Perspectives on Lessons From the COVID-19 Outbreak for Post-pandemic Higher Education: Continuance Intention Model of Forced Online Distance Teaching

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Abstract: The response of most universities to the Coronavirus disease (COVID-19) pandemic was Online Distance Teaching (ODT), which was a new experience for many educators and students. The aim of the study was to investigate the response of university teachers to ODT. A questionnaire was sent to all university teachers (N = 914). We received 290 usable responses. To create a Continuance Intention Model of Forced Online Distance Teaching (CIMoFODT), Confirmatory Factorial Analysis (CFA) and Structural Equation Modelling (SEM) were used in addition to descriptive and inferential statistics. The main findings were as follows: (i) during the closure, use of the videoconferencing system MS Teams was the only item that increased significantly, owing to mandatory use; (ii) the increase in the use of other applications (e.g., Moodle, email) was minimal; (iii) after the reopening of the university, email, Moodle, and supplementary online materials will be used for ODT; MS Teams will be used for small group teaching and individual consultations; (iv) CIMoFODT can be applied to explain the intention to continue ODT. The main conclusion is that teachers will return to traditional teaching when classrooms reopen.

Keywords: *Continuance intention, COVID-19 outbreak, higher education, online distance teaching.*

Introduction

In just over a century, there have been more than six separate influenza pandemics and epidemics, and at least seven coronaviruses, including severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that have caused illness and death. Therefore, it is reasonable to accept the prediction that new deadly outbreaks caused by new pathogens or variants of existing pathogens are inevitable (Maxmen, 2021). From retrospective analysis of responses, it is clear that the response of states and agencies has not always been optimal. Whether a new pandemic is caused by new strains of SARS-CoV-2 or by a yet unknown pathogen, the question is whether lessons have been learned to avoid repeating the mistakes of recent and past epidemics (Maxmen, 2021). To prevent such mistakes, previous actions should be carefully examined, and tools should be developed to allow an objective evaluation, not only to describe an event or a combination of events, but also to predict possible obstacles to avoiding them and offer better solutions.

Following the closure of universities due to the Coronavirus disease (COVID-19) pandemic in early 2020, most higher education institutions around the world responded literally overnight by moving to online distance learning, which means that instructors and learners are physically separated. Historically (Moore et al., 2011), any new technology and service that enable distance communication was tested and sooner or later used for distance education. More recently, the boom in distance learning has been enabled by the invention of the Internet, along with web-based applications and protocols that enable synchronous and asynchronous communication between course providers (teachers) and users (students). However, prior to mandatory closure of universities, this transition was fluid, and face-to-face learning could coexist or blend with distance learning forms, showing that the addition of an instructor to online materials strongly contributed to achievements (Tzur et al., 2021). That was no longer the case in 2020, when traditional forms of instruction were suspended, and classes moved to the Internet virtually overnight. No one questioned whether everyone involved in the pedagogical processes at universities was pedagogically and materially prepared for this

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transition. At best, short courses on the use of Internet tools were offered. Whether or not faculty and students were prepared for the novel situation, teachers had to begin teaching with a great deal of improvisation, a situation Hodges et al. (2020) referred to as "emergency remote teaching".

For the present work, we adopted the term Online Distance Teaching (ODT), as a teacher-centred approach with teaching as the primary role of the teacher, to distinguish it from Online Distance Learning (Cheawjindakarn et al., 2012), which is a student-centred approach that recognizes learning as the primary task of the students. Both are integral and often inseparable components of Online Distance Education (Hodges et al., 2020). We will use the term 'teacher' as an umbrella term for a person who performs the act of teaching as an interaction between teacher and learner (student). The term Forced Online Distance Teaching (FODT) was introduced as a description of university teaching practices during the closure of the university. The word 'forced' reflects the top-down approach to the introduction of distance education into pedagogical practice, where voluntary decisions about pedagogical methods used as part of the teacher's autonomy are largely set aside. Such an approach, especially if rushed, can have several undesirable side effects (Dolenc et al., 2021). FODT should be distinguished from Voluntary Online Distance Teaching (VODT) and Online Distance Teaching (ODT) since the term encompasses both forms. They should also be distinguished from any models that consider various forms of online learning as an activity of students affected by the pandemic (Ploj Virtič et al., 2021).

Aims and Scope

The main interest of the study was the response and adjustment of university teachers to FODT as experienced during the lockdown. The big difference from the time before the pandemic was that teachers had previously worked autonomously to introduce Information and Communication Technology (ICT)-based technologies (including online teaching) into their teaching. We were also interested in whether they were planning to continue teaching online after the end of the measures and reopening of the university. Since every decision is based on numerous factors (see the next sections for information on the factors included in the model), we sought to find out which of these were more or less decisive. The objective of this work was to develop an empirical model that could be used to implement ODT in a university setting. The novel model was designated the CIMoFODT and will in future allow comparative studies and decisions based on evidence.

The research questions were as follows:

RQ1: Is there a qualitative and quantitative difference in the use of ICT programmes and applications before and after the closure of the university due to the pandemic?

RQ2: What are the continuance intentions of teachers in terms of using the resources tested in FODT after reopening of the universities?

RQ3: Can future behaviour (continuance intentions) of teachers be explained by constructs from previous studies?

The study was exploratory, so the direction of the results (whether negative, positive, or neutral) was not estimated.

Literature review

The first theoretical predisposition was extracted from Sternberg's Theory of Successful Intelligence (Sternberg, 2005). Sternberg states in the introduction that "There is no one formula that works for every teacher" (p.190). Taking this into account, a wise teacher will choose "to (1) adapt to the new environment; (2) adapt the environment or (3) change the environment" (Dolenc et al., 2021).

