ORIGINAL ARTICLE

E-Learning Readiness and Anxiety Levels among Preclinical Medical Students during the COVID-19 Pandemic

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ABSTRACT

Introduction: The Coronavirus Disease (COVID-19) pandemic has had a significant impact on all sectors, including education. The change from conventional learning systems to e-learning during the pandemic could affect students' mental health, such as the emergence of anxiety. Therefore, this study focused on the relationship between e-learning readiness and anxiety levels, a topic that has not been previously studied in Indonesia.

Methods: This was an observational analytic study with a cross-sectional approach. A total of 132 preclinical medical students were chosen through a stratified random sampling technique. Variables were measured using the e-learning readiness (ELR) and Zung Self-Rating Anxiety Scale (SAS) questionnaires. Bivariate analysis using Spearman's rho correlation test was performed using the International Business Machines Corporation (IBM) Statistical Package for Social Sciences (SPSS) for Windows version 24.0, with a $p<0.05$ considered statistically significant.

Results: The results showed that the sample was ready to run e-learning but needed minor improvement (55.3%) and had low anxiety levels (87.1%). Spearman's rho correlation test showed no significance, with $p=0.545$ ($p>0.05$; $r=-0.053$).

Conclusion: There was no statistically significant relationship between e-learning readiness and anxiety levels of preclinical medical students during the COVID-19 pandemic. These results are crucial for evaluating the ongoing implementation of e-learning as a form of innovation in medical education, even after the COVID-19 pandemic has ended.

Highlights:

1. The e-learning readiness measurements were positive, and the level of anxiety was found to be relatively low.
2. Many factors can affect both aspects of e-learning readiness and anxiety among medical students.

Introduction

The Coronavirus Disease (COVID-19) pandemic has significantly impacted all sectors of life, including education. The Indonesian government implemented online learning systems from home to prevent the transmission of SARS-CoV-2. Face-to-face learning was finally transitioned to online learning on 17 March 2020. Online learning refers to the process of learning that utilises the internet and electronic devices as learning media.[1]

In addition to education, the COVID-19 pandemic has also affected mental health, causing various psychological effects such as depression, anxiety, and panic disorders.[2] One of the psychological effects on students during the COVID-19 pandemic is the emergence of anxiety.[3] Anxiety is a response to stress characterized by activity within response systems that includes subjective phenomenological experience, such as feelings of fear or worry, overt behaviors, and neural activation, both peripheral and central, manifesting as physiological arousal and muscle tension.[4] A survey of a population of 7,143 university students in China showed that 24.9% of them experienced anxiety due to the COVID-19 pandemic.[5] Among them, 0.9% experienced severe anxiety, while 21.3% experienced mild anxiety.[5]

Anxiety in students can also manifest as a result of online learning. A study in Bangladesh highlighted the importance of assessing the e-learning readiness of university students and the mental health outcomes, especially during the COVID-19 pandemic.[6] Another study among medical students in Saudi Arabia also showed that online learning participants frequently expressed anxiety.[7] This suggests that the anxiety that also arises in the problem-based learning (PBL) learning method, as a form of a student-centered competency-based curriculum, also appears in the e-learning method, which places students at the centre of the learning process.[8]

Although the use of information and communication technology (ICT) in medical education can be regarded as a learning innovation, especially in the context of the COVID-19 pandemic, the transition to an online learning system has presented challenges.[9] Based on the literature, we believe that there is a relationship between e-learning readiness and anxiety levels in preclinical medical students. Although online learning is now being reinstated on a full or hybrid basis, this study is essential to consider the aspects needed to improve the quality of medical learning in the future and to determine the impact of preparation and learning methods on the mental health of medical students. This study was conducted among students who accepted the change, focusing on the relationship between e-learning readiness and anxiety levels in preclinical medical students, a topic that had not been previously studied in Indonesia.[9]

