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Impact of online education due to the pandemic among college students: Knowledge, Attitude and Practices analysis with structural equation modeling

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Abstract:

Pandemic 2019 is observed in all sectors of the world which had caused a huge disruption in the education system in India as well as worldwide adding challenges to student's life. We aimed to provide an outline on E-Learning and the difficulties experienced by students of various colleges in the southern parts of India and to conduct knowledge, attitude and practices (KAP) analysis based on student's perception regarding E-learning by collecting an online survey, 346 valid questionnaires were retrieved. In order to evaluate the association between the variables of KAP, structural equation modeling was used for data analysis. The influencing factors of KAP were observed to know the effect of the pandemic on E-learning from the model. The result finding moderately fit the collected data and reveals a good fit of the model in the means of satisfying the threshold values.

Keywords:

Confirmatory factor analysis, E-learning, knowledge, attitude and practices survey, structural equation modeling

Introduction

The pandemic of 2019 was first reported in Wuhan, Hubei Province, China. The virus has evolved and rapidly spread to other countries worldwide as a global threat. More than 2.99 crores of confirmed cases were reported in India.^[1,2] This sudden outbreak across the globe has forced to shut down educational institutions to control the spread of the virus.^[3] The suspension of classroom teaching led to an immediate switch to the online teaching for college students which became more effective^[4,5] but led to additional challenges such as poor network connection, ineffective learning strategies, poor motivation, distraction, lack of interaction, change of behavior

and adaptability. The study is to observe the challenges faced by students based on the knowledge, attitude, and practice of students regarding E-learning and to provide its impact using Structural equation modelling in order to improve E-learning for a better future of students.

Materials and Methods

Study design and setting

The knowledge, attitude and practices (KAP) instrument had a title, a short introduction that includes instructions, a section that collects sociodemographic information's, and the main section that comprises the questions to which responses about knowledge, attitudes, and practice are expected.

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Study participants

The study type is observational and the data was collected in the year of 2020. A data of 25 items that relate to knowledge (6 items), attitude (9 items) and practice (10 items)^[6] was collected by a self-administered questionnaire. Likert scale was used with 2–5 scores assigned to each of the items based on the student's perceptions^[7] on E-learning. Data was collected from 352 college students in the Southern parts of India from places like Kerala, Karnataka, Andhra Pradesh, Telangana, and Tamil Nadu. Out of the total 352 questionnaires only 346 questionnaires were fully completed in all aspects. Questionnaires were sent through the official E-mail id of SRIHER.

Data collection tool and techniques

The collected data was entered in a spreadsheet program like Excel and was then imported to the SPSS for windows; version 16.0; Chicago, SPSS Inc for frequency and percentage calculation. Statistical methods like exploratory factor analysis, confirmatory factor analysis was used to examine the impact of E-learning by using Analysis of Moment Structure (AMOS) software package. Structural equation modelling (SEM) was used to evaluate the fitness of the model.

Ethical consideration

Ethical clearance reference CSP/21/MAR/91/195 was approved from the Institutional Ethics Committee at Sri Ramachandra Institute of Higher Education and Research (Deemed to be University) in Chennai. Confidentiality from the participants was maintained.

Results

Table 1 shows the basic profile of the participants. 346 complete questionnaires were collected from students of various colleges in the southern parts of India. Mean age was approximately 22 ± 2 with a minimum age of 16 and maximum age of 27.

Table 2 shows the responses of students based on the availability of technological needs during this pandemic. Majority of the respondents used smartphones and 4th generation type of internet services. From the responses, the quality of the internet was considered better. 52% agreed that they acquired knowledge from the lectures provided by the university.

Table 3 describes the effect of pandemic on the education process. 54.9% of respondents agreed that the faculties postponed their educational programs and 59% of respondents agreed that this pandemic has affected their career plan of future interest.