The theoretical constructs intended to be used in the model relate to Information Systems Continuance Intention Theory (Bhattacherjee, 2001). The logic of models based on Continuance Intention Theory is that the predecessor of an actual behavior regarding use of a technology is an intention to use this particular technology. Forerunners of such models include theories such as the Self-Efficacy Unifying Theory of Behavioral Change (Bandura, 1977) the Theory of Planned Behavior (Ajzen, 1991), and Self-Determination Theory (Ryan & Deci, 2000). Constructs based on the theoretical assumptions of these theories form a constituent part of numerous theories dealing with the introduction and application of digital tools in different economic sectors. The most prominent are the Technology Acceptance Model (TAM) (Davis, 1989), Innovation Diffusion Theory (Rogers, 1995), the unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), and more recently, a General Extended Technology Acceptance Model for E-learning (GETAMEL) (Abdullah & Ward, 2016). The difference between these theories and models, mostly stemmed from TAM, since still prevailing theory includes several factors in addition to the original ones as included in TAM (Abdullah & Ward, 2016; Scherer et al., 2019; Šumak et al., 2011). After a decision to use and test a technology, and assuming voluntary conditions, someone can continue using it or abandon its usage. The theory explaining such decisions is Information Systems Continuance Intention Theory (Bhattacherjee, 2001).

Methodology

Research model and hypotheses

Since teachers were forced to go online involuntarily during the lockdown, voluntariness as a basic assumption of Information Systems Continuance Intention Theory (Bhattacherjee, 2001) and related theories addressing the acceptance of and desire for continued use of a particular technology, was violated. Therefore, the importance and predictive power of factors included in models based on these theories may be quite different from those in empirical models based on the primary versions of the theories. To avoid the trap of omitting an important factor in the SEM models (Kline, 2015), we reviewed the constructs used in previous studies of distance e-learning (e.g., Bhuasiri et al., 2012; Park, 2009; Šumak et al., 2010; Sun et al., 2008) and in reviews (Abdullah & Ward, 2016; Cheawjindakarn et al., 2012). Using this approach, we created a model, CIMoFODT (Figure 1), that we hope will balance the length of the questionnaire with the predictive power of the instrument (Ploj Virtič et al., 2021) and provide an easy-to-follow procedure for replicating the study in the same or different populations and contexts. The full list of the constructs and items, as well as references to the original source, is provided in Table 4.
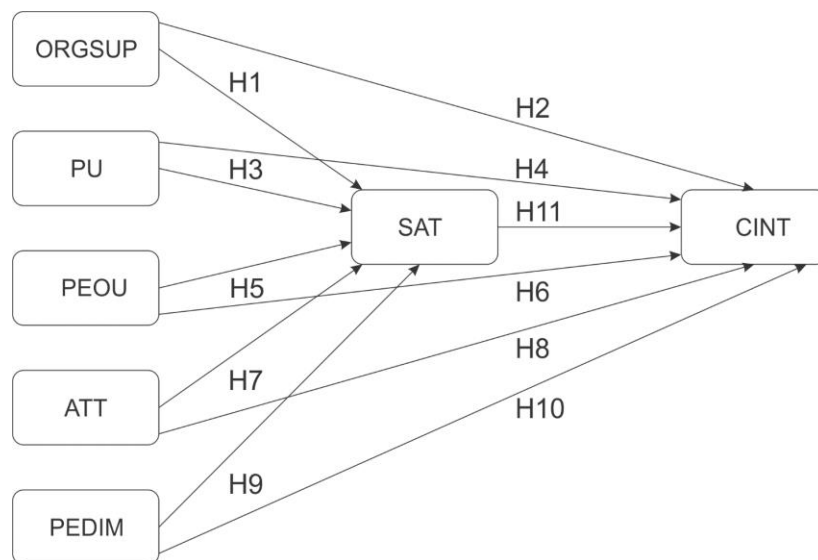
Note: ORGSUP – Organisational support, PU – Perceived usefulness, PEOU – Perceived ease of use, ATT – Attitudes, PEDIM – Perceived pedagogical impact, SAT – Satisfaction and CINT – Continuance intention to continue on-line teaching

Figure 1. Continuance Intention Model of Forced Online Distance Teaching

Predictor constructs (latent variables)

Organisational Support (ORGSUP): There are many ways in which an organisation can act as a promoter to influence the adoption of technology or act as a suppressor of its use. For a person with teaching responsibilities in an academic institution, management, pedagogical, and technological support are important. While management and technology support are commonly used in predictive models (e.g., Al-alak & Alnawas, 2011; Bandyopadhyay & Natarajan, 2011), pedagogical support is not. For our study, we combined items copied verbatim from the Slovenian version of the management support scales as used by Šumak et al. (2017) in their study of teachers' use of i-whiteboards. To fill the gap, we added two items: one item (Q8f) asking about pedagogical support, and one item (Q8e) asking about technical support. Thus, we hypothesised two things: ORGSUP simultaneously influences satisfaction (SAT) (H₁) and Continuance intentions (CINT) (H₂).

Attitudes (ATT), Perceived Ease of Use (PEOU), and Perceived Usefulness (PU) are constructs from TAM (Bagozzi et al., 1992; Davis, 1989).

Based on the work of Wu and Zhang (2014), we can define constructs ATT, PEOU and PU as follows:

- ATT toward ODT as the degree of a person's feelings toward ODT. The feelings can range from negative to positive.
- PEOU is the belief about the effort required to invest in ODT.
- PU can be identified as the belief in the benefits of ODT.

A meta-review by Šumak et al. (2011) reported that PEOU and the PU tend to be the factors that can influence the ATT of users toward using an e-learning technology in equal measure for different user types and types of e-learning

technology settings. For the study, we adapted a Slovenian translation of the constructs used in a study on the use of i-whiteboards among teachers (Šumak & Šorgo, 2016; Šumak et al., 2017). In our study, which is different from TAM and UTAUT, teachers had actual experience with ODT. Consequently, ATT (H_7, H_8), PEOU (H_5, H_6), and PU (H_4, H_5) were predictors of SAT and CINT in our model (see Figure 1). In combination with PU and PEOU, the ATT towards FODT would influence both actual use of the technology and the duration of ODT use. The hypotheses (Figure 1) were that PU influences SAT (H_3) and CINT (H_4); PEOU influences SAT (H_5) and CINT (H_6); ATT influences SAT (H_7) and CINT (H_8).

