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Has Covid-19 Provided a Rare Opportunity to Integrate Knowledge Delivery with Technology at University Level? Role of Teacher's Technological Knowledge, E-Autonomy and ICT Practices In the context of Pakistan

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Abstract

The Corona Virus outbreak has impacted various sectors of various countries all over the globe and the education sector is one of those sectors that are impacted by COVID-19 even worse as compared to the other sectors. To ensure the continuity of learning and education, various educational institutes used the concept of online learning using information and communication technology. The effectiveness of education through online learning has been a great challenge for the students as well as for the teachers. In this regard, the current study has been designed with the motive to find out the impact of teacher's perceived technological knowledge, teachers e-autonomy and ICT pedagogical practices on the technology integration in knowledge delivery along with the mediating role of perceived effect of teaching with technology on students in the educational institutions of Pakistan. The data was collected from 447 teachers teaching online through ICT and the results were obtained through the analysis of the collected data. The results have suggested that all the independent variables i.e. teacher's perceived technological knowledge, teachers' e-autonomy, and ICT pedagogical practices are having a significant impact on the technology integration in knowledge delivery. On the other hand, in case of mediating role of perceived effect of teaching with technology is considered, it is found significant in case of only teacher's perceived technological knowledge and teacher's e-autonomy but in case of the relation between ICT pedagogical practices, the mediating role of PETT is not significant.

Keywords: Teacher's perceived technological knowledge, E-autonomy, ICT pedagogical practices, Technology integration in knowledge delivery, the Perceived effect of teaching

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1 Introduction

1.1 Background

Autonomy is termed as one of the educational goals that are applicable in different situations, and it is considered as a capability that helps in enabling the learners to be responsible for their process of learning(Waghodekar, 2018). Most of the Pakistani students depend on their teachers for learning as they are not aware of online education and the lectures that are provided by different teachers on the internet(Farooq, Rathore, & Mansoor, 2020). The students depend on the teacher in the classroom for learning, and very few opportunities have been provided to them in Pakistan, especially the master students(Adnan & Anwar, 2020). Pakistanis believe that the learning responsibility of students and their results is on the shoulder of their teachers, no matter if the students are bright or dull(Abbas, Aman, Nurunnabi, & Bano, 2019). Furthermore, the below table enlists some crucial responsibilities of online teachers in the current situation for smooth information delivery;

Table 1: Online teacher's responsibilities in the current situation

Duties and responsibilities	Description
Design lesson and lecture plan	E-tutors and teachers develop lesson overall plan and follow almost all curriculum needs to be provided by their supervisor and the condition where their supervisor is based.
Create and deliver assignments	E-tutors should assign homework, extra projects, and also deliver reading assignments to students through online facility.
Engage students during an online lecture	Another major responsibility of the online teachers is that they should encourage student participation and lead student discussions to keep motivated and engaged in the learning process for effective information delivery.
Maintain availability	Online tutors should also engage with students as well as with parents to give progress updates and reports entirely through online chat sessions and email facilities for better results.

The exclusive phenomenon of online education and integrate knowledge delivery majorly with technology has been considerably gaining significant attention from the academic scholars since the past few months in the context of Asian nations Thrower, Harwood, and Spray (2019) though it is seen that even now a teaching performance gap exist majorly due to teachers technology background in the online classes and education as the number of teachers conduct online classes in the present situation.Goodman, Melkers, and Pallais (2019), Bialous et al. (2017)