Table 4 shows the understanding of respondents towards E-learning. 77.5% respondents were aware of E-Learning

Table 1: Basic profile of the students

Characteristics	Frequency (%)
1. Age (years)	
16-21	263 (76)
22-27	83 (24)
2. Gender	
Female	247 (71.4)
Male	99 (28.6)
3. State	
Andhra Pradesh	9 (2.6)
Karnataka	10 (2.9)
Kerala	9 (2.6)
Pondicherry	1 (0.3)
Tamil Nadu	304 (87.9)
Telangana	13 (3.8)
4. Resident	
Rural	55 (15.9)
Sub-urban	27 (7.8)
Urban	264 (76.3)
5. Course	
Arts and science	82 (23.7)
Dental	8 (2.3)
Engineering	71 (20.5)
Medical	66 (19.1)
Others	11 (3.2)
Paramedical	108 (31.2)
6. Year	
First year	49 (14.2)
Second year	80 (23.1)
Third year	67 (19.4)
Fourth year	132 (38.2)
Fifth year	18 (5.2)

that it depends on the digital electronic environment. 67.9% of respondents found E-Learning as an interactive system. 50.3% of respondents considered E-learning as expensive while 49.7% considered it as less expensive. 83.5% of respondents made use of various multimedia contents like audio recordings, videos and eBooks.

Table 5 shows the respondents applicability and usability of E-learning. Only 6.8% agreed that online lectures are better than live content while 42% were neutral. Most of the students strongly disagreed (27.3%) that practical aspects of their educational curriculum were not covered. 31.3% of respondents agreed E-learning to be more flexible than traditional learning while 43.2% of respondents agreed that they faced financial difficulty while 44% were neutral.

Table 6 describes the student's response to E-Learning practices. 59.8% of students participated in various online programs. Students were able to use the internet regularly to attend various problem-based learning and other courses to obtain information and knowledge. 84.4% of respondents used online applications for education purposes. Majority of the students were able to study in groups with friends through online meetings.

Table 2: Usability of technology tools during the pandemic

Variables	Total (%)
1. Level of capability in using various electronic devices	
Inadequate	11 (3.1)
Acceptable	75 (21.3)
Very good	99 (28.1)
Good	125 (35.5)
Proficient	42 (11.9)
2. Type of internet service available	
ADSL	20 (5.7)
3G	28 (8)
4G	304 (86.4)
3. Quality of internet service	
Bad	19 (5.4)
Acceptable	95 (27)
Good	184 (52.3)
Very good	54 (15.3)
4. Which of the following items do you personally own and utilize in your education?	
Personal computer	108 (30.7)
Tablet	24 (6.8)
Smartphone	220 (62.5)
5. Does your device support any of the following technologies?	
Augmented reality	25 (7.1)
High-definition phone camera	48 (13.6)
4G service	245 (69.6)
All the above	34 (9.7)
6. Your education depends upon	
Lectures provided by the university	180 (52)
Courses provided by the private education centre's/courses	98 (28.3)
Self-study utilizing various educational sources	68 (19.7)

ADSL=Asymmetric digital subscriber line, 3G=3rd generation, 4G=4th generation

Table 3: Impact of pandemic on education

Variables	Total (%)
1. Did you suspend your educational program (of your own volition) recently due to any of the following reasons?	
Have not suspended educational program	268 (77.5)
Suspended educational program due to the civil unrest/relocation from residence	15 (4.3)
Suspended educational program due to financial problems	19 (5.4)
Suspended educational program due to my social status and personal responsibilities	14 (4.0)
Suspended educational program due to other reasons	30 (8.8)
2. Did the faculty suspend or postpone the educational program in response to Pandemic?	
Yes	156 (45.1)
No	190 (54.9)
3. Did the pandemic affect your career plan and future interest?	
It has affected the career plan of future interest	204 (59.0)
Became interested in public health/infectious diseases	33 (9.5)
Has not affected career plan or future interest	109 (31.5)

Table 7 shows the Kaiser-Meyer-Olkin and Bartlett's test. The sampling adequacy measure is 0.737 and Bartlett's test of sphericity showed a value of 0.0005 which is significant.

