Rising to the Occasion: The Importance of the Pandemic for Faculty Adoption Patterns

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Abstract
Technology adoption patterns, in general, have been shown to have a common set of predictive factors such as performance expectancy, social influence, voluntariness, effort expectancy, and facilitating conditions. However, the significance of such factors varies dramatically by situation and conditions. In the faculty adoption of online teaching modalities, three conditions were investigated in a university case study with 180 faculty respondents. Using the unified theory of acceptance and use of technology model, participants were asked to respond to questions about these factors prior to the pandemic, their perceptions about *continuing* pre-pandemic use in the future, and their perceptions about *increasing* pre-pandemic adoption of online teaching in the future. Critical to prior expectations were performance expectancy and level of effort. Continued use relied on all five factors, but only the negative aspects of social influence were significant. Factors affecting increased adoption (assuming voluntariness) were performance expectancy and facilitating conditions. Findings suggest that increased exposure to online teaching may not be as crucial as the quality of faculty experiences during the pandemic. The rationale for these factor shifts is provided, the effects of institutional support are discussed, the threats and limitations to generalizability are reviewed, and the ramifications for institutions trying to enhance faculty adoption are summarized.

Keywords: faculty adoption of online teaching, performance expectancy, effort expectancy, social influence, voluntariness

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Online learning at the university level has been on a steady growth pattern for at least 15 years, especially in the U.S. (Inside Higher Ed, 2020; Seaman et al., 2018), until it spiked with the COVID-19 pandemic (hereafter pandemic). This growth has occurred as student perceptions have improved modestly (Dennis, 2020), despite a relatively constant rate of various concerns by faculty (Allen & Seaman, 2013; Fox et al., 2021; Inside Higher Ed, 2020; Seaman et al., 2018; Shreaves et al., 2020). Reasons may include challenges caused by constantly evolving technology (Cox & Quinn, 2021) and, more recently, by the tremendous challenges online learning presented around the world during the pandemic (e.g., Turnbill, Chugh, and Luck, 2021; Belta-Salvador et al., 2021; Rodrigues, Chimenti, & Nogueira, 2021). Given the tension between relatively constant faculty resistance and increasing usage, what predicts faculty adoption of online teaching in higher education?

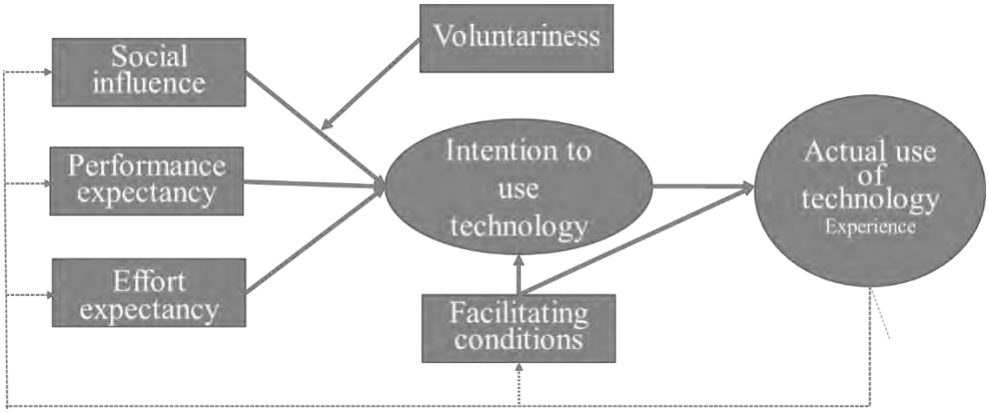
While many descriptive studies have investigated the barriers, challenges, and de-motivators of faculty adoption, those studies have tended to stop at correlational analysis (e.g., Hunt et al., 2014) or regression analysis of functional domains instead of examining faculty adoption patterns per se (e.g., Lloyd et al., 2012). A limited number of studies have adapted well-tested technology adoption models.