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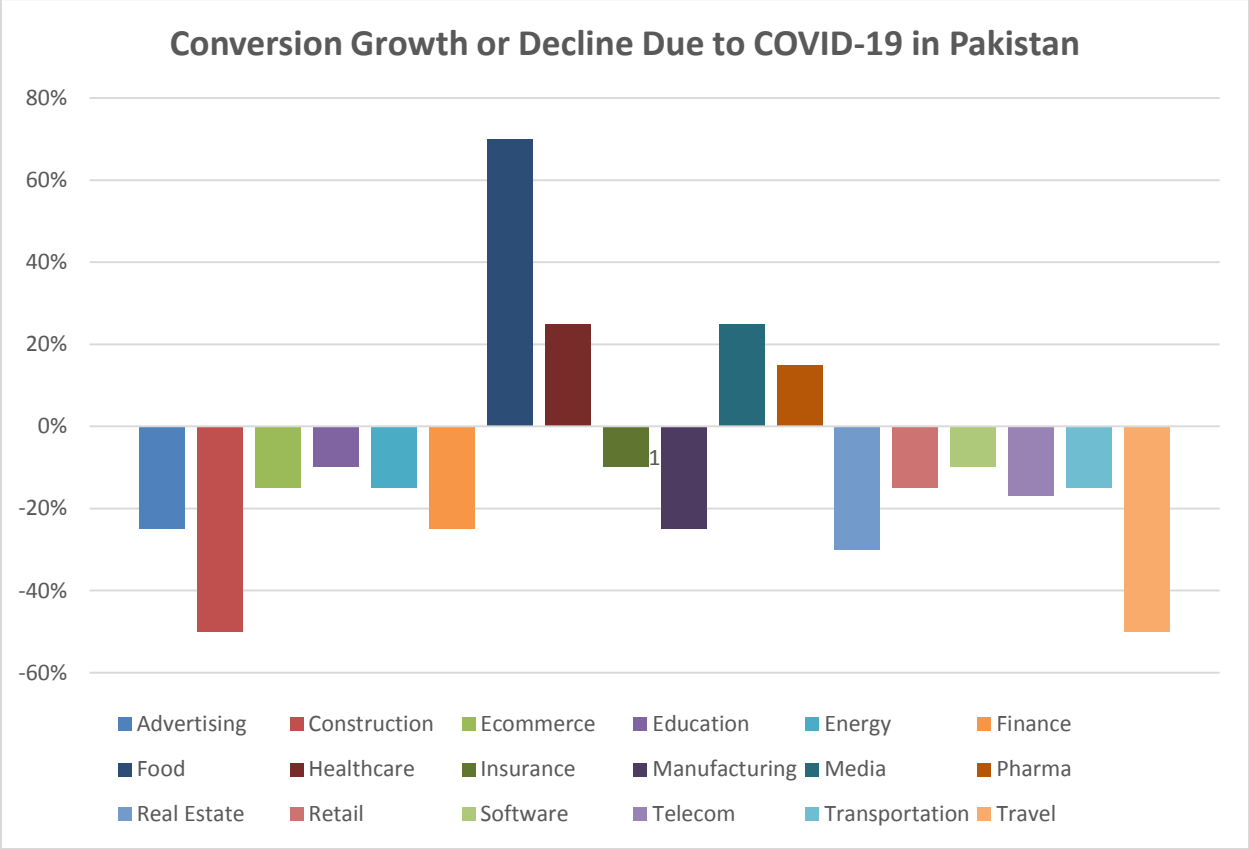
recommended that to fill this technology gap, some important contextual factors affecting the significance of online education and knowledge delivery through technology need to evaluated and observed in detail. Since the research efforts on teacher's perceived technological knowledge (TPTK) are sparse and limited, therefore study needs to be completed on the teacher's perceptions of some nations.



1.2 Research objectives

Based on the above justification statement, the major objective of the given research is to empirically observe the influence of TPTK on the overall technology integration in knowledge delivery (TIKD); another aim of the given paper is to evaluate the association between teachers E-autonomy and the exclusive TIKD in context of Pakistan in the situation of COVID-19. The third major purpose of the given effort is to analyze the overall impact of ICT pedagogical practices in the country on the TIKD in Pakistan in the given situation. Besides, the final purpose of the paper is to investigate the mediating role of the perceived effect of teaching (PET) with technology on students in the relationship between TPTK, teachers' E-autonomy, ICT pedagogical practices, and TIKD in the context of Pakistan.

