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Self-Approbation in Undergraduates of Pure Sciences: Analysis of Physical and Technological Environment of E-Learning During COVID-19

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Abstract

The current investigation was carried out to determine the level of E-learning during COVID-19 on Self-approbation of learners of Pure Sciences at undergraduate level in universities of Islamabad. The study objectives were to; explore the opinion of learners of Pure Sciences regarding their experience of the physical and technological environment of E-learning at the undergraduate level in Islamabad; analyze the level of self-approbation in the physical and technological environment during E-learning in undergraduate learners of Pure Sciences in Islamabad. A research design of quantitative survey was adopted to carry out the research. The population of the study included undergraduates from Engineering, Medical Studies, and Computer Science Departments from 23 universities of Islamabad. Snowball sampling technique was used and a sample of 274 science learners from different universities of Islamabad filled in the online Google form. Descriptive analysis was carried out to study the responses of the participants of the study. Percentage, frequency, means, and variance were calculated to compile the results of the investigation. The result of the study showed that the undergraduates of Pure Sciences showed a satisfactory level of self-approbation in all the subscales of physical and technological environment of E-learning except

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for Self-Approbation and Social Influence. In light of the conclusion of this research, it was recommended that the existing content and structure of E-learning can be improvised to complement the outcomes of the program by ensuring that the instructors of the E-learning sessions, involve the science learners and encourage them to participate by valuing their effort.

Keywords: self-approbation, undergraduates, e-learning, covid-19, pure sciences, physical and technological environment.

Introduction

COVID-19 took the world by surprise affecting each aspect of life. In numerous countries, conventional face-to-face learning was halted to ensure the safety of students, lecturers, and personnel. The expected pandemic (brought a state of detachment or restricted access instituted as a security measure) directly affected educational establishments everywhere. Fortuitously, current technology has made electronic learning (E-learning) a pivotal way to deal with teaching and education programs during the COVID-19 epidemic. E-learning is a mode of modern education using information technology to advance education (Ananga, 2020).

Online teaching has been commonly used in undergraduate programs, but not as a stand-alone method, but rather as part of a blended approach with traditional teacher-led instruction (Blissitt, 2016). The realization of E-learning depends on numerous variables, including accessibility, appropriate methods, course content, and evaluation criteria. Electronic learning, like any teaching method, has its pros and cons for both students and teachers. Notwithstanding e-learning during the COVID-19 explosion, other benefits worth mentioning include increased convenience, access to resources regardless of size and time, cost reduction, and air contamination (Singh & Hussain, 2021). According to Attardi and Rogers (2015) online courses additionally have obstacles, including internet access, the nature of feeble internet connections, and the inadequacy of the computerized capacity of respondents. Few perks, for example, time flexibility, can likewise be obstacles, especially for students with self-regulatory difficulties (Attardi & Rogers, 2015).

The advancements in E-learning have become universally acknowledged practice in higher education learning worldwide that happened because of the COVID-19 pandemic, primarily to overcome the educational loss of learners abrupt shifting of traditional learning to E-learning. This study focused on the acceptance of E-learning among learners of Pure Sciences and their level of self-approbation during online classes as an effective tool. The desired goals for E-learning are achieved adequately as the end-user acceptance process is recognized. The parameter of the successful indicator of environment that affects the self-approbation of learners during the E-learning model was adapted from a study by Stukalina (2014) and used as a framework of the investigation.

Statement of the Problem

COVID affected every life aspect, whether business, education, medical services, or employment; the effect was inevitable. Suddenly, educational institutions had to shut down because of drastically increased death rates and the number of people being affected. Weeks later, the abrupt shifting of traditional to E-learning was implemented as an alternative to overcome the damage as per the instruction of HEC in Pakistan. Pandemics took everyone by surprise, leaving less room for planning, training, and managing. The outcome was felt in students as deep-rooted anxiety and pressure of unseen work allotted to them especially for Pure Sciences learners because they have to do lab work. Researchers in the past have always emphasized Self-approbation (Satisfaction) as part of learning outcomes. This study evaluates the Self-approbation of undergraduate science learners during the COVID pandemic, where the E-Learning was not pre-planned or tested due to lack of time.