Statistical analysis

To test the fitness of the model SEM was used to assess the causal relationship between the variables as well as to verify the compatibility of the model. Figure 1 is the multilevel structural equation model. The data was summarized into groups of variables that are interrelated. By confirmatory factor analysis the hypothesis for the structure of the variables were formally tested. From this model to know the impact of E-learning, the values obtained from each of the items were evaluated and by these influencing factors of KAP were estimated. The values <0.5 were considered less influencing factors which denoted the impact of E-learning and values >0.5 were considered as more influencing factors towards KAP on E-Learning.

It can be inferred that out of 25 items, 15 items (K1, K2, K4, K5, K6, A1, A2, A3, A6, A7, A8, P3, P5, P7, P9) are having more than 0.5 factor loadings and were

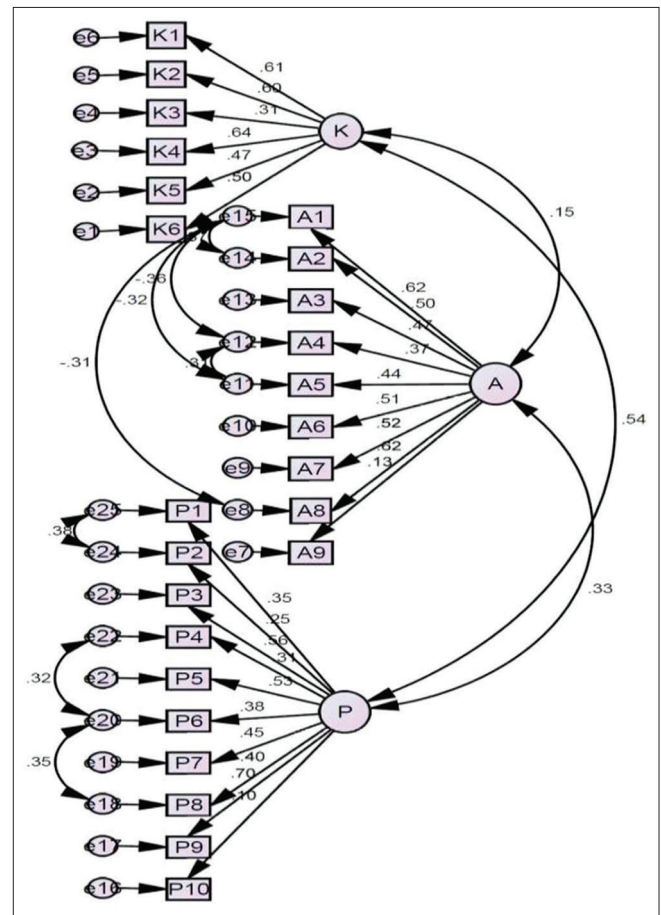


Figure 1: Knowledge, attitude and practices structural model by confirmatory factor analysis

considered as the most influencing factors whereas the other items were considered as less influencing factors towards student's KAP on E-Learning. It was further taken for analysis of model fit assessment.

Table 8 shows the fit indices of the model from the AMOS structural equation modelling.

Chi-square

In order to evaluate the model which could help us to examine the probability distribution of the data, emphasis was given to Chi-square. From the result, Chi-square value with $P = 0.000$ does not show a good fit of the model. Schumaker and Lomax^[12] suggested that a sample size of over 346 could affect the Chi-square statistics. Based on Chi-square, Barbara^[13] suggested that the population distribution would have led to drawbacks of the fit. The researchers developed fit indices in order

to address the Chi-square limitations which will need more practical aspects for further evaluation.

Fit indices

This model is considered for further evaluation in the measure of fit indices. Comparative fit index, Incremental Fit Index, Tucker Lewis Index, Root mean square error of approximation, Parsimonious Comparative Fit Index and Parsimonious Normed Fit Index obtained from the model fit summary of Spss AMOS to estimate the goodness of fit measures.^[7]

From our findings [Table 8] the values of PCFI (0.69), IFI (0.793), and RMSEA (0.062) showed overall the criteria for an accepted model hence indicated a good fit of the model whereas CFI (0.789), PNFI (0.605), NFI (0.688), TLI (0.769) showed a poor fit of the model. From this model we were able to formally test the hypothesis about the structure of the variables.