In the 1990s, a good deal of research was conducted on technology acceptance modeling (e.g., Davis & Venkatesh, 1996; Venkatesh & Davis, 2000). Some of these researchers worked collaboratively to create the unified theory of acceptance and use of technology (UTAUT) model (Venkatesh et al., 2003). The intent was to furnish a technology model that could be applied to various technology adoption contexts and could provide a relatively high level of explanation of variance. The overall model generally explains 65 to 75% of the variance related to behavioral intention in most studies (Chang, 2012; Khechine et al., 2017; Williams et al., 2015). This widely used model has been adapted to a variety of different contexts (Dwivedi et al., 2019). For example, Venkatesh, Thong, and Xu (2012) adapted the model to fit the consumer context by adding price value and hedonic motivation and called it UTAUT2. While UTAUT2 is only better than the original UTAUT model in a narrower class of situations, it does illustrate the need for the adaption of the basic UTAUT model.

The first purpose of the study is to investigate the adaption of the basic UTAUT model to the context of faculty adoption of online teaching. How well does it perform overall as an explanatory theory, and what adaptations are useful in the context of online teaching to improve the performance of the various factors? In addition to adapting the model, this study used the adapted UTAUT model to examine the evolution of online adoption patterns as the pandemic has jolted long-term usage practices. In particular, what effect did the involuntary requirement of online teaching usage have on future intentions, and why?

The basic UTAUT model has five independent factors and two dependent factors. The five factors are social influence as moderated by voluntariness, performance expectancy, effort expectancy, and facilitating conditions. The two dependent factors are intent to use and actual use. After initial use, an important feedback loop (i.e., experience), substantially shifts the importance of factors over time (with performance expectancy becoming more important and social influence declining in importance, generally). Figure 1 provides the basic model below.

Figure 1
Basic UTAUT Model



Note. The dotted line indicates the feedback loop.

The Venkatesh Model and the Online Teaching Context

Social influence occurs when potential adopters are affected by the usage and perceptions of others who are either in positions of influence themselves or function as important role models and the perception of support by the institution. In online teaching, numerous researchers have pointed to colleagues' impact (e.g., Casdorph, 2014; Lewis et al., 2013). Some have also suggested the effect of student feedback (Moser, 2007). Several researchers have pointed to the roles of status and prestige, or lack thereof (e.g., Bailey, 2016; Maguire, 2005; Myers et al., 2004). An area of social influence that has not been empirically investigated is the role of negative social influence, which may be relevant in the online teaching context. *Negative social influence* occurs when non-adoption may not be required, but non-users believe they are perceived as poor colleagues. This negative social influence may be significant in a highly collegial environment when the demand for technology use puts pressure on the department.

Voluntariness moderates social influence (Venkatesh et al., 2003). When voluntariness is high, social influence has a more significant role. Conversely, when voluntariness is low, a decrease in the *social* aspect of this factor occurs. Social influence plays a modest to moderate role, as reported in the online teaching literature (Johnson et al., 2011; Lewis et al., 2013). However, as voluntariness decreases, social influence becomes a more important factor; when voluntariness is eliminated, it becomes the only significant factor in adoption. This condition primarily existed during the height of the pandemic. It also exists in online teaching when no face-to-face version of a course or program is available. In the online teaching context, it is unclear if the dramatic changes in voluntariness during the pandemic affected other factors in unanticipated ways.

Performance expectancy is a multiple-dimension category relating to utility, speed, productivity, and career success as initially articulated in the UTAUT model (Venkatesh et al., 2003). When voluntariness is high, performance expectancy is generally the most critical factor. Performance expectancy indicators are extensive in the literature but conceptualized in a variety of ways (Abdekhoda et al., 2016; Bailey, 2016; Casdorph, 2014; Horvitz et al., 2015; Hunt et al., 2014; Lawrence & Tar, 2018; Lewis et al., 2013; Lloyd et al., 2012). Utility and productivity

tend to be conceptualized as learning achievement, learning experience, and intellectual challenge. Other elements that have been loosely associated with performance expectancy that are sometimes highlighted are the ability to motivate students (e.g., Tanner et al., 2011), student access (e.g., Mansbach & Austin, 2018), and faculty satisfaction (Horvitz et al., 2015; Maguire, 2005). A technical research question is whether faculty satisfaction is roughly equivalent to career success and, therefore, an element of performance expectancy or an altogether different factor. Speed as an element of performance originally conceptualized in the UTAUT model is not directly equivalent to the online teaching adoption literature. Speed might be conceptualized as flexibility (e.g., reduction in commute times, scheduling, etc.) (Hunt et al., 2014; Mansbach & Austin, 2018; Stewart et al., 2010; Stickney et al., 2019; Tanner et al., 2011). In the online teaching context, it is unclear whether flexibility is a function of performance or loads as a separate factor altogether because of its importance (Green et al., 2009).