The Perceived Pedagogical Impact (PEDIM) was included after the finding by Šumak et al. (2017) that PEDIM influences all phases of technology acceptance, as established in studies of differences between technology acceptance among users and nonusers of i-whiteboards and educational software (Chroustová et al., 2017). The importance of beliefs about the perceived or actual pedagogical impact of technology was discussed in studies such as those by Ertmer (2005) and Tondeur et al. (2017). The general TAM and Continuance Intention Theories do not include this construct because it is applicable only to educational technologies. We follow the recognition by Zhao and Cziko (2001) that teachers will use novel technologies because they predict and, in our case, confirm after testing, that technology is useful and more effective than traditional methods and technologies. Thus, we hypothesised that PEDIM simultaneously influences SAT (H_9) and Continuance intentions CINT (H_{10}).

Outcome variables

SAT with a device or service can be considered a key factor for continued or discontinued use (Thong et al., 2006). It is based on personal experience, and both positive and negative events can influence SAT. This construct originated from Expectation Confirmation Theory (Oliver, 1980) and is used as a predictor of information system use, CINT, in the Continuance Intention Theory for information systems (Bhattacherjee, 2001). The hypothesis (H_{11}) was that SAT influences CINT.

CINT (Bhattacherjee, 2001; Carillo et al., 2017) is not a construct included in TAM, UTAUT and their extensions, where the outcome is the actual use of a particular technology, but continuity is not examined. Since it is expected that regular, face-to-face courses will resume in parallel with ODT after the normalization of university routines, it is unknown to what extent the newly gained experience will be incorporated into the classroom. In our model, we hypothesize that all the given constructs will influence CINT.

Sampling procedure and sample

Owing to the lockdown caused by COVID-19, a web survey was a plausible option for reaching the target audience, that is, university staff with teaching responsibilities, referred to as teachers in the study. The open-source web survey application 1Ka (University of Ljubljana, 2021) was chosen for data collection. The call for participation in the survey was sent to all potential respondents (N = 914) through the university email list. A reminder was sent one week after the initial call. Data collection ended after two weeks. Respondent anonymity was assured, and no benefits or disadvantages were foreseen for those who stopped answering the questions or opted out during the survey. Since no fields were marked as mandatory, starting to answer was taken as consent.

The sample (N = 290) consisted of 52.4% men, 46.9 women, and 0.7% others. 74.4% of the respondents were professors and 25.5% were teaching assistants. Almost all (96.2%) combined teaching and research duties.

Description of the instrument

The instrument consisted of four parts:

1) the use of the different types of ODT from the list (emails, MS-Teams, etc.) before and after the closure of the university. We also asked respondents about the actual methods of synchronous and asynchronous teaching they use during ODT classes. A 5-point scale was used. The scores on the scale were "Never" (1), "Rarely" (2), "Occasionally" (3), "Often" (4), "Whenever appropriate" (5).

2) the constructs ORGSUP, PU, PEOU, SAT, ATT, and PEDIM were assessed using a set of items, most of which have been tested and used in previous studies on digital technologies in education (Ploj Virtič et al., 2021; Šumak et al., 2017; Šumak & Šorgo, 2016) and adapted for the purposes of the present study. The response format was a 7-point scale ranging from "Completely disagree" (1) to "Completely agree" (7).

3) university teachers' intention to continue using various resources (applications) used in ODT after the university reopens (CINT) was assessed using the statement: 'When classroom teaching is restored, I will use them'. The list of 7 items (e.g., emails, MS teams) was provided. The response format was a 7-point scale ranging from "Completely disagree" (1) to "Completely agree" (7). For those who did not teach and were inadvertently included in the mailing list, there was a "fallback item".

Table 1. Constructs, their Sources, and Cronbach's Alphas of the Initial and Final Models

Construct	Source of items	Cronbach's alpha	
		Initial model	**Final model**
ORGSUP	adapted from Igbaria et al., 1996, 1997; Thompson et al., 1991; Ploj Virtič et al., 2021	.84	.84
PU	adapted from Liao et al., 2009	.94	.82
PEOU	adapted from Liao et al., 2009; Urbach et al., 2010	.90	.85
SAT	adapted from Debevc et al., 2020; Nijs, & Leman, 2014	.78	.78
ATT	adapted from: Liao et al., 2009; Ploj Virtič et al., 2021	.91	.91
PEDIM	adapted from Bourgonjon et al., 2010	.96	.92
CINT	Ploj Virtič et al., 2021	.78	.77

Note. Text of the items is provided in Table 5.

4) the demographics of the respondents: gender, working position at the university and teaching field.

Statistical analysis

The dataset was downloaded from the survey platform and checked for missing data before being included in the SPSS statistical package. Records where respondents only visited the introduction page and did not continue with the questionnaire were excluded. Frequency distribution and central tendencies (mean, Standard Deviation, mode and median) were calculated. Each construct was tested for unidimensionality by applying Principal Component Analysis and Principal Axis Factoring (results not shown), which yielded essentially equal results. The calculation of Cronbach's alpha was used to assess the reliability of the constructs. All constructs passed the first test, so we proceeded with the analysis of SEM.

To create Fit Measures and indices of the model shown in Figure1, a selection was made from the options available in the IBM AMOS package (Byrne, 2013), following the recommendations of Byrne (2013) and Kline (2015). Our choice was as follows (Ploj Virtič et al., 2021): (1) The ratio of chi-squared to degrees of freedom (CMIDF or χ^2/df) with a recommended value below 3; (2) Incremental fit index (IFI) and a comparative fit index (CFI). Values closer to one indicate a better fitting model; (3) Standardised Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA). The acceptable range for both indices is .08 or less.