Table 4: Student's knowledge towards E-learning

Variables	True, n (%)	False, n (%)	I don't know, n (%)
1. E-learning depends on a comprehensive digital electronic environment displaying educational curriculum through electronic networks	268 (77.5)	26 (7.5)	52 (15.0)
2. E-learning is an interactive system that provides an opportunity for learning through information and telecommunication technology	235 (67.9)	82 (23.7)	29 (8.4)
3. E-learning in the education field is not considered less expensive than conventional learning	172 (49.7)	93 (26.9)	81 (23.4)
4. E-learning provides a digital multimedia content (written text, audio, video and images)	289 (83.5)	25 (7.2)	32 (9.2)
5. One of the benefits of E-learning with live content is that the scholar receives instant feedback from the instructor	189 (54.6)	97 (28.0)	60 (17.3)
6. E-learning is considered a type of tele-education	250 (72.3)	23 (6.6)	73 (21.1)

Discussion

The impact of pandemic 2019 was observed in every sector of the world. The pandemic has accelerated adoption of digital technologies to offer education. Our study explores the challenges that students experienced in the E-learning environment, carrying out confirmatory factor analysis to determine the student's perception about the three factors on E-learning- "knowledge, attitude and practice" using structural equation model. From the results it showed that they had an acceptable level of knowledge, attitude, and practices towards E-learning, which revealed the usability of E-learning during the pandemic. The challenges faced during the pandemic varied from one student to the other based on the type and extent.^[14] Classes have been suspended and exams at different levels postponed. Not all teachers and students were ready for this sudden transition from face-to-face learning to online teaching. A considerable number of college students responded that they were not able to afford laptops, computers or supporting mobile phones and also experienced financial and technical

Table 5: Student's attitude towards E-learning

	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
1. E-learning is applicable in India	36 (10.2)	26 (7.4)	129 (36.6)	136 (38.6)	25 (7.1)
2. E-learning is a possible substitute for standard education	43 (12.2)	92 (26.1)	98 (27.8)	109 (31)	10 (2.8)
3. Downloadable E-learning content is better than live content	32 (9.1)	61 (17.3)	148 (42)	87 (24.7)	24 (6.80)
4. E-learning can cover the practical aspect of education curriculum	96 (27.3)	88 (25)	95 (27)	65 (18.5)	8 (2.3)
5. E-learning is more convenient and flexible than conventional learning	44 (12.5)	86 (24.4)	110 (31.3)	83 (23.6)	29 (8.2)
6. The quality of internet services in India can support E-learning	45 (12.8)	68 (19.8)	146 (41.5)	73 (20.7)	20 (5.7)
7. It is possible to obtain educational material through the internet	12 (3.4)	31 (8.8)	94 (26.7)	174 (49.4)	41 (11.6)
8. Interaction between students and lecturers is possible through E-learning	29 (8.2)	49 (13.9)	151 (42.9)	108 (30.7)	15 (4.3)
9. College student have financial difficulty in gaining access to E-learning	19 (5.4)	26 (7.4)	155 (44)	115 (32.7)	37 (10.5)

Table 6: Student's practice evaluation towards E-learning

Variables	Yes, n (%)	No, n (%)
1. Were you awarded certificates through online training courses related to the particular field?	199 (57.5)	147 (42.5)
2. Did you participate in any online education program during this period?	207 (59.8)	139 (40.2)
3. Did you use the internet to attend courses, obtain information or understand the related concepts?	292 (84.4)	54 (15.6)
4. Do you download content related to your college education in a periodic manner?	268 (77.5)	78 (22.5)
5. Did you use online applications and platforms for college education purposes?	292 (84.4)	54 (15.6)
6. Did you use the internet to study with a friend or a group of friends through online meetings?	268 (77.5)	78 (22.5)
7. Did you use the internet to attend a course in Problem-based learning format?	206 (59.5)	140 (40.5)
8. Do you utilize your personal computer while studying online?	272 (78.6)	74 (21.4)
9. Do you use the internet regularly in your studies?	297 (85.8)	49 (14.2)
10. Did you purchase an electronic device in order to have access to E-learning opportunities?	152 (43.9)	194 (56.1)