Objectives of the Study

The objectives were to:

1. Explore the opinion of learners of Pure Sciences regarding their experience of the physical and technological environment of E-learning at the undergraduate level in Islamabad.
2. Analyze the level of self-approbation in the physical and technological environment during E-learning in undergraduate learners of Pure Sciences in Islamabad.

Research Questions

1. What is the opinion of learners of pure sciences about their experience of Physical and Technological Environment of E-learning at undergraduate level Islamabad?
2. What is the level of self-approbation in Physical and Technological Environment during E-learning in undergraduate learners of Pure Sciences in Islamabad?

Theoretical Framework and Conceptual Framework

In the current study, the researcher used the framework of the study by Stukalina (2014):

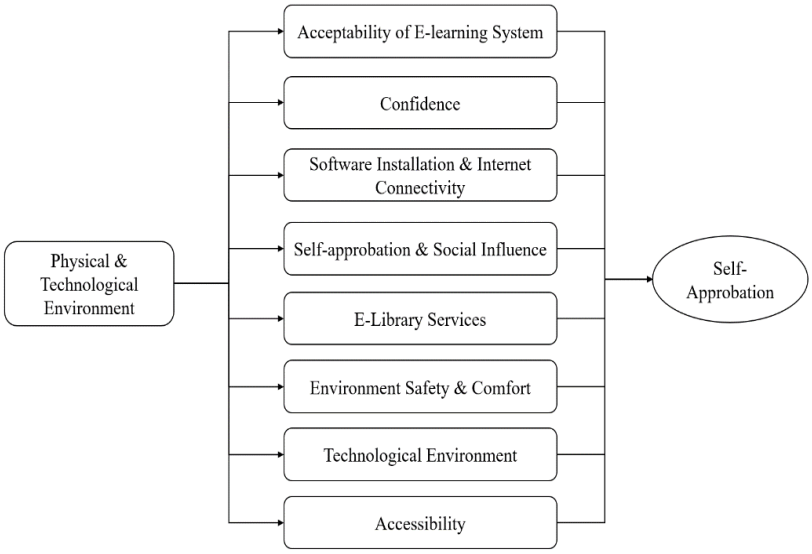


Figure1. Physical & Technological Environment of E-learning & Self-approbation in Learners (Stukalina, 2014)

The framework used in the study measured parameters of E-learning environment also refers as the physical and technological environment. The quality evaluation of e-library, environment safety and comfort, software installation, and internet connectivity support from staff and teachers are gauged using these parameters of E-learning. The subscales mentioned above are directly interlinked with the characteristics of self-approbation accessibility, feeling secure, and peace of mind.

Literature Review

COVID-19 was a global pandemic declared by WHO (2020) that posed multi-prolonged challenges to countries all over the world. About 1.7 people around the world, making 20% of the total world population were put under forced lockdown, and several countries around the world had to

enforce SOPs in their territories to control the disease. Many countries were forced to seal their borders and partially or completely shut down their markets, schools, and financial institutions, including economic and developmental institutions, which brought a drastic drop in the world economy.

On 26th February 2020, Pakistan confirmed its first COVID case in the country that was found in travelers from Iran. Within one month, on 13th March 2020, the cases nationwide were reported to be 602,536, including 13,476 deaths and thousands of confirmed cases of COVID in all the provinces of Pakistan (Government of Pakistan, 2020). Many steps were taken in this regard, like policy formulation, implementation of an emergency nationwide, mandatory COVID screening at different points in the cities, and surveillance (Noreen et al., 2020).

Effect of Pandemic on Learners

During COVID, learners faced lots of challenges regarding health that were never experienced before. The dramatic effect of the multiple waves of COVID changed the mode of life and left a mark to deal with the prospect it might bring in the future (Aristovnik, Keržič, Ravšelj, Tomaževič, & Umek, 2020). As mentioned earlier, many researchers backed the idea of E-learning in order to avoid the loss of time of learners and other damages that COVID posed on the educational system around the world (Crawford et al., 2020).

COVID pandemic not just affected the life practices of students but also had a more significant impact on the teachers of higher education. The channel of the academic work, libraries, mode of communication support in terms of administration, assessment methods, workload and expectation were drastically changed (Cao et al., 2020; Aristovnik et al., 2020; Owusu-Fordjour, C., Koomson, C. K., & Hanson, D. (2020).