By inspecting the standardised residual covariance matrix and modification indices provided by the AMOS software (Byrne, 2013), it was possible to identify redundant items and link error terms within some of the constructs.

The authors are aware of the potential methodological biases introduced by respondent self-selection, omission of constructs and items from the models (Kline, 2015), and common methodological biases (Podsakoff et al., 2003; Podsakoff & Organ, 1986) that may influence the results of this type of study.

Results

Results are given in two parts. The first part presents results of descriptive statistics on the use of the different types of ODT and methods before and after the closure of the university. The second part provides results of analysis of the constructs used in the models. In the third part, initial and final CIMoFODT models are presented.

Part 1: The use of ODT applications before and after closure and the use of different forms in ODT.

Tables 2, 3, and 4 provide results of differences in the use of various applications and forms used in ODT.

Table 2. Measures of Central Tendencies for Frequency of Use of Various Forms of Online Instruction Prior to Instructional Process Interruption During the COVID -19 Outbreak Closure and Three Weeks After Instructional Process Interruption and Forced Online Use (n = 290)

	How often had you used various forms of online teaching before interrupting the teaching process due to the COVID-19 disease?					How often do you use various forms of online teaching now?					Cohen's *d*
	Missing	Mean	SD	Mode	Median	Missing	Mean	SD	Mode	Median	
Videoconferencing system (MS Teams)	11	1.66	1.19	1	1	10	4.59	.98	5	5	2.69
Online materials (e-materials. e-textbooks. etc.)	1	3.38	1.29	4	4	14	3.79	1.25	5	4	.32
E-mail	2	4.25	1.17	5	5	9	4.54	0.87	5	5	.28
Online classrooms (Moodle)	7	3.54	1.49	5	4	14	3.9	1.45	5	5	.25
Web applications (Padlet. Kahoot. etc.)	6	1.56	.98	1	1	14	1.66	1.06	1	1	.10

From the results provided in Table 2, it is evident that frequency of use of various forms of online instruction was higher in all considered forms. However, only the use of the videoconferencing system showed a major increase (Cohen's *d* = 2.69).

Table 3. Descriptive Statistics for Different Forms of Synchronous Teaching Employed by Professors and Assistants in Distance Teaching (n = 290)

When teaching distance in real-time (synchronous teaching):	Missing	Mean	SD	Mode	Median
a) I transfer classes or exercises in real time.	10	4.44	1.11	5	5
b) I comment on pre-prepared teaching materials in real time.	12	4.31	1.00	5	5
c) I provide students the tasks they have to solve in real time, individually or in groups.	21	3.15	1.33	4	3
d) Students have to study the prepared teaching materials in advance; then we have discussions in real time.	8	3.07	1.12	3	3
e) I provide the students with teaching materials during the class, and we discuss these in real time.	9	3.03	1.23	3	3

Note: The scale: never (1), rarely (2), occasionally (3), often (4), whenever appropriate (5).

When considering the results provided in Table 2, it is clear that the majority of teachers transferred their lectures into an online "talking heads" format using the videoconferencing system, which, from the student perspective, is a passive format. Active methods involving active student participation were less common. The division was approved by PCA analysis (details not shown), where two uncorrelated components ($r = -.14$) explaining 62.1% of variance were extracted. The first component (items c, d, e; eigenvalue = 1.79) explains 35.8% of the variance and is composed of items which can be considered active methods. The second component (items a, b; eigenvalue 1.32) explains 26.3% of the variance and is composed of two items reflecting passive teaching.

Table 4. Descriptive Statistics for Different Forms of Asynchronous Teaching Employed by Professors and Assistants in Distance Teaching (n = 290)

When teaching distance not in real-time (asynchronous teaching)	Missing	Mean	SD	Mode	Median
c) I provided students with online links to learning materials (e. g., Moodle).	14	3.88	1.34	5	4
e) I gave students instructions for tasks to be completed outside the online environment.	13	3.47	1.35	5	4
f) I gave students the resources they needed to study independently.	15	3.47	1.28	3	3
d) I gave students instructions for tasks to be completed within the online environment.	14	3.33	1.46	5	4
a) I provided students with recordings of lectures or lab work.	19	1.87	1.32	1	1
b) I recorded an audio explanation of the pre-prepared learning materials (e. g., PPT).	17	1.76	1.25	1	1
g) I rescheduled lectures and lab work to a time when it would be possible to return to classrooms and labs.	28	1.42	0.93	1	1

Note: The scale: never (1), rarely (2), occasionally (3), often (4), whenever appropriate (5)

From the results provided in Table 3, it is evident that many teachers understand asynchronous teaching as the provision of teaching materials and instructions to be finished outside lecture time. Only a minority filmed their lectures or accompanied their teaching materials with recorded explanations. This pattern is opposite to that in synchronous teaching. The division was approved by PCA analysis (details not shown), where two weakly correlated components ($r = .23$) explaining 59.7% of variance were extracted. The first component (items c, d, e, f; eigenvalue = 2.27) explains 37.8% of the variance and is composed of items which can be considered as active learning. The second component (items a, b; eigenvalue 1.32) explains 21.9% of the variance and is composed of two items reflecting recording and a passive teaching approach.

Part 2: Analysis of the constructs used in the Models

Measures of central tendencies and Cronbach's alphas for all items included in the models are given in Table 4. Codes for items that were excluded from the final model (Figure 3) are printed in italics. Cronbach's alphas α_{M1} and α_{M2} relate to the initial (M_1) and final (M_2) models.