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Like any effort, the current effort also has profound advantages to theory as well as practice; theoretically, the present effort contributes entirely to the current body of knowledge on these above variables by observing the underlying mechanism through evaluating the effect of PET with technology on students in the connections of TPTK, teachers E-autonomy on TIKD in the perspective of Pakistan. Practically, the current study proves to be very beneficial for the academic practitioners and the online education policymakers who must promote an effective and technological framework for the University teachers so that more and more teachers are encouraged to conduct online classes and manage their profession successfully. Moreover, rest of the study is organized as follows; the second chapter of literature review consists of a review of past literature relevant to the given paper; and the third chapter of study methodology provides study design, tools, and methods, whereas chapter four provides the section of data analysis and techniques in the results are analyzed and finally the fifth chapter consists of a discussion of results, conclusion, research implications, and future study suggestions.

2 Literature review

2.1 Theory of online collaborative learning (OCL)

OCL is a situation according to Robinson, Kilgore, and Warren (2017) in which two or more individual learn and attempt to learn something together, unlike individual or physical learning, individual engage in online learning capitalize on one another's resources and skills through techniques such as asking one another for information, analyzing one another's ideas(Altınay, 2017). More specifically, OCL is majorly based on the framework that knowledge can be developed within a population through online and technology resources where members actively interact by sharing experiences and take on asymmetric roles and responsibilities(Cheng, Wang, Huang, & Zarifis, 2016). According to this theory teacher E-knowledge background and ICT practices in the region become an important and favorable factor in OCL, because virtual environments required expert and technical people for effective knowledge delivery(Yücel & Usluel, 2016). There has been a development of new ICT practices that facilitate collaborative online education and effective delivery of knowledge in the middle and higher education department of the region.

2.2 The relationship between teachers perceived technological knowledge and technology integration in knowledge delivery

There exists a direct relationship between technology integration in knowledge delivery and TPTK because it helps the teachers to teach effectively, and it becomes easy for the students to learn efficiently (Ching, Hsu, & Baldwin, 2018). It results in the enhancement of the process of learning and improves the methods of learning for the students. Much advancement has been made in the technology resources that have resulted in the enhancement of the engagement of the

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students (Alqurashi, Gokbel, & Carbonara, 2017). Some teachers may not know different specifications in the technology; for this purpose, professional development should be arranged for the teachers so that they can be benefitted from integrating knowledge(Koehler, Greenhalgh, Rosenberg, & Keenan, 2017). The theory of OCL has stated that online education is effective than physical learning, and more than one individual can learn through online lectures. Thus, the overall above findings lead to the establishment of the following hypothesis;

H1: There is a direct and significant correlation that exists between a teacher's perceived technological knowledge and TIKD.

2.3 The correspondence between teachers E-autonomy and technology integration in knowledge delivery

The overall concept of teachers E-autonomy majorly refers to the E-professional independence of teachers in educational institutions, universities, and especially the extent to which they make autonomous and effective decisions about what they teach online to students and how they mainly teach it through online facilities(Aliakbari & Amoli, 2016). In recent months, E-autonomy of teachers has become an important agenda of discussion in Pakistani public education, majorly as a consequence of online educational policies that, certainly argue, restrict the responsiveness, professionalism, effectiveness, authority, and creativity of teachers in terms of online education and classes(Bei, Mavroidis, & Giossos, 2020). At the same time, E-autonomy of the teacher is most generally discussed majorly in the context of what teachers teach to students through an online platform and how they teach it, the problem may also describe in other ways (Kiefer & Pennington, 2017). Moreover, the E-autonomy of teachers means that both faculty members of an institution and students can engage in debate largely without fear which can directly affect the technology integration in information delivery and transmission(Slater, 2017). Besides, teachers, E-autonomy provides both students and teachers the right to study and do research on the topics they choose and also develop what conclusions they find and all directly affect the degree of information delivery in online education context. Therefore, based on above findings the given research study suggests the following hypothesis;

H2: There is a direct and positive relationship that exists between teachers' E-autonomy and technology integration in information delivery.

