Pakistan.

3. For PhD faculty members, it has been observed that students hesitate to ask them a question freely, and there is a communication gap between the two groups. Thus, such teachers should teach the students at the level of students with a friendly environment so that students can have the freedom to ask questions and understand the lecture completely.

4. Professional industry experience plays a vital role in delivering the lectures more efficiently. It has been suggested to HEC that a minimum of three to five years of professional experience must be added to the eligibility qualification for academic staff in engineering education.

5. A teaching training session must be provided to all the faculty members irrespective of their academic titles. Since pedagogical skills are of utmost importance in delivering the lecture to students, it must be emphasized to have a diploma of education and teaching for all personnel who want to establish their career in academia.

5. CONCLUSIONS

Based on the questionnaire survey, it can be concluded that senior faculty are getting trouble learning the technology of digital semester quickly, and the lockdown situation has restrained them with a search of online academic material. Young and junior faculty members are not happy with the outdated course plan and want to update the engineering education syllabus structure. The shortage of Young PhDs has also been observed since the majority of PhD professors are of mature old age, and students are a bit uncomfortable in asking questions with them. It is to be appreciated that most teachers respond quickly to students in this pandemic and classes are also held regularly. On average, students reported better understanding those teachers having some professional experience in the construction industry.

This article proposes some solutions to make engineering education more effective in Pakistan. Teachers training for online software and various programs, a minimum professional experience for eligibility qualification of faculty members, and opening of all institutions for a minimum of one day a week is suggested under the regulations of country SOPs. Similarly, teachers training seminars and pedagogical diplomas are offered to make it compulsory for an academic career.

There must be a balance maintained in pedagogy art and technology to improve the education infrastructure in Pakistan and HEC must start working in this direction as soon as possible.

6. CONFLICT OF INTEREST

The authors declare no conflict of interest.

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