Table 5. Descriptive Statistics for the Items Forming Constructs Considered in The Model (n = 290)

Codes	Items	Missing	Mean	SD	Mode	Median
Q8a	The University encourages me to use OTP for instruction.	1	6.28	1.09	7	7
Q8b	The University is aware of the benefits that can be achieved with the use of OTP in instruction.	6	5.78	1.38	7	6
Q8c	The University recognizes my efforts in using OTP for instruction.	8	4.36	1.75	4	4
Q8d	The University has a strong interest in my using OTP.	6	5.2	1.74	7	6
Q8e	The university provides me with appropriate technical support for teaching in OTP.	2	5.68	1.63	7	6
Q8f	The university offers me appropriate pedagogical support for teaching in OTP.	4	5.26	1.66	7	6
Q9a	Using OTP improves my teaching performance.	1	4.37	1.79	4	4
Q9b	Using OTP improves my teaching productivity.	3	4.33	1.75	4	4
Q9c	Using OTP enhances my effectiveness in teaching.	3	4.21	1.75	4	4
Q9d	I find OTP to be useful in my teaching.	2	5.05	1.57	5	5
Q9e	My interaction with OTP is clear and understandable.	2	4.97	1.41	5	5
Q9f	Interaction with OTP does not require a lot of my mental effort.	3	4.41	1.71	4	4
Q9g	I find it easy to get OTP to do what I want it to do.	3	4.62	1.6	4	5
Q9h	I find OTP easy to use.	2	4.73	1.57	4	5
Q9i	OTP offers appropriate functionality.	2	4.9	1.44	5	5
Q9j	OTP offers comfortable access to all the teaching applications I need.	5	4.88	1.54	5	5
Q10a	After trying OTP, I can describe the experience as fun.	3	4.47	1.63	5	5
Q10b	After trying OTP, I can describe the experience as instructive.	2	5.33	1.36	5	5
Q10c	After trying OTP, I can describe the experience as difficult (reversed item).	2	3.38	1.66	4	3.5
Q10d	After trying OTP, I can describe the experience as understandable.	3	5.2	1.23	5	5
Q10e	After trying OTP, I can describe the experience as successful.	3	5.54	1.3	6	6
Q10f	Using OTP for teaching is a good idea.	2	5.49	1.61	7	6
Q10g	Using OTP for teaching is a wise idea.	5	5.41	1.62	7	6
Q10h	I like the idea of using OTP for teaching.	5	5.07	1.69	7	5
Q10i	Using OTP is a pleasant experience.	3	4.87	1.62	5	5
Q10j	After using OTP, I have changed my thoughts on using it in a positive direction.	7	4.71	1.67	4	5
	OTP use in teaching has an impact on…					
Q11a	…the teaching process.	5	4.48	1.66	4	4
Q11b	…student curiosity.	4	4.35	1.63	4	4
Q11c	…student concentration.	5	3.9	1.67	4	4
Q11d	…student creativity.	5	4	1.57	4	4
Q11e	…student motivation.	5	4.16	1.61	4	4
Q11f	…student achievement.	12	3.97	1.41	4	4
Q11g	…students' higher order thinking skills (critical thinking, analysis, problem solving).	9	3.89	1.52	4	4
Q11h	…students' competence in transversal skills (learning to learn, social competences, etc.).	6	3.97	1.63	4	4
	When classroom instruction is restored, I will use:					
Q12a	E-mail.	5	5.67	1.88	7	7
Q12b	Online learning platforms (e. g., Moodle, etc.).	7	5.55	2.01	7	7
Q12f	Online materials designed to supplement knowledge (e. g., e-materials, e-textbooks, PowerPoint audio presentations, etc.).	3	5.19	1.79	7	5
Q12e	Online learning materials (e. g., e-learning materials, e-textbooks, PowerPoint presentations with audio, etc.).	4	4.94	1.94	7	5
Q12c	Video conferencing system (e. g., MS Teams) for small groups of students or individual lessons.	5	4.31	2.08	7	5
Q12d	Video conferencing system (e. g., MS Teams) for large groups of students.	10	3.55	2.07	1	4
Q12g	Web applications (e.- g., Padlet, Kahoot, etc.).	8	2.74	1.9	1	2

Part 3: The CIMoFODT Model

In Figures 1 and 2, both the hypothesized and final models are presented.
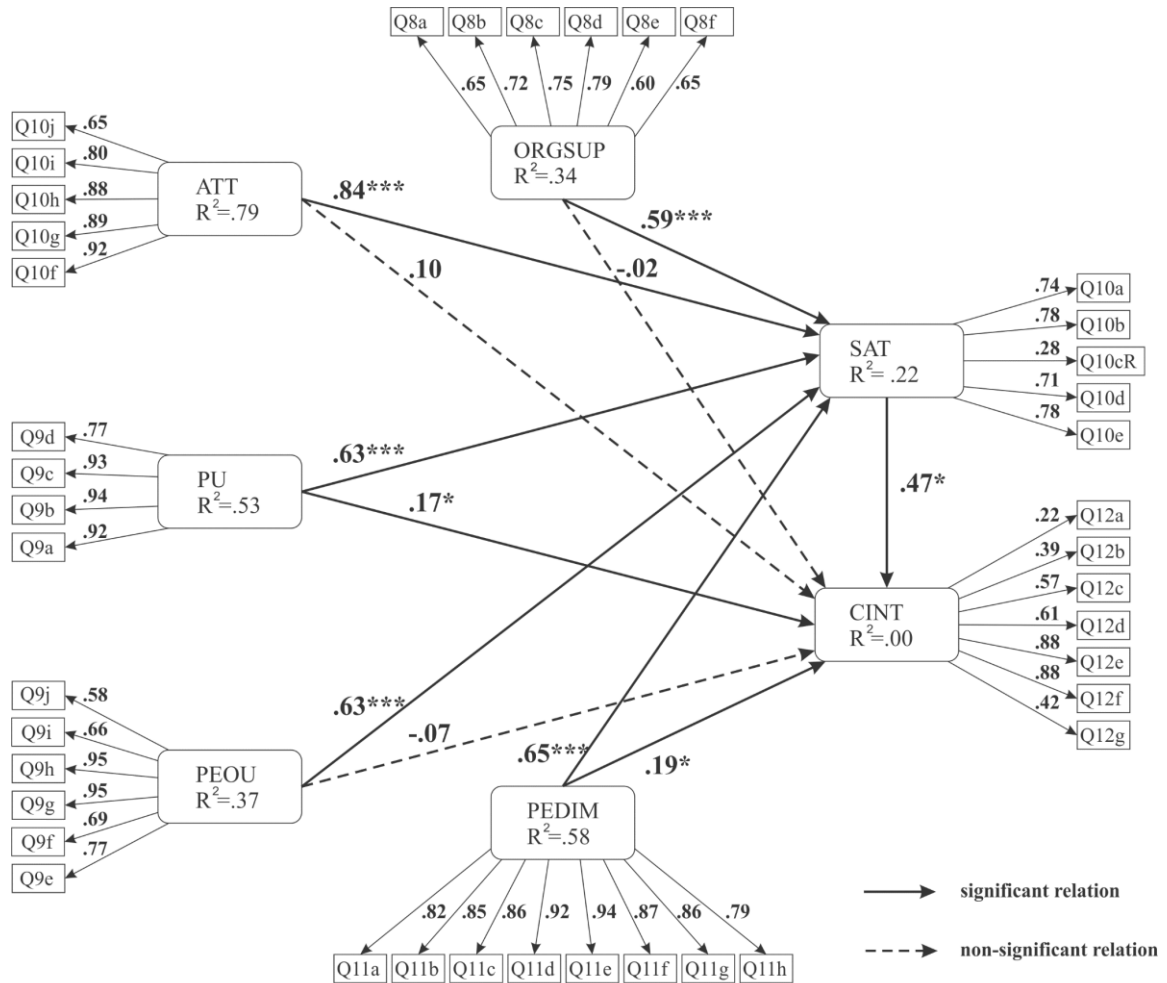