2.4 The inter-connection between ICT pedagogical practices and technology integration in knowledge delivery

Pedagogical practices are most commonly understood as the important approach to teaching, and according toIslam, Mok, Gu, Spector, and Hai-Leng (2019) majorly refers to the theory and effective practice of learning, and how this mechanism affects and is affected by, the political, social and psychological development of the students. ICT pedagogical practices are taken as an

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online academic discipline is the concept of how information and knowledge are imparted from an educational perspective, and it majorly considers the interactions that take place during online learning (Blau, Grinberg, & Shamir-Inbal, 2018). ICT pedagogical practices are often described as the significant act of online teaching, and the modern practices adopted by teachers majorly shapes their actions, judgments, and other teaching strategies that directly influence the process of knowledge delivery through technology integration(Alonso-García, Aznar-Díaz, Cáceres-Reche, Trujillo-Torres, & Romero-Rodríguez, 2019). As mentioned above, technology and ICT practices can encourage active and effective participation in the online class which also is a very significant factor for improved knowledge delivery largely through technology integration. So, the above entire discussion leads to the development of the following hypothesis;

H3: There is a direct and favorable connection that exists between ICT pedagogical practices and TIKD.

2.5 The mediating impact of perceived effect of teaching with technology on students on the connection between TPTK and TIKD

Teaching with technology and online education has gained huge popularity among working professionals as well as students pursuing middle and higher education and according to Francis (2017), these ranges of technology teaching and online learners find significant advantages in the flexibility and autonomy that these topics and courses provided. Online teaching and courses can majorly be planned around their schedule which generally includes caring for family and full-time employment (Kissi, Nat, & Armah, 2018). Teaching with technology can also facilitate them to take out some quiet time to research which enhances the effectiveness of knowledge delivery through technology. Besides, teaching with technology is so powerful largely because it necessarily works its magic by breaking down the restrictions put in place by the conventional type of teaching(Ibili, Resnyansky, & Billinghurst, 2019). Hence, based on the above discussion the present study hypothesized that;

H4: Perceived effect of teaching with technology positively mediates the interdependence between TPTK and TIKD.

2.6 The mediating role of perceived effect of teaching with technology on students in the nexus between teachers E-autonomy and TIKD

TIKD is a method of technology that helps in enhancing the educational environment and also leads to the motivation of the students (Oyeniyi & Okike, 2019). There exists a positive relation between E-autonomy and TIKD because, according to E-autonomy, the teachers are independent of teaching the course by using digital means. If the technology is advanced, it will be helpful for the teachers to deliver the lectures online. Okike and Oyeniyi (2019) have emphasized that the perceived effect of teaching has a direct impact on the relationship of these variables as the

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teaching method will be enhanced with the implementation of TIKD and will be helpful for the students to learn. The theory of OCL has proved that expertise and technical people are required to run a technological or virtual environment. Therefore, the given research hypothesized that;

H5: PET with technology on students favorably mediates the nexus between teachers' E-autonomy and TIKD.

2.7 The mediating influence of the perceived effect of teaching with technology on students in the inter-connection between ICT pedagogical practices and TIKD

The use of chalkboards has been neglected in many institutions due to the advanced technology, and digital means of learning are highly preferred (Serriawati & Azwar, 2020). So, there is a positive relationship between ICT pedagogical practices and TIKD, and there is a direct impact of perceived teaching on this relationship (Lancaster, 2018). Mostly, the students are allowed to use their smartphones, laptops, or other devices in the classroom for learning due to advanced technology. The theory of online collaborative learning has stated that developments of ICT have facilitated collaborative online education and efficient knowledge delivery. So, in the line of the above arguments the present research hypothesized that;

H6: PET with technology on students significantly mediates the correlation between ICT pedagogical practices and TIKD.