Table 7: Outcomes of Kaiser-Meyer-Olkin and Bartlett's test

Measurement	Values
KMO measure of sampling adequacy	0.737
Bartlett's test of sphericity	
Approximate χ^2	1932.091
df	300
Significance	0.0005

KMO=Kaiser-Meyer-Olkin

Table 8: Outcomes of model fit indices

Fit indices	Results	Threshold values
Chi-square	0.000	>0.05
CFI	0.789	>0.90 (Hu and Bentler, 1999) ^[8]
NFI	0.688	≥0.90 (Hu and Bentler, 1999) ^[8]
IFI	0.793	≤1
TLI	0.769	≥0.90 (Hair et al., 1998) ^[9]
PGFI	0.69	≥0.7 (Mulaik et al., 1989) ^[10]
PNFI	0.605	≥0.7 (Mulaik et al., 1989) ^[10]
RMSEA	0.062	≥0.08 (Hair et al., 2006) ^[11]

CFI = Comparative fit index, NFI = Normed fit index, IFI = Incremental fit index, TLI = Tucker Lewis index, PGFI = Parsimonious comparative fit index, PNFI = Parsimonious normed fit index, RMSEA = Root mean square error of approximation

difficulties while using E-learning platforms. Laboratory based practical studies in subjects like engineering and medical is important which was not possible in this pandemic period and is again a big loss for college students. From the respondents (50.3%) E-learning was considered more expensive than conventional learning in the educational field. This is due to the purchase of smart devices and internet services to assess their online

classes. Majority of the students disagreed (38.3%) that E-learning is not a possible substitute for standard education. Before the pandemic, the south Indian education system did not support the use of smart devices during their educational curriculum. Most of the students disagreed (52.3%) that practical aspects of their educational curriculum were not covered by E-learning. This is because important concepts had to be explained with live demonstration for better understanding of the subject. 56.1% respondents did not purchase any electronic devices in order to assess E-learning. Another issue was focused on the mode of teaching since E-Learning differs from traditional mode of teaching which leads to lack of interest and interactions among students and teachers during E-Learning. The study has its own limitations. Since this study is confined to only the southern parts of India, the findings may not be applicable to other parts of the country. Globally further research can be carried out from the students pertaining towards the impact of E-learning.

From the result, influencing factors with <0.5 factor loadings can be focused to improve E-Learning. By confirmatory factor analysis, the structural model used in this study moderately fits into the collected data. Influencing factors were evaluated to know the impact of E-learning. As per the result, CFI (0.789), PNFI (0.605), NFI (0.688), TLI (0.769) values were found nearer to the threshold values. The values of PCFI (0.69), IFI (0.793), and RMSEA (0.062) showed the criteria for an accepted model hence indicating a good fit of the model. By confirmatory factor analysis and by way of satisfying the recommended values it can be concluded that the structural model used in this study moderately fits into the collected data.

Limitation and recommendation

Limitations

Students based survey may have limitations against the advantages. Factors limiting the study accuracy will be due to the inability of the students to interpret the questions and respond them accordingly to it.

Recommendation

The same survey can be collected from all states in order to help students gain basic insights in the field of online education.

Conclusion

As we are facing different crises during the pandemic, the study aimed to find the impact of the pandemic on college going students regarding E-learning. In this study, using confirmatory factor analysis they obtained model was found to be a good fit for identifying the KAP of the pandemic on E-learning, it confirmed the validity of our

questionnaire.^[15] E-Learning provides rapid growth and proved to be the best in all sectors, especially in education during the lockdown. The development in technologies has offered a favorable domain for teaching-learning processes. Even if the pandemic continues for a longer period of time or if there is any possibility for another pandemic we believe that the questionnaire and the model can help to improve education and the future career of the students to continue effectively without any disruption

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Conflicts of interest

There are no conflicts of interest.

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