Note: χ^2/df = 2.57, IFI = .84, CFI = .84, SRMR = .10

Figure 2. Model 1 - Measurement Model Including Standardised Path Coefficients

After inspection of the hypothesized model, it was established that all constructs significantly loaded on SAT; however, only PEDIM and PU loaded to CINT, as well. The fit indices of the initial model were below the values recommended in the references. Therefore, we built the final model 2 using the stepwise approach.
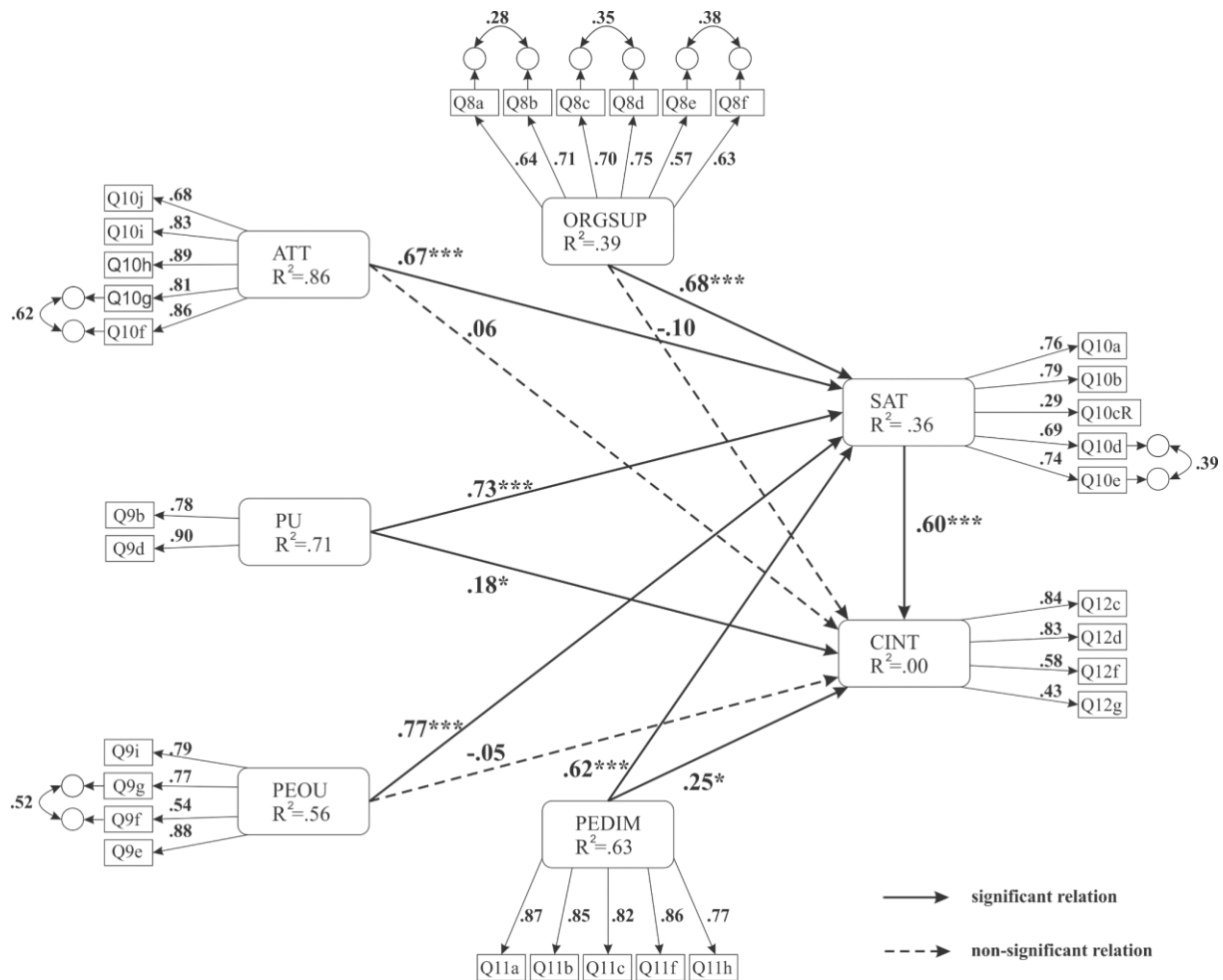
Note: χ^2/df = 1.88, IFI = .92, CFI = .92, RMSEA = .06, SRMR = .06

Figure 3. Model 2 - Final Structural Model Including Standardised Path Coefficients

After the interventions in the original model, all the fit indices checked now fall in the good range; the model can therefore be accepted. Reviewing the modified Model 2, we find that all constructs included in the model are predictors of SAT (R^2 = .36). However, the differences between the path coefficients are small.