3 Methodology

This section focuses on different aspects of data collection methods and procedures along with the sampling technique used. Furthermore, the measurement items used for questionnaire building and the tests applied to the collected quantitative data for its analysis have also been discussed in this section.

3.1 Data and Sample

The motive to conduct this study is to explore how different aspects of technology and teaching methodology integrate to deliver knowledge to the students in educational institutions of Pakistan. For this purpose, specifically, the impact of TPTK teacher's e-autonomy and ICTPP in educational institutes are supposed to be found on TIKD with the mediating role of PETT on students in Pakistan. For this purpose, the researcher has considered the teachers of educational institutes of Pakistan as population and selected the teachers of those educational institutes providing master level education as the sample of the study. The purposive sampling technique has been used and the data has been collected from those teachers that are providing education through online teaching so that the technology factor can be covered by the collected data. The instrument used for data collection was a well-developed questionnaire containing the measurement items associated with each of the variables. The questionnaire was developed under the supervision and guidance by the experts in education and the use of technology in this

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regard. The questionnaire was filled using online sources due to the closure of educational institutes i.e. through the mail. It was emailed to 500 teachers overall and after receiving the responses and screening them, only 447 responses were selected to be used for the analysis of the data, and the rest were discarded either because they were incomplete or were not reliable enough to be used in the study. The sample teachers were contacted beforehand and their consent was obtained for data collection. All the other ethical aspects were also communicated to them before data collection so that authentic data can be obtained.

3.2 Measurements

The independent variables of the study include TPTK, teacher's e-autonomy, and ICTPP; the dependent variable is TIKD and finally, the mediating variable is PETT. In this regard, the TIKD contains three measurement items. These items have been obtained from a study conducted in the past (Schmidt et al., 2009). A sample is "I can teach lessons that appropriately combine my subject, technologies, and teaching approaches". In the same way, the independent TPTK has been measured through six measurement items, developed by a past researcher (Schmidt et al., 2009). A sample is "I know about many different technologies". The other independent variable teacher's e-autonomy is measured through seven items. These have been developed in past literature by other researchers (NAYERNIA, 2020). The last independent variable, ICTPP also contains seven items for measurement (Kenttälä, Kankaanranta, & Neittaanmäki, 2017). A sample is "Presenting of information, demonstration, and/or giving instructions to students". Besides, one mediating variable is also involved in the study. This mediating variable PETT contains nine items for measurement purposes (Kenttälä et al., 2017). A sample is "Knowledge of the subject". In this way, all the constructs have been measured and the scale used for this regard is a five-point Likert scale, having the range of 1 to 5, where 1 refers to strongly disagree and 5 means strongly agree.

4 Analysis

For analysis purposes, the author of the study has utilized SPSS and AMOS statistical analytical tools and techniques. The tests such as factor analysis, confirmatory factor analysis, structural equation modeling, etc. have been employed for analysis. Besides, the impact of one variable over the other can also be checked through these techniques. These tests through the used software have provided the required results for the study that have been interpreted in the following section.

4.1 Demographics

The demographics of 447 respondents have been discussed here. Two indicators have been used in this regard i.e. age and gender of the respondents. As far as the gender is concerned, the total respondents included 247 males which make up 55.3% and 200 females which make up the rest 44.7% of the total respondents. On the other hand, in the context of their age, the largest proportion of the respondents is associated with the age group of 25 to 35 years. The younger teachers having age less than 25 years are 31.3% and those having the age group of 35 to 45 years are 22.1%. Finally, the older teachers having the age of more than 45 years are just 3.6%.

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4.2 Descriptive Statistics

The descriptive statistics of the collected data has made two things quite clear. The first one is that there is no presence of any outlying value in the collected data because the range obtained in this regard is starting from 1 and ending at 5. This range confirms with the five points Likert scale. The second thing cleared by these statistics is that the data collected us distributed normally which is evident based on the skewness values.