Effort expectancy has to do with the perceived time and energy required to learn to operate a technology system, become skillful, use it on an ongoing basis, and find the system clear and understandable (Venkatesh et al., 2003). In some technology adoption models, it is called "ease-of-use." Nearly universally, researchers report increased workload issues for faculty teaching online (e.g., Hunt et al., 2014; Maguire, 2005; Mansbach & Austin, 2018), and many researchers recommend providing reassigned time to compensate for the time to learn online teaching methods and build classes (Bailey, 2016; Lloyd et al., 2012; Orr et al., 2009). Professional surveys of faculty opinions find substantial concerns about workload (Fox et al., 2021; Inside Higher Ed, 2020), which is collaborated by most work analysis studies (Aryal & Aryal, 2015; Tomei, 2006; contrarily, see Van de Vord & Pogue, 2012).

Effort expectancy changes the overall technologies' adoption cycle, which is especially important in adopting online teaching patterns. First, initiating online teaching requires a lot of effort to learn the methods, adapt teaching approaches, and build out initial class structures (Fox et al., 2021). After these sunk costs are invested, that aspect diminishes. However, course upgrades and increased faculty monitoring may also increase perceptions of effort after the initial course, while eventually, experience/habit and some of the automated features that are rolled over from one course to the next may decrease effort perceptions (e.g., Fox et al., 2021; Lewis et al., 2013). This raises the question about the quantity of effort, which has a cost-benefit basis, versus the perceived impact of the effort. That is, is the overall perception that the effort required for online teaching is worth it (or not) and, whatever the amount of that effort, linked to effort expectancy or another factor?

Facilitating conditions refer to the resources and knowledge to use a system, assistance with initial and ongoing challenges, and the degree to which the system works well or does not interfere with other technologies (Venkatesh et al., 2003). In practical terms, facilitating conditions involve generic and customized training and tech support, so they are widely referenced in the literature. While some more rigorous studies find facilitating conditions to be significant (Hunt et al., 2014; Lloyd et al., 2012; Stickney et al., 2019), some studies have not found them to reach statistical significance in adoption situations (Abdekhoda et al., 2016; Casdorph, 2014). Unlike the other factors, facilitating conditions have little effect on the intent to teach online and a more direct influence on actual use. Further, because training tends to increase performance and support tends to reduce the perception of effort, facilitating conditions have a stronger impact on experience (i.e., the feedback loop) than social influence, and to a lesser degree, effort expectancy (Hunt et al., 2014). In the context of online teaching, examining the role of facilitating conditions is of particular interest because it is possible that the suddenness of

demand overwhelmed service providers and training support systems, exacerbating a difficult situation. This raises the issue of using a model over time because initial adoption and continued use are not identical (Lolic, 2021).

To date, only four studies use versions of the well-respected Ventaketesh et al. unified theory of acceptance and use of technology or UTAUT model context (Venkatesh et al., 2003; Venkatesh & Bala, 2008) in ways related to the online teaching context; however, they have some limitations. Two studies are less-than-ideal because of their relatively low explanation of variance rates, 56% and 47% (Abdekhoda et al., 2016; Casdorph, 2014). A third has a very small number of respondents, 47 (Lewis et al., 2013). Hu, Laxman, and Lee (2020) find that the bulk of adoption explanation comes from performance expectancy and habit, but it is in the specific case of emerging mobile technologies rather than online teaching per se.

This study sought to address some of the issues raised in the literature review.

(1) Can the Venkatesh model, as adapted to the online teaching context, achieve a high level of explanatory power?
(2) Is there any difference between positive and negative social influences in how they load on the Venkatesh factors?
(3) Is there any difference between the quantity of perceived effort versus the impact of effort?
(4) Do flexibility and/or satisfaction load as separate factors or are they subsumed under performance expectancy?
(5) How are the factors affected by the rather dramatic changes associated with the pandemic (pre-pandemic, during the pandemic, post-pandemic)?