Methods

This study employed an observational analytic design with a cross-sectional approach, which is ideal for examining prevalence and observing a cross-section of a phenomenon at a single point in time.[10] The study was conducted online at the Faculty of Medicine, Universitas Tanjungpura, in June 2021. This study was approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Tanjungpura (Ethical Clearance No. 2132/UN22.9/TA/ 2021). The subjects of this study were 132 preclinical medical students enrolled in the Faculty of Medicine, Universitas Tanjungpura. The estimated sample size was determined using the Slovin formula to ensure population representation and minimize the chances of bias, with a 5% acceptable error and a population size of 195. This study employed a stratified random sampling technique, ensuring that the large proportion of second-year students (n=97) and third-year students (n=98) in the academic year samples was 1:1. The inclusion criteria for this study were subjects who had experienced at least one semester of face-to-face learning and one semester of e-learning. Subjects were excluded if they were under psychiatric treatment and/or if the Lie Minnesota Multiphasic Personality Inventory (L-MMPI) questionnaire score was ≥10.[10]

The tools of the study included two questionnaires. The e-learning readiness (ELR) questionnaire from the Aydin & Tasci model was used to measure the level of e-learning readiness. The questionnaire intended for students consisted of 19 statements based on four factors, including human, self-development, technology, and innovation.[11] The scale is ranked on a 5-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The average value of the statements for the same factor and the total average value of all questions were assessed for their level of readiness based on the Aydin & Tasci ELR model of readiness measurement scale. The other questionnaire was the Zung Self-Rating Anxiety Scale (SAS), a self-report anxiety measurement tool developed by William W.K. Zung in 1971. This questionnaire was developed based on the symptoms of anxiety in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III). This measure focuses on the most common disorders of generalized anxiety, both psychological and somatic.[12] This questionnaire consists of 20 questions/statements where each question/statement has a score of 1-4 (1=never, 2=sometimes, 3=often, 4=always). The validity and reliability of the research instruments were tested to assess their feasibility. The research instrument was considered valid if the significance value (sig. 2-tailed) was less than the value of α=5% with valid results for both instruments (ELR <0.05, SAS <0.05). The research instrument was considered reliable if the value of Cronbach's Alpha >0.60, with reliable results for both instruments (ELR=0.901, SAS=0.905).[12]

Data retrieval was conducted directly through Google Forms via Zoom Meeting.[13,14] Before data collection through questionnaire administration, the subjects were informed about the research and asked to provide informed consent. Subjects who subsequently agreed to participate were then permitted to complete the questionnaire. Data were processed using Microsoft Excel software and analyzed further using the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) for Windows version 24.0.[15,16] A normality test was performed by using the Kolmogorov-

Smirnov test. The bivariate analysis used in this study was Spearman's rho correlation test and the chi-square test.[16]

Results

The majority of subjects were 20 years old (53.8%). The female students (62.1%) outnumbered male students (37.9%) in this study. The results also show that most subjects lived in urban areas (78%), with parents (84.8%), and had stable family incomes (75%).

Table 1 shows that 78.8% of the subjects were ready for e-learning, while 55.3% of them required some improvement. The chi-square test revealed no significant difference between the sample groups based on demographic characteristics, as indicated by a p-value greater than 0.05.

Table 1. Distribution of demographic characteristics and their correlation with e-learning readiness and anxiety