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
TPTK	447	1.00	5.00	3.1902	1.04817	-.162	.115
ICTRP	447	1.00	5.00	3.3503	1.00994	-.334	.115
TeaEA	447	1.00	5.00	3.5066	1.17146	-.534	.115
PETTS	447	1.00	5.28	3.4134	1.15388	-.508	.115
TIKD	447	1.00	5.00	3.5409	1.14066	-.562	.115
Valid N (listwise)	447						

4.3 KMO and Bartlett's Test

These two tests are very important in recognizing the sufficiency of the collected measurement items for the study. The closer the value of the KMO test is to 1, the better it is. As in the current scenario, this value is .956 and this is very close to 1, therefore it can be stated that this result is favorable. In the same manner, the significance value of Bartlett's test also gives the same result.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.956
Bartlett's Test of Sphericity	Approx. Chi-Square	17491.376
	Df	496
	Sig.	.000

4.4 Rotated Component Matrix

The major purpose to apply this technique is to find out whether the items of constructs of the study are valid or not. If the values of factor loading reported in this matrix are greater than 0.7, it will indicate the validity of the measurement items, which is the case in the current study.

Table 4: Rotated Component Matrix

	Component				
	1	2	3	4	5
TK1				.809	
TK2				.859	
TK3				.810	

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TK4				.762	
TK5				.799	
TK6				.827	
PP1			.748		
PP2			.728		
PP3			.782		
PP4			.848		
PP5			.819		
PP6			.871		
PP7			.819		
EA1		.823			
EA2		.837			
EA3		.836			
EA4		.875			
EA5		.893			
EA6		.883			
EA7		.878			
TS1	.781				
TS2	.809				
TS3	.801				
TS4	.847				
TS5	.900				
TS6	.903				
TS7	.900				
TS8	.902				
TS9	.905				
KD1					.830
KD2					.833
KD3					.846

4.5 Convergent and Discriminant Validity

The composite reliability value, greater than 0.7 indicates the reliability of the collected data. In the same way, the average variance extract value greater than 0.5 indicates the convergent validity and finally, the value of MSV smaller than AVE indicates the discriminant validity of the data. All these conditions are fulfilled in the current scenario.

Table 5: Convergent and Discriminant Validity

	CR	AVE	MSV	TS	TK	PP	EA	KD
TS	0.924	0.806	0.276	**0.898**				
TK	0.945	0.742	0.323	0.443	**0.861**			
PP	0.945	0.711	0.323	0.382	0.568	**0.843**		
EA	0.915	0.850	0.276	0.525	0.458	0.455	**0.922**	
KD	0.912	0.776	0.278	0.329	0.472	0.527	0.451	**0.881**