Stating these research questions as hypotheses to be tested:

(1) When using customized items, the Venkatesh model can achieve at least a 65% explanation of variance related to online faculty adoption patterns.
(2) Social influence has positive and negative factors that will load separately and be significant.
(3) Perceptions of effort vary depending on whether it is perceived as a quantity or impact.
    a. The impact of effort will load as a separate factor from the quantity of effort.
    b. The impact of effort will load on a factor other than the quantity of effort.
(4) Flexibility and/or satisfaction will load as one or two separate factors.
    a. Flexibility will load separately from performance expectancy and be significant.
    b. Satisfaction will load separately from performance expectancy and be significant.
(5) The weight of the various factors will vary depending on the phase of the pandemic.

Methods

Setting

Participants were obtained from a public research university in Florida, an institution that has approximately 17,000 students (14,500 undergraduate and 2,500 graduate students). It offers undergraduate and graduate degree programs, including doctoral degree programs. This university reflects other midsized universities in the United States, which are the majority of higher education institutions: it is a regional university (students from Florida make up 93% of

all students) in a large city that was founded after the 1965 Higher Education Act to meet the growing demand created in the 1960s (Geiger, 1980).

Instrument Development

A Qualtrics survey instrument regarding faculty adoption was used to collect data to empirically examine the above hypotheses using the UTAUT 1 model (Venkatesh et al., 2003). The survey instrument was Beta-tested in spring 2019, approximately a year prior to the educational lockdown, at a California midsized public research university, with several hundred usable responses resulting in an unpublished, descriptive, internal report. The Beta test led to several item adjustments and refinements. The instrument (see Table 3 for a list of items included) used in the study contains a total of 52 questions. Forty-two questions addressed the UTAUT model covering performance expectancy, effort, social influence (including negative influence from the pandemic) and facilitating conditions. Six items specifically referenced perceptions that might be time sensitive by asking about prior experience and six alternate questions referenced perceptions since the pandemic related to facilitating conditions and social influence (e.g., "Prior to [since] the pandemic, good training was [has been] available about the learning platform at my campus"). Some poor-performing items were removed from the analysis. Seven demographic (i.e., age, race, gender, academic cluster, rank, distance to campus, and previous online teaching experience) and two training questions rounded out the question pool. The questions about training were not used in this study.

To examine the pre-pandemic adoption of online teaching, survey responses to "I have not taught any online courses at a university" and "I am teaching my first class online because of the Coronavirus" were used to construct a dummy dependent variable (taught online before the pandemic = 1, otherwise = 0).

Data Collection

After getting institutional IRB approval, the survey was distributed to all 886 faculty, both full and part-time, on August 19, 2020. A follow-up reminder email was then sent one week later to those who had not completed the survey. A total of 194 surveys were started (21% response rate), but any survey that was incomplete was considered to have been withdrawn from the study and discarded. That left 184 surveys completed, and 169 were analyzed after eliminating missing variables.

Demographic Makeup of the Sample

Regarding respondents' age, the survey sample fell in a bell curve centered on people aged between 42 and 57 (born from 1965 to 1980). Participants were overwhelmingly White (76%). Distribution across the colleges was relatively proportional to college size. A slight majority of the respondents were women (51%). Seventy-seven percent of the respondents live within 20 miles of the campus (see Table 1 for demographic details). The sample population was compared to the university's faculty demographic composition regarding college, age, race, rank, and gender. The sample was slightly more female, and the percentage of respondents in the 42–57 age range were more represented than university faculty in that grouping, while those in the next grouping (58–76) were slightly less represented. All other demographic data were comparable to the population studied.