Only PU, PEDIM and SAT load directly to CINT (R^2 = .00). Owing to the deletion of some items and connection of error terms, there were changes in the R^2 of most latent variables, but not in CINT.

Discussion

The situation where virtually the entire education sector went online was a new experience in education (Dhawan, 2020). Therefore, there are only a few available references on models of continuance intentions among university instructors in a novel situation (e. g., Hussein et al., 2021; Nikou, 2021) with which to compare the results. One important element--the laboratories, practical work, and fieldwork--does not receive comment. Because of the physical closure of the university at the time of the study, this type of work was severely limited in the virtual environment and often could not be replaced by videos, animation, or simulations.

As the results in Table 1 show, there is an increase in the use of all the applications that use ODT that we asked about. All applications were already available before the closure, and except for the videoconferencing system, MS Teams, the increase in all other applications was minor in terms of effect sizes. It was also recognised that web applications such as Padlet, Kahoot, etc. had been used before and continue to be used by a minority of teachers after closure. The frequency of use of email, e-textbooks and Moodle increased only slightly, but not significantly. A pattern emerged that whenever possible, teachers delivered presentations used in traditional lectures prior to closure and accompanied these with online instruction or combined them with asynchronous uploading of assignments and materials. Less than one-tenth of the teachers reported an asynchronous form of teaching. The explanation may be that this was the easiest way for them to get started with FODT, offering lectures that were often supported by presentations online. We can safely say that for large classes, where classroom debates are assumed to take place in frontal teaching because of the large

number of students, such a system can work, since nothing has changed in unidirectional teaching. The loss is greater for medium-sized and small groups; it is even greater for medium-sized groups than for small groups, in which everyone can get a voice.

Looking at Tables 2 and 3, we can see that in both cases, items fall into two groups (components). In synchronous teaching, strategies for transmitting lectures in online form predominate, in which teachers passively recite teaching content with or without a background presentation from the students' perspective. Active methods, from the perspective of the students, are less common. If available, these are probably limited to working with small groups. In contrast, asynchronous methods involve the provision of tasks and teaching materials for students to access in their free time. Only a small minority of teachers record their lectures or provide presentations with recorded explanations. Therefore, the mantra of ODT about the availability of learning opportunities anytime, anywhere, is reduced to anywhere.

The continuance intention results for the use of different online applications and communication channels are shown in Table 4. The results based on the second research question, whether teachers will use applications as they were used during the suspension, can hardly be compared with references because they are missing. However, we can identify two main groups of applications. The first group includes applications that enable communication and ODT and were used before the lockdown (email, Moodle, and material sharing). These were used continuously during the lockdown, and it is obvious that teachers will continue to use these in the future. If they have integrated professional software into their courses (e.g., programming languages, robotics, simulators, and the like), we predict that they will continue to use these. Some types of specialized software (e.g., Padlet, Kahoot) were not used before the lockdown and will not be used in future. The pattern found is similar to findings of a study conducted with students from the same university (Ploj Virtič et al., 2021), who shared the same preferences as their teachers.

The main difference lies in the use of video conferencing systems (MS Teams). Almost all teachers have at least basic experience with one or more platforms when communicating between colleagues. Because of their experience, most will give up this form of ODT, especially when teaching large classes. These respondents have tried new methods, but even where they are satisfied with an individual application, they lack the firm intention to continue using ODT after the university reopens. The FODT has helped many of them to "get out of their comfort zone" and try new methods and forms of ODT, but most will return to traditional teaching when the classrooms reopen.

We were unable to detect a published model like CIMoFODT at the time of the study preparation. However, several continuance intentions models with a combination of constructs stemming from different theoretical perspectives appeared later during the prolongation of university closure (e.g., Hussein et al., 2021; Nikou, 2021). The closest model that allows comparison of some of the included paths during the closure is the model by Nikou (2021). Among models researching continuance intention among university students, SEM was used in the model by Ploj Virtič et al., 2021. Direct comparison between views of students and teachers at the same university on online experiences is provided in Dolenc et al., 2021, showing that these two groups do not necessarily share the same views. However, it has been possible to compare the paths between constructs (latent variables), particularly those used within Continuous Intention Theory (Bhattacherjee, 2001). All constructs in the model are unidimensional, have appropriate Cronbach's alphas, and the values of all fit indices are above acceptable thresholds.

Most of the original hypotheses can be accepted, including all the hypotheses that were used to predict SAT, but not those to predict CINT. Hypotheses H_2, H_6, and H_8 were rejected. Because of the novelty of the model, it cannot be discussed with reference to comparative analysis of studies based on the same model. However, some paths can be discussed considering previous models that served as the basis for constructing the model.

The hypothesis H_1 that ORGSUP has an effect on SAT was accepted, and the hypothesis H_2 that ORGSUP has an effect on CINT was rejected. Similar results were observed in the study of Hepp et al. (2004), which confirmed that, without motivated and well-trained teachers, the intention to include ICT in the classroom will most likely fail. Therefore, we can say that although good organisational support increases teacher satisfaction, it alone does not influence the intention to continue.

The hypotheses that PU (H_3), EOU (H_5), and ATT (H_7) will influence SAT, and that PEOU (H_6) will influence CINT were accepted; however, the hypotheses that PEOU (H_6) and ATT (H_8) will influence CINT were rejected. We did not find a reference that would allow a comparison of the paths for PEOU and ATT towards SAT and to CINT. However, PU is a construct connected to SAT and to CINT (Bhattacherjee, 2001). The same pattern that PU influences SAT and CINT has already been reported (Benlian et al., 2011; Carillo et al., 2017; Deng et al., 2010; Lee, 2010; Nikou, 2021; Roca et al., 2006). In most studies, connections to SAT were weaker, except in studies by Deng et al. (2010), Lee (2010), and Roca et al. (2006), where it was moderate. Connections with PU and CINT were moderate in the study by Benlian et al. (2011), weak in the study by Bhattacherjee (2001) and Lee (2010) and insignificant in the study by Carillo et al. (2017).