Effects of Pandemic in Education System of Pakistan

In contrast to the measures taken in the rest of the world, Pakistan had also taken various precautionary measures to slow down the effect of COVID-19 and reduce the spread of COVID. Closure of educational institutions for a short or a long period of time had a deep impact on learners (Rajput, Noonari, Bukhari, Dehraj, & Rajput, 2020). According to the direct orders of the Ministry of Health and Services Pakistan (2020), the educational institutes were advised to close down their functioning due to the fear and

spread of COVID-19. Eventually, the educational sector was badly shaken due to the pandemic precautions taken nationwide.

Research showed that 89% of the worlds' student population was directly affected by COVID-19 (Muthuprasad, Aiswarya, Aditya & Jha, 2021). In comparison to educational institutions around the world especially in developed countries, the institutions in Pakistan developed a strategy to cope with the serious situation. This was done by making use of digital technologies and engaging learners to learn online in order to save time and the loss of the precious academic year (Gul & Khilji, 2021). Schools, colleges, and universities in Pakistan worked closely on the order of the government of Pakistan. On 13th March 2020, (Kouser, Kausar, & Ghani, 2020), in order to cop up with E-learning, a TV distant channel named 'Tele-school' was set up.

Electronic Learning Worldwide

In the world today, E-learning has been found beneficial in order to fulfill the needs of inquisitive learners (Adnan, Yousaf, & Gilani, 2019). E-learning and artificial intelligence have constantly been gaining popularity in the world (Soni, 2020). Few students were unable to access the traditional means of education due to any reason in the pre-pandemic like the inconvenience of transportation, distances, etc have been using the mode of E-learning.

At the start of COVID-19, the educational institutions worldwide shifted to E-learning in order to save time and minimize the disruptive aspects of COVID-19 (Soni, 2020). Educators had been teaching online using E-resources and lectures in the form of PDF, Word documents, PowerPoint presentations and also uploading them on web pages using tools for online learning and communicating (Sapkota, 2020). In addition to this, during pandemic the lectures had also been taken through video, online teaching apps like Google-meet, Skype, Voov, Zoom, WeChat, university LMS, etc (Felix, 2020; Naik et al., 2017). Thamarana (2016) in her investigation also emphasized that the E-learning mode has actually altered learning and teaching procedures for university students and faculty members.

Perspective of Undergraduate Learners in E-Learning in Pakistan

According to Malik, Ajmal, and Jumani (2020), Pakistan is the tenth largest known internet user in the world. However, the E-learning

experience was still a huge challenge for both teachers and learners in Pakistan (Malik, Ajmal, & Jumani, 2020). No wonder there has been an abrupt shift from the existing traditional educational system to an online E-learning education system in the country (Farooq, Rathore & Mansoor, 2020). Detailed lesson plans to make effective online study material was the primary concern of universities and facilities at the beginning of the abrupt shift to E-learning (Puljak et al., 2020).

The number of challenges in E-learning education that every university across the world faced include; lack of online teaching skills in faculty members, lack of support material and resources, lack of technical teams, overload of internet traffic, and urgent development courses for faculty members (Sathish, Sornaganesh, Sudha, & Chellama, 2020). It was not just teachers, but the learners also faced challenges due to the lack of practice and deficiency of proper learning attitude, lack of experience in using e-resources and material for learning, incapability of involvement in classroom learning and discipline, lack of motivation and learning environment at homes (Brazendale et al., 2017).

Self-approbation in Learners

Interaction is an element that plays a vital role in both conventional and E-learning programs (Kuo, Walker, Belland, & Schroder, 2013). Much literature has proved that the quality and quantity of students' interaction is directly correlated with the satisfaction of learners almost at any level of learning (Umer, Susnjak, Mathrani, & Suriadi, 2021). A study by Ke and Kwak (2013) described five elements of student satisfaction: relevance, active learning, autonomy, technology, and authentic learning. Similarly, Kuo, Walker, Belland, and Schroder (2013) emphasized that the interaction of learner and instructor and learner with the content of education and technology add to the learners' positive perceptions in learning.

While on the other hand, Su and Guo (2021) argue that positive perception of students needs effective learner-instructor interaction only. In addition to this, Keengwe, Diteeyont and Lawson-Body (2012) argued that learners' expectations are directly influenced by how the instructor designs the effective technology tool in the case of online learning, which has proved to be a key element in building satisfaction level among students. The study further concluded that satisfaction was one of the foremost elements that impact learning convince in case combined with the effectiveness of E-learning tools.