Table 1
Demographic Information of the Participants

	Freq.	%		Freq.	%
Age Group			***Race***		
58–76	45	27%	White	127	76%
42–57	72	43%	Latino	5	3%
26–41	31	18%	African American	5	3%
18–25	2	1%	Asian Pacific Islander	5	3%
Other	19	11%	Other	26	15%
Total	**169**	**100%**	**Total**	**168**	**100%**
Academic Cluster	**Freq.**	**%**	***Faculty Rank***	**Freq.**	**%**
Arts and Letters	38	23%	Assistant Professor	23	14%
Business	23	14%	Associate Professor	48	29%
Education	13	8%	Professor	35	21%
Law, Architecture, and Others	13	8%	Adjunct	12	7%
Natural Sciences	40	24%	Instructor	37	22%
Social Sciences	41	24%	Other	11	7%
Total	**168**	**100%**	**Total**	**166**	**100%**
Gender	**Freq.**	**%**	***Distance to Campus***	**Freq.**	**%**
Female	87	51%	Within 10 miles	62	37%
Male	63	37%	11–20 miles	67	40%
Other	2	1%	21–50 miles	31	18%
Prefer not to say	17	10%	Over 50 miles	9	5%
Total	**169**	**100%**	**Total**	**169**	**100%**

Table 2
Faculty Online Teaching Adoption

Teaching Online	Count	Percent	Never taught, but intend to teach online in future	Count	Percent
Have not taught online	9	5%	Strongly agree	2	22%
Teaching the first online class	22	12%	Agree	1	11%
Have taught at least one online class	80	44%	Neither agree nor disagree	6	67%
Have taught between 2-10	14	8%	Disagree	0	0%
Have taught between 11-20	23	13%	Strongly disagree	0	0%
Have taught more than 20	32	18%	Total	9	100%
Total	180	100%			
Will continue to teach online	**Count**	**Percent**	**Intend to teach more online**	**Count**	**Percent**
Strongly agree	80	47%	Strongly agree	60	36%
Agree	43	25%	Agree	43	26%
Neither agree nor disagree	26	15%	Neither agree nor disagree	34	20%
Disagree	16	9%	Disagree	19	11%
Strongly disagree	4	2%	Strongly disagree	12	7%
Total	169	100%	Total	168	100%

Data Analysis

To test the robustness (RQ1) and articulation (RQ2 through 4) of a UTAUT model adapted to an online context, an exploratory factor analysis (EFA) using a principal component method and direct oblique rotation was conducted to determine best-fit, pre- and post-factor solutions. A logistic regression analysis was used to examine the effects of the independent factorial variables.

A multiple regression analysis was used to test for changes in adoption practices (RQ5). Specifically, it examines the intention to *continue* teaching online versus indicating *increased* online teaching after the pandemic. Factors for the two conditions were determined by a *p*-value greater than 0.1.

Results

Baseline Use and Future Intentions to Use Online Teaching

All but nine respondents had taught online before the pandemic. However, 46% reported being newcomers to online, either teaching a single class or just beginning to teach online during the pandemic. This reflects the percentage of faculty nationally who had taught an online course prior to the pandemic (46%, Inside Higher Ed, 2020). In addition, many of the base findings in this study align with Inside Higher Ed's national survey measuring faculty attitudes on technology in higher education institutions.

When asked about their intent to continue to teach online after the pandemic, 72% agreed or strongly agreed. This number dropped to 62% when respondents were asked whether they intended to teach online more than they had done before the pandemic.

Factor Loading and Regression Analysis: Perceptions Prior to the Crisis

A five-factor EFA solution matched the theoretical model very well and explained 68% of the variance. Six and seven-factor solutions did not perform as well theoretically, nor did they reveal a coherent sixth factor such as satisfaction or flexibility as hypothesized. The satisfaction item loaded cleanly with a 0.846 Cronbach Alpha on performance expectancy and the other teaching performance items. Flexibility for students and for "me" items loaded with only 0.633 and 0.578 values, respectively, but also loaded on the voluntariness factor. Performance expectancy was the dominant factor.

EFA results showed that facilitating conditions loaded with three substantial items: time and resources, customized training, and general training. Receiving incentives loaded both on facilitating conditions and voluntariness. Social influence was comprised of the presence of colleagues in the university, colleagues in the department, and university supportiveness—all positive aspects of social influence. Effort expectancy was reflected by the effort to teach online, additional time to teach online initially, and additional time to teach online even after the first time teaching the course. These items are essentially negative. However, the positive expression of effort reflected in the item "I believe that the effort it takes to teach online is worth it" loaded on performance expectancy.

While voluntariness had five items that loaded on the factor with individual values of about 0.3, and all those items related to the concept, only one had a relatively high item value (0.757). That item was related to teaching online beyond one's standard load. As mentioned, flexibility and incentives also affected voluntariness. See Table 