The hypothesis H_9 that PEDIM influence SAT and CINT (H_{10}) was accepted. The general TAM and Continuance Intention Theories do not include this construct; therefore, there are no published studies for comparison.

The hypothesis (H_{11}) that SAT influences CINT was accepted. In a study by Zhou et al. (2012), the connection was weak.

Moderate connections have been observed in studies by Benlian et al., (2011), Bhattacherjee (2001), Carillo et al., (2017), Deng et al., (2010), Lee (2010), and Roca et al., (2006). In a study by Ploj Virtič et al. (2021), continuance preferences of the students were reported as good.

Conclusion

Emergency remote teaching caught educators unprepared; however, they reacted instantly by introducing FODT, which should be distinguished from Voluntary Online Distance Teaching (VODT). The University of Maribor as an institution responded quickly and in an organised manner -- and so did the teachers. Most respondents became used to the new working environment within a single weekend.

Unlike previous studies that measured various factors influencing the voluntary decision to engage in distance education, the teachers in our study did not have a choice, which was the reason for the rapid transition to distance teaching. The results of the study clearly show that teachers adapted to the new environment by adapting existing teaching methods to ODT, which indicates a wise adaptation decision, but one not necessarily optimal from the standpoint of quality learning outcomes.

The results showed that most teachers transferred their lectures into an online "talking heads" format, which from the student perspective, is a passive format, by using the video conferencing system. Active methods involving active student participation were less common. The explanation may be that this was the easiest way for teachers to start with FODT by offering lectures, often supported by presentations.

We found that most teachers understood asynchronous teaching as the provision of teaching materials and instruction to be completed outside the lecture period. Only a minority filmed their lectures or accompanied their teaching materials with recorded explanations. The pattern is the opposite from that in synchronous teaching.

The finding that there were major differences in teaching large groups of students compared to small groups is in line with Ploj Virtič et al. (2021). Working with small groups of students, as in live teaching, allows for more individualized teaching, group work in pairs and similar active methods of teaching.

Applications that are used for communication (e.g., email and Moodle) were used continuously during lock down and will obviously continue to be used by lecturers in the future. Specialized software items (e.g., Padlet, Kahoot) that had not previously been used were not used during the crisis, and most probably will not be used in the future. We can see that respondents have tried new methods, and even when satisfied with a single application, they have no firm intention of continuing to use ODT after the university reopens.

We can conclude that FODT has helped many teachers to "get out of their comfort zone" and try new methods and forms of ODT, but many of them will return to traditional teaching when the university reopens.

In the light of Sternberg's Theory of Successful Intelligence, the combined response by teachers and the university shows teachers choosing to adapt to the new environment and the university adapting the environment, which can be seen as a formula for success.

Recommendations

The recommendations are twofold. The first are recommendations for future research, and the second are recommendations for practice. We would like to emphasize that voluntary decisions are predisposition of most of the models and theories on technology acceptance and continuance intentions from the times before COVID 19, lockdown. The results of previous studies examining the voluntariness of technology acceptance and continued use may not generalise to the case of involuntary lockdown, and new models should be tested. CIMoFODT constitutes an initial attempt but should be tested in a range of higher education institutions with different teaching cultures and subjects. In this way, universal patterns can be distinguished from local, authentic results that can be used to strengthen online teaching in each course. Based on the results, the leadership of each institution should develop specific recommendations to address the cognitive, technological, and structural issues caused by FODT. Recommendations should be made to enhance not only cognitive outcomes but also the satisfaction of all stakeholders with good education. Special attention should be given to the role of the institution in supporting teachers and courses with the goal of communicating more effectively.

Limitations

This study is one of the first attempts to analyse the theoretical constructs used in previous studies of technology acceptance (e.g., TAM, UTAUT) and continuance intention to use various applications under FODT pressure. In previous research on factors influencing intention to continue use, studies have usually addressed factors in an environment where the decision to use was not forced, which can be referred to as VODT.

The study has several limitations that should be considered to make the results more objective. The primary purpose of this study was to determine continuation intentions related to programmes and applications used during closure once the university reopens and to explore the understanding of factors that influence continuation intentions. It is possible

that a model with other variables could provide clearer results and stronger differences. However, it is impossible to include all possible factors in a single study.

The next limitation relates to the lack of response from the invisible majority of teachers. We can only speculate that they held the same opinions and acted in accordance with those who responded. However, within the context of the study design, it is impossible to compensate for this possible error.

We can only speculate about the applicability of the results to teachers as a whole because the study was conducted with data collected from Slovenian-speaking teachers at the University of Maribor in Slovenia. Teachers' continuance intentions and satisfaction could vary depending on the university setting, systems used, organisational support and similar factors. In light of this, the study should be repeated with the inclusion of teachers from other countries.

Other limitations relate to the nature of the survey. For example, the results provide a snapshot of the impact on intention to continue use. Longitudinal studies would help to continue this research.

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Declaration of Interest statement

The authors declare that they have no conflict of interest. The article is an original work of all the authors, and has not been submitted elsewhere, nor is it under consideration for publication in any other journal.

Authorship Contribution Statement

Dolenc, Šorgo and Ploj Virtič developed the idea of the study, designed a theoretical framework, and assembled the instrument (questionnaire). Dolenc collected the data, which were statistically analyzed by the second and third authors. The results of the analyses were critically discussed by all three authors. Based on the discussions, Dolenc prepared a first version of the paper, which was reviewed and improved by Šorgo and Ploj Virtič.

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