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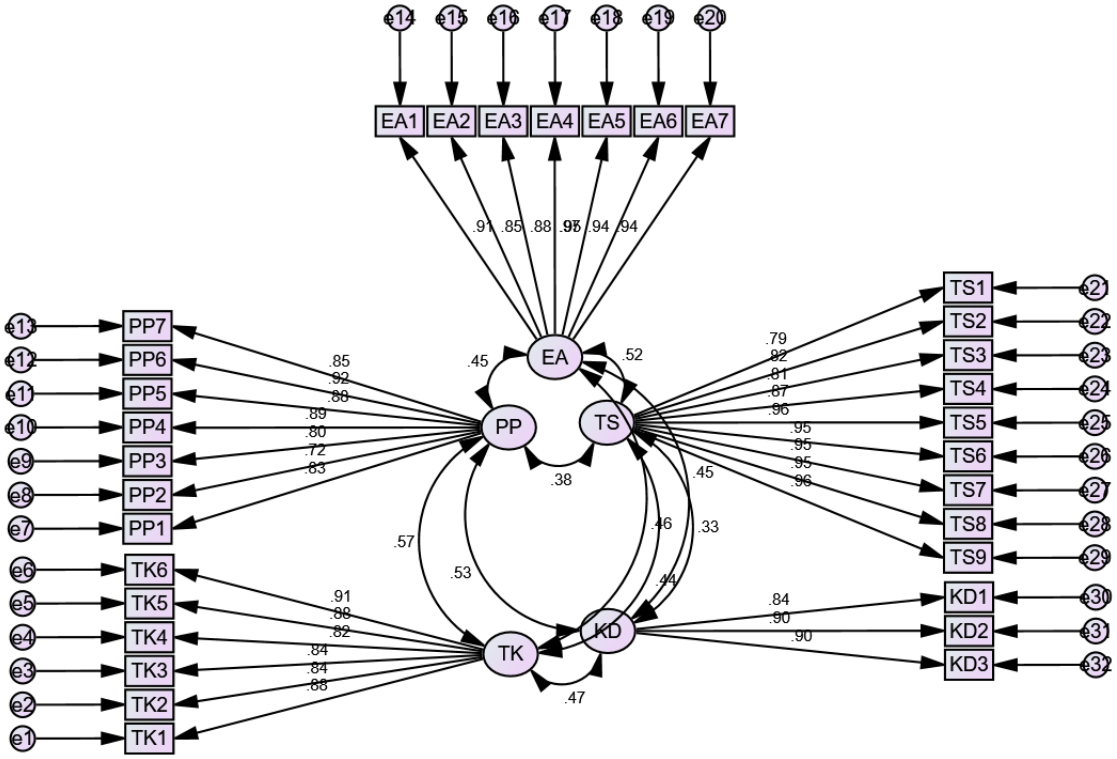
4.6 Confirmatory Factor Analysis

All the indicators associated with CFA are found to possess values that are present within the range of threshold for each item such as CMIN/DF, GFI, IFI, CFI, and RMSEA, etc. indicating that the fitness of the model for the study.

Table 6: Model Fit Indices

CFA Indicators	CMIN/DF	GFI	IFI	CFI	RMSEA
Threshold Value	≤ 3	≥ 0.80	≥ 0.90	≥ 0.90	≤ 0.08
Observed Value	2.724	0.841	0.955	0.955	0.062

Figure 2: CFA



4.7 Structural Equation Modeling

Finally, the results of SEM have indicated that all the independent variables i.e. TPTK, teacher's e-autonomy, and ICTPP are having a significantly positive direct impact on TIKD. As the value of TPTK, teacher's e-autonomy and ICTPP increase by one percent, it will bring an increase of 16.6%, 29.3%, and 12.9% in TKID. On the other hand, if the mediating role of PETT is

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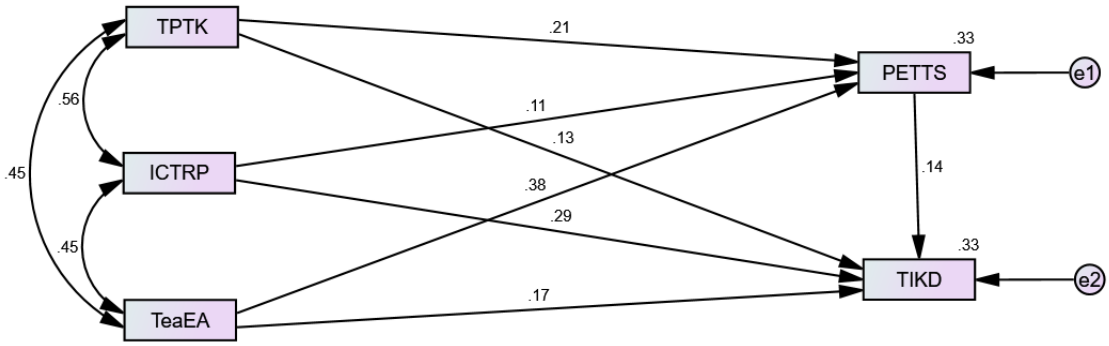
considered, it is found significant in the case of only TPTK and teacher's e-autonomy but in case of the relation between ICTPP and TIKD, the mediating role of PETT is not significant.