Variable	Not ready, needs a lot of work (range score 1-2.6)		Not ready, needs some work (range score 2.6-3.4)		Ready but needs a few improvements (range score 3.41-4.2)		Ready, go ahead (range score 4.21-5)		p	Mild (range score 20-44)		Moderate (range score 45-59)		Severe (range score 60-74)		Panic (range score 75-80)		p
	n	%	n	%	n	%	n	%		n	%	n	%	n	%	n	%	
Academic Year									0.936									0.125
3rd year	1	1.5	12	18.2	37	56.1	16	24.2		59	89.4	7	10.6	0	0.0	0	0	
2nd year	2	3.0	13	19.7	36	54.5	15	22.7		56	84.8	6	9.1	4	6.1	0	0	
Gender									0.282									0.765
Male	2	4.0	10	20.0	23	46.0	15	30.0		44	88.0	4	8.0	2	4.0	0	0	
Female	1	1.2	15	18.3	50	61.0	16	19.5		71	86.6	9	11.0	2	2.4	0	0	
Age (years old)									-									-
<20	1	3.1	5	15.6	18	56.3	8	25.0		30	93.8	1	3.1	1	3.1	0	0	
20	1	1.4	15	21.1	40	56.3	15	21.1		60	84.5	8	11.3	3	4.2	0	0	
>20	1	3.4	5	17.2	15	51.7	8	27.6		25	86.2	4	13.8	0	0.0	0	0	
Place of Residence									0.938									0.310
Rural	1	3.4	6	20.7	16	55.2	6	20.7		23	79.3	5	17.2	1	3.4	0	0	
Urban	2	1.9	19	18.4	57	55.3	25	24.3		92	89.3	8	7.8	3	2.9	0	0	
Family Income									0.501									0.372
Unstable	0	0.0	7	21.2	16	48.5	10	30.3		29	87.9	2	6.1	2	6.1	0	0	
Stable	3	3.0	18	18.2	57	57.6	21	21.2		86	86.9	11	11.1	2	2.0	0	0	
Living with Parents									0.190									0.642
Yes	3	2.7	18	16.1	65	58.0	26	23.2		97	86.6	12	10.7	3	2.7	0	0	
No	0	0.0	7	35.0	8	40.0	5	25.0		18	90.0	1	5.0	1	5.0	0	0	
Total	**3**	**2.2**	**25**	**19**	**73**	**55.3**	**31**	**23.5**		**115**	**87.1**	**13**	**9.8**	**4**	**3**	**0**	**0**	

Source: Research data, processed

Table 1 also shows that 87.1% of the subjects had mild anxiety. The results of the chi-square test analysis revealed no significant difference between the sample groups based on demographic characteristics, as indicated by a p-value greater than 0.05. The e-learning readiness factor scores presented in Figure 1 suggest that human factors (4.19), technology (4.01), and innovation (3.67) fall within the 'ready' category but require some improvement. In contrast, the self-development factor (3.39) indicates that they are not yet ready and require some improvement. The unpreparedness in the self-development factor is attributed to third-year students (3.35), which affects the overall average value of the self-development factor. However, the general research sample has shown readiness in e-learning (3.82), but requires some improvement.
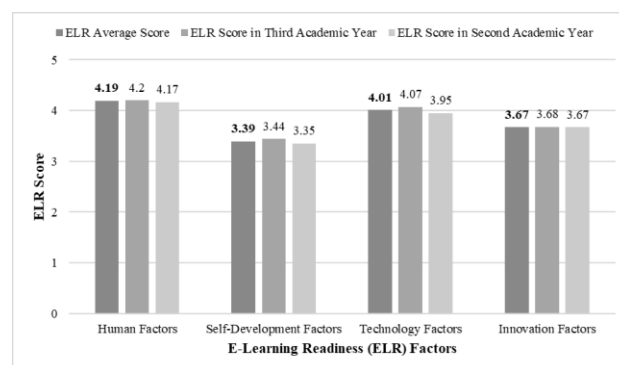
Source: Research data, processed
Figure 1. E-learning readiness factor scores among 2nd- and 3rd-year medical students

A normality test was performed using the Kolmogorov-Smirnov test, which indicated a normal distribution (p>0.05).