Self-Approbation in Learners during E-learning in COVID-19

Many countries the world over did not adopt E-learning as a mode of education until it was forced on them by the ongoing pandemic and was the only solution for continuing the studies (Mahajan, 2020). Many E-learning teaching Softwares were explored by teachers and educational institutions to maximize the ease of learning for their students (Nassoura, 2020). Learning institutions found it quite necessary to find out the personal opinion and experiences of the learners and teachers to explore the inclination of students towards E-learning methodology, including their level of adaption, in order to find room for amendment using their suggestions (Bali & Liu, 2018).

Most of the learners showed satisfaction during the E-learning courses in different parts of the world (Bawaneh, 2021). Similarly, some studies (Shrestha, Mehta, Mandal, Chaudhary, and Pradhan (2019); Pérez-Pérez, Serrano-Bedia, and García-Piqueres,2020) exhibited satisfaction of students for E-learning. As per the study of Elkaseh, Wong and Fung (2016) the students' perceptions were affected by several factors, including computer literacy skills, learning styles, level of technology acceptance, etc.

E-learning on Self-approbation of Pure Sciences Learners at Undergraduate-Level in Universities of Islamabad

In light of the above literature, it is evident that the self-approbation of learners depends upon many aspects, which can be termed as subscales of self-approbation. The use of technology and continuing studies through E-learning during COVID-19 was a scenario that didn't give any option to students worldwide to choose otherwise in order to save losing time. Since this is a recent scenario where pandemics hit the world, it was something that this generation or the former didn't experience before. Hence, there was a need and gap in research to determine how the learners reacted and perceived self-approbation during learning experiences in their online classes. The current study is focused on the self-approbation of undergraduate learners of pure sciences studying in the HEC recognized universities in Islamabad. It will aid in identifying the challenges and provide guidelines to an existing E-learning system in the city through learners' perspectives.

Methodology

Research Design

The research was a quantitative study where the data was interpreted via descriptive analysis.

Population and Sample

The population of the study comprised of all the learners of pure sciences studying in the HEC recognized universities in Islamabad. As per HEC record, there are 23 universities in Islamabad (during 2021). A number of 274 science learners made the sample of the study. This sample was collected using the snowball sampling technique as a Google form. The unpredicted lockdown in the city limited the researcher from personally visiting the universities for data collection.

Table 1.
Population of the Study

HEC Recognized Universities	No. of Learners Enrollment-HEC	Faculties	Departments
23	594,084	Pure Sciences	Medical Studies Computer Science Engineer Sciences

Instrument

The instrument of the study was an adapted questionnaire based on 5-point Likert scale ranging Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1). The scale had 57 items.

Table 2.
Scale of Self-approbation in E-learning

Subscale	Number of items	Authors
Acceptability of E-learning system	13	(Salloum & Shaalan, 2018)
Environment safety and comfort	9	(Salloum & Shaalan, 2018)
Confidence in using E-learning tools	6	(Salloum & Shaalan, 2018)
Self-approbation and Social Influence	4	(Salloum & Shaalan, 2018)
Accessibility	3	(Salloum & Shaalan, 2018)
E-library	9	Standardized from education survey
Technological Environment	4	(Simpson, 2012)
Software Installation and Internet Connectivity	10	(Sritharan, 2018)

Given above are the numbers of items per subscale of the instrument. They were adapted to the present instrument after getting permission from the respective authors.

Validity of the Instrument

Experts of Social Sciences of Air University, Islamabad and Institute of Applied Phycology, University of Punjab, Lahore. Language experts from Headstart checked the phraseology and the configuration of items of the instrument. Suggested changes were incorporated, and the researchers finalized the instrument for the administration.

Reliability of the Instrument

The reliability of the instrument was calculated using Cronbach's Alpha.

Table 3.
Reliability of the Instruments

S No.	Subscale	Number of Items	Cronbach Alpha
1	Acceptability of E-learning System	13	0.963
2	Environment Safety & Comfort	9	0.960
3	Confidence in Using E-learning Tools	6	0.923
4	Software Installation & Internet Connectivity	4	0.818
5	Accessibility	3	0.882
6	E-library	9	0.898
7	Technological Environment	4	0.875
8	Self-approbation & Social influence	10	0.773

Values in this table confirmed that the Cronbach's Alpha of each of the subscales was reliable and could be used for data collection.

Research Procedure

Mean, standard deviation, frequency, and percentage were used to explore the opinion and analyze the level of self-approbation of learners of Pure Sciences regarding their experience of Physical and Technological Environment of E-learning at undergraduate in Islamabad. The data was collected by researchers through Google form. Due to COVID-19 researchers were unable to visit the participants of the study personally.

Data Analysis

Descriptive statistics (percentage, frequency, and mean) were used to measure the data. The analysis was carried out using graphs and tables.

Results

Descriptive Statistic Analysis

Given below is the description of the respondents of the study in terms of gender.

Gender

The sample of the study included 274 participants. These participants were found to be 225 males and 49 females, as demonstrated in the table below:

Table 4.
Participation Ratio w.r.t. Gender

Male	Female	Total
225	49	274
82.1%	17.9%	100%

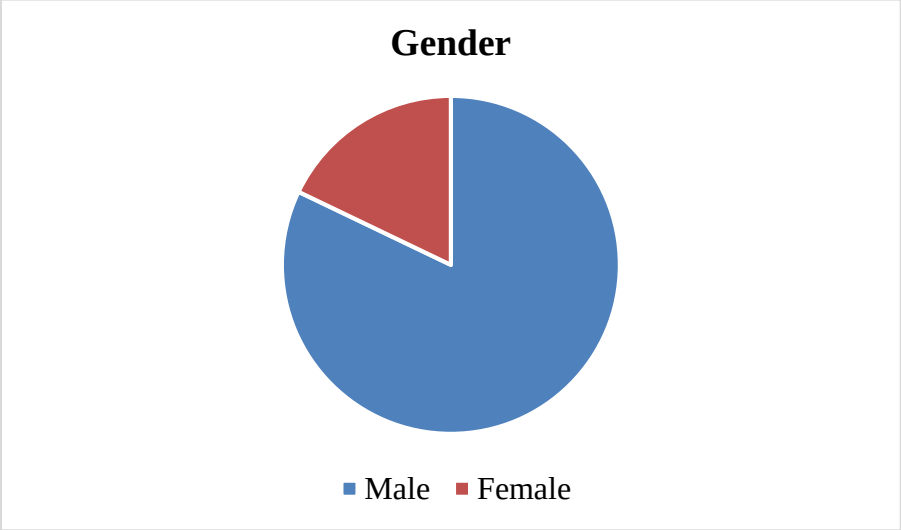


Figure.1. Participation Ratio w.r.t. Gender

The graphical presentation of the data as per gender classification reveals that 82.1% of the sample of the current investigation were male

participants. While on the other hand, 17.9% made up the female participants.

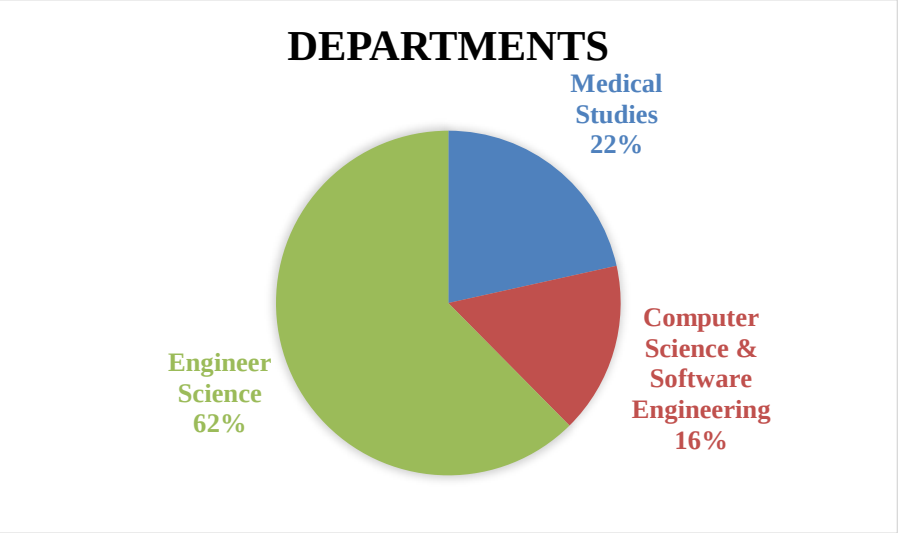
Departments

The data collected from the universities in Islamabad belonged to three different departments: Medical Studies, Software & Computer Science, and Engineering. The frequency of these departments, as mentioned earlier, is given below in Table 5 as follows:

Table 5.
Participation Ratio w.r.t. Educational Departments

Medical Studies	Software & Computer Science	Engineering	Total
59	44	171	274
21.5%	16.1%	62.4%	100%

Figure 2. Participation ratio w.r.t. educational departments



As demonstrated in the graph above, the frequency of sample distribution within different departments of universities in Islamabad is given in percentage. Figure 2 reveals that 62% of the data collected belonged to the Engineering Science Department. About 22% of participants were made up from Medical Studies and participants from the Software and Computer Science Department were 16% of the sample.

Mode of Online Classes

The mode of online classes was divided into the following three categories: University LMS, Zoom/Skype/Google Meet, and others. Table 6 given below, shows the tabular presentation of the data collected:

Table 6.
Mode of Online Classes

University LMS	ZOOM/Skype/Google Meet	Other
28	127	119
10.2%	46.4%	43.4%

As per Table 6, most of the participants used Zoom/Skype/Google Meet as their mode of online classes, which contributed as a group of 127 science participants in the data collected for the current investigation. 119 undergraduate students used other modes of online communication. Whereas 28 science students used LMS assigned by their university to access online learning during COVID.

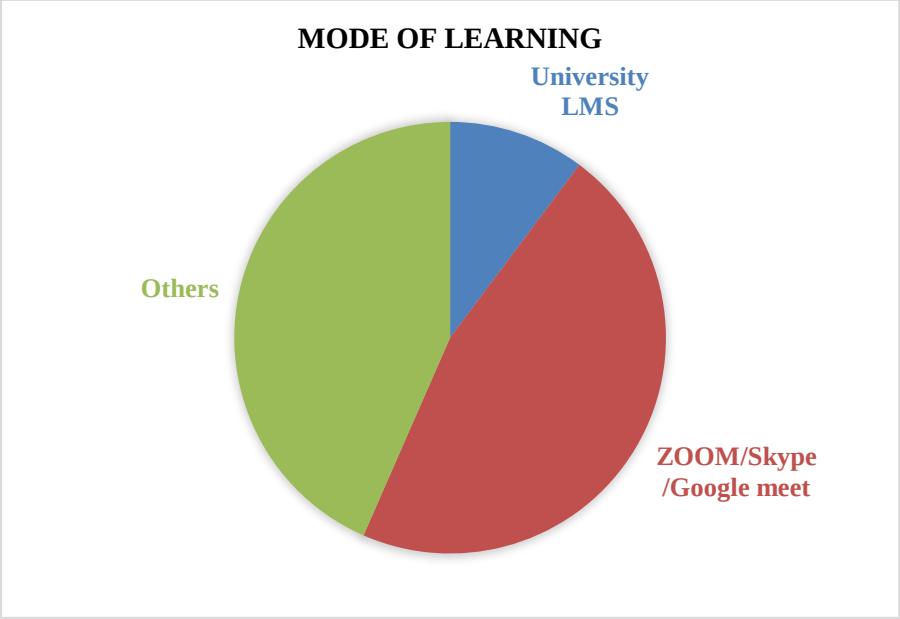


Figure 3. Mode of online classes

Figure 3 shows that most participants used Zoom/Skype/Google Meet as online learning modes in their undergraduate studies in COVID. It made 46.4% of the science participants of the current investigation. About 43.4% of the students made up the participants who used other means to attend online classes, 10.2% of science students used LMS to attend online classes during the COVID pandemic.

Table 7.
Mean, Standard Deviation and Variance of Physical & Technological Environment of E-learning

S No	Subscales of E-learning	Mean	Standard deviation	Variance	n
1	AES	36.9927	12.65403	160.124	274
2	ESC	29.4161	8.50911	72.405	274
3	CONFI	19.8905	5.71571	32.669	274
4	SASI	12.8504	3.70667	13.739	274
5	ACCESSIBILITY	9.3285	3.00819	9.049	274
6	ELIBRARY	29.2336	7.57503	57.381	274
7	TE	12.6460	3.46551	12.010	274
8	SIIC	35.1533	5.87338	34.497	274

As per the table given above, the value of the sum of the mean of Acceptability of E-learning System (AES) was the highest (36.9927), followed by Software Installation & Internet Connectivity (SIIC) (35.1533), Environment Safety & Comfort (ESC) (29.4161) and then E-library (29.2336). The standard deviation of Accessibility was calculated to be the highest, that is (12.65403), followed by Environment Safety & Comfort (ESC) (8.50911), E-library (7.57503), Confidence (5.71571).

The highest variance of the subscales of E-learning was calculated to be Accessibility (AES) (160.124) implies that this subscale had more scattered responses from the value of its mean, as indicated by the research (Kourkoulos & Tzanakis, 2010). The subscale of Accessibility with the lowest variance of 9.049, implying that this subscale had the least scattered responses from the value of its mean.

Table 8.
Frequency and Percentage of Physical & Technological Environment of E-learning

	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	F	*%*	*F*	*%*	*F*	*%*	*F*	*%*	*F*	*%*
AES	615	17	711	20	846	24	1016	29	374	10
ESC	278	11	369	15	607	25	946	38	266	11
CONFI	192	12	190	11	416	25	623	38	223	14
SASI	106	10	174	16	347	32	342	31	127	11
ACCESSIBILITY	105	13	117	14	201	25	314	38	85	10
ELIBRARY	322	13	285	12	703	28	886	36	270	11
TE	93	9	157	13	367	34	389	36	90	8
SIIC	209	8	259	9	721	26	973	36	578	21
∑ Physical & Technological Environment	1920	12	2262	14	4208	26	5489	35	2013	13

As per the result shared in the table given above, most of the respondents (35%) agreed and showed satisfaction in self-approbation during the physical and technological environment of E-learning during COVID. 26% of the respondents were neutral. 14% of the sample were not satisfied, 13% showed a high level of satisfaction. Whereas 12% were highly unsatisfied.

Discussion

Findings of the current study revealed that only 10.2% of the university in Islamabad used LMS whereas maximum universities practiced using Zoom/ Skype/ Google Meet. The subscale of Accessibility of E-learning System (AES) showed the variance of 160.124 which implies this subscale has the most scattered responses from the participants. Whereas the subscale of Accessibility has the lowest variance of 9.049 implying that this subscale has the least scattered value from the values of its mean. In the subscale of Accessibility of E-learning System (AES) maximum respondents showed satisfactory self-approbation of 29%; in each of the subscales of Confidence, Accessibility, and Environment Safety and Comfort (ESC), maximum respondents showed satisfactory self-approbation of 38% respectively. In the case of each of the subscales of E-library, Technological Environment and Software Installation &

Internet Connectivity (SIIC) maximum respondents showed satisfactory self-approbation of 36% respectively. However, maximum respondents stayed neutral in terms of their self-approbation in the subscale of Self-Approbation and Social Influence (SASI). The overall percentage of physical and technological environments showed that the maximum number of respondents (35%) displayed satisfactory self-approbation during E-learning.

Conclusion

The opinion of the undergraduate learners of Pure Sciences was positive towards E-learning, especially in most of the areas of Physical and Technological Environment except for Self-Approbation and Social Influence (SASI). The undergraduate learners of Pure Sciences exhibited a satisfactory level of self-approbation in each subscale of Physical and Technological Environment during E-learning in Islamabad, namely Accessibility of E-learning System (AES), Confidence, Accessibility, Environment Safety and Comfort (ESC), E-library, Technological Environment and Software Installation & Internet Connectivity (SIIC).

Recommendations

As per the results following are the recommendations of the study:

1. Universities need to look into the aspects of Self-Approbation and Social Influence (SASI) in order to ensure that the learners of Pure Sciences have a satisfactory level of self-approbation during E-learning in COVID. This can be done by ensuring that the instructors who conduct E-learning sessions, involve the learners and encourage them to participate by valuing their input.
2. The self-approbation of undergraduate learners of Pure Sciences can be enhanced to a higher level by involving instructors (Visiting or Permanent) of the universities in undertaking mandatory professional development crash courses to facilitate E-teaching.
3. In light of the current research, the content and structure can be improvised to complement the outcomes of the E-learning program. This can be done by facilitating the universities in terms of training the technical and non-academic staff.

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