Table 7: Structural Equation Modeling

Total Effect	**TeaEA**	**ICTRP**	**TPTK**	**PETTS**
PETTS	.377**	.113	.205	.000
TIKD	.218**	.309**	.157**	.137**
Direct Effect	TeaEA	ICTRP	TPTK	PETTS
PETTS	.377**	.113	.205**	.000
TIKD	.166**	.293**	.129**	.137**
Indirect Effect	TeaEA	ICTRP	TPTK	PETTS
PETTS	.000	.000	.000	.000
TIKD	.052**	.016	.028*	.000

Figure 3: SEM



5 Discussion and Conclusion

The major purpose of the given paper is to observe the factors majorly contributing to online teacher's freedom and autonomy support in the context of Pakistan and evaluate the impact of teacher E-autonomy on the overall knowledge and information delivery to students during the lockdown. The given attempt is largely made to evaluate the validity of the final frame to the gathered information and to establish a freedom or autonomy support questionnaire for effective and accurate results. Besides, the given paper investigates the exclusive impact of ICT practices of pedagogical nature on the entire knowledge delivery with technology integration. Moreover, the analysis and results of the given study revealed that TPTK significantly impacts the overall information transmission and delivery that are conducted are majorly conducted through technology integration and therefore, the hypothesis has been accepted. This is because

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according toDeCoito and Richardson (2018) TPTK improves engagement and also encourages the overall process of online learning which significantly affects the entire information delivery process. Moreover, the results also indicate that ICT pedagogical processes and practices directly affect the online education process and so the hypothesis has been accepted. Besides, the factor loading for settings and online dais is very high and significantwhich means Pakistani online teachers and instructors thought that settings and dais in online education context the students play an important part in establishing autonomy between them in online classes and education. The significance of teacher autonomy is also discussed in Vangrieken, Grosemans, Dochy, and Kyndt (2017) research which majorly recommends that E-autonomy is a type of constructivist concept in an online education which can establish the autonomous type of learning and education.

5.1 Conclusion

Since the advantages ofe-learning and online teaching have been upholding by several research efforts and studies Kimiloglu, Ozturan, and Kutlu (2017), Choudhury and Pattnaik (2020) and the number of online students who are enrolling in online education are enhancing positively. However, the central objective of the paper is to evaluate the information and knowledge delivery with technology at the University level; and also to analyze the role of teacher's technological knowledge, ICT best practices, and E-autonomy in the context of Pakistan. For this purpose, the analyst of the given paper collects data from about 447 teachers out of which 55.3% were male and 44.7% were females which belong to different educational institutions and Universities of Pakistan. Moreover, for analysis and evaluation, the given study incorporates KMO, Bartlett's test, and structural equation modeling. The final results and findings of SEM analysis suggest that teacher's technological knowledge and ICT practices play a direct role in information delivery with technology at the University level.

5.2 Implications/Limitations and future recommendations

The present research is a very supportive description of the significance ofthe teacher's technological information and teacher autonomy for the entire delivery process during virtual education. This study very clearly evaluates the importance of ICT pedagogical practices in the exclusive process of virtual and online education. Therefore, the verdicts of this research will facilitate future analysts and academic experts to investigate multidimensional aspects of online education and the role of teachers in virtual learning. Moreover, the present paper has certain limitations that give important opportunities to future researchers and academic experts to further investigate the results of the given study in a broad manner. The major limitation of the given paper is that the given paper only focuses on the role of teacher's such as technical knowledge of the teacher, teacher's E-autonomy; therefore, due to this limitation, the analyst of the paper recommended that future studies should focus on other factors that affect the degree of data

delivery during virtual classes such as student participation, and patterns of participation as well as technology and other interface properties.

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