Table 2. The relationship between e-learning readiness and anxiety level

| E-Learning Readiness | Anxiety Level | | | | | |
| | Mild | | Moderate | | Severe | |
	n	%	n	%	n	%
Not ready, needs a lot of work	2	1.5	1	0.8	0	0
Not ready, needs some work	21	15.9	2	1.5	2	1.5
Ready but needs a few improvements	65	49.2	7	5.3	1	0.8
Ready, go ahead	27	20.4	3	2.3	1	0.8
Spearman's rho	p=0.545, r=-0.053					
3rd year	p=0.845, r=-0.024					
2nd year	p=0.548, r=-0.075					

Source: Research data, processed

The bivariate analysis, as shown in Table 2, revealed no statistically significant relationship between e-learning readiness and anxiety levels among the subjects, as indicated by a p-value of 0.545 (r=-0.053), which is greater than 0.05.

Discussion

A study on the online learning readiness of medical college students in Nepal showed an online learning readiness score of 87.1%.[17] Competency and proficiency in using different types of information technology (IT) and access to the internet play a crucial role in determining e-learning readiness. E-learning readiness is supported by ICT-related experiences that facilitate more effective approaches to online learning.[17] Human (4.19) and technology (4.01) factors both received relatively high e-learning readiness scores. It was previously noted that human and technological factors were focused on the capabilities and experience of human resources related to the use of technology.[11] This is further supported by the characteristics of the subject, most of whom are young. The average age of the subjects was 20 years old, indicating that they belong to Generation Z and have a high tendency to engage with technology. Generation Z prefers web-based learning, video-based presentations, and other learning methods that incorporate technology approaches.[18]

A study conducted at Universitas Airlangga indicated a correlation between stress levels and learning motivation among pre-clinical medical students.[19] This finding suggests that learning motivation in online education may differ from that in conventional methods. Learning behavior encompasses learning time, rest or recreation time, and learning methods, all of which impact the quality of an individual's learning process.[19] One influencing factor is the budget allocated for e-learning.[11] This can also be seen through the characteristics of a quarter of the subjects, which suggest instability of family income affecting the fulfillment of household needs. Although there is no significant difference in the characteristics of family income

stability, this can be a concern in achieving better e-learning readiness.[11,17]

The findings of various tests on characteristics such as generation, gender, type of area, family income, and living arrangements with parents showed no significant differences. These findings indicate that samples with different characteristics have equal opportunities to achieve e-learning readiness. Similar results regarding gender characteristics (p=0.067) were found in a study conducted in Nigeria, and family income characteristics were associated with dimensions of online learning readiness, including computer/internet self-efficacy (p=0.21), self-directed learning (p=0.26), learner control (p=0.91), motivation to learn (p=0.16), and online communication self-efficacy (p=0.95), as found in a study in the Philippines.[17,20]

This study represents a new phase in the development of learning in medical schools. A previous study has demonstrated that the time flexibility of asynchronous learning and the improved well-being it offers are significant advantages of e-learning.[21] Therefore, e-learning readiness needs to be improved before e-learning is implemented in medical schools. Improved readiness will support better outcomes during the e-learning process and help minimize potential obstacles. In the future of medical education, e-learning readiness assessments can be applied during the pre-e-learning period in the first semester to measure and project an e-learning model that aligns with the identified readiness levels.[9,17]

A literature review study that aimed to provide an overview of student anxiety levels in various countries during the COVID-19 pandemic showed that mild anxiety (28.9%) was most frequently reported among 25,984 students outside Indonesia.[22] A different study conducted in Indonesia regarding student anxiety levels during the COVID-19 pandemic also showed similar results, with most students experiencing mild and normal anxiety (41.58%).[23] The results of this study are not as severe as those of another study in Indonesia, which aimed to determine the effect of distance learning and physical distancing on the anxiety levels of medical students. That study found that most medical students experienced severe levels of anxiety (88%).[24] It is understandable that the subjects in this current study have undergone a process of adaptation and coping strategies during the COVID-19 pandemic, resulting in lower anxiety levels compared to earlier research conducted at the beginning of the pandemic. The challenges that arose during the COVID-19 pandemic forced students to overcome various obstacles and adapt to changing circumstances.[25]

An interesting result found that severe anxiety was present only among second-year students. This can be explained by the fact that anxiety also depends on individual experiences, which affect the way individuals evaluate situations that can trigger anxiety. Students with longer study periods tend to have more experience dealing with problems related to lectures, making them more accustomed to the various pressures they encounter.[8] One of the dimensions used to measure readiness for e-learning is the ability to learn independently.[26] The method of e-learning will focus on student-centered learning, hence

students play a more active role in the learning process. Based on the dimensions of self-study ability, a study in Indonesia found no significant relationship between self-study readiness and anxiety levels among medical students (p=0.217).[8]

The results of this study and several previous studies have shown that e-learning readiness is not the main factor contributing to anxiety levels in medical students, especially during the COVID-19 pandemic. Additionally, a previous study has shown that medical students expressed satisfaction with the online learning environment during the COVID-19 pandemic.[27]

Regarding anxiety in students during the COVID-19 pandemic, other studies have shown several factors such as the experience of experiencing COVID-19 symptoms (p<0.001), delays in the implementation of the final exam (odds ratio/OR=1.6, 95% confidence interval/CI [1.3, 2.1], p<0.0001) and reduced study time due to academic impairment (OR=1.3, 95% CI [1.1, 1.6], p=0.031), as well as having relatives or acquaintances who suffer from COVID-19 (OR=3.007, 95% CI [2.377, 3.804]).[5,28,29] The protective factors against student anxiety during the COVID-19 pandemic included living in urban areas (OR=0.810, 95% CI [0.709, 0.925]), family income stability (OR=0.726, 95% CI [0.645, 0.817]), and living together with parents (OR=0.752, 95% CI [0.596, 0.950]).[5] Furthermore, it is essential to recognize that anxiety in medical students can stem from various factors beyond e-learning readiness. Internal factors such as student personality, as well as external factors like lecture load, examinations, limited social interaction, and financial stressors, often contribute to anxiety.[30,31]

A study suggest that the highest prevalence of anxiety was found in males and middle-born children, particularly among students who were dissatisfied with their body condition, perceived health as unimportant, had a history of chronic diseases, frequently experienced conflict with their parents, and whose parental income was below the minimum wage.[32] Academic problems are the leading cause of depression that increases the risk of suicide among students.[33] Moreover, research suggests that the highest rates of depression in medical students are linked to the challenge of adapting to a previously unfamiliar learning system.[34]

The findings of this study suggest a positive perspective, emphasizing that the enhancement of e-learning readiness and the quality of medical faculties should encompass multiple facets. A multifaceted review is essential to develop strategies that effectively enhance e-learning readiness and alleviate anxiety levels among medical students.[34]

Strengths and Limitations

The strength of this study lies in its novel exploration of the research topic, which focuses on e-learning readiness and its impact on medical student anxiety levels. However, a limitation of this study was its inability to rule out potential biases stemming from other factors that may influence anxiety levels among medical students.

Conclusion

There was no statistically significant relationship between e-learning readiness and anxiety levels of preclinical medical students during the COVID-19 pandemic. These results are significant for considering the implementation of e-learning despite the end of the COVID-19 pandemic as a form of innovation in medical education.

Conflict of Interest

The authors declared there is no conflict of interest.

Ethical Clearance

This research received approval from the Research Ethics Committee of the Faculty of Medicine, Universitas Tanjungpura (Ethical Clearance No. 2132/ UN22.9/ TA/ 2021) on 03-09-2021. Consent was obtained from participants for the research study.

Authors' Contributions

Designed the study and drafted the manuscript: DW. Collected data and performed background literature review: DW and IA. Performed statistical analysis: DW. Supervised results and discussion: DW, SEP, and IA. All authors reviewed and approved the final version of the manuscript.

Data Availability

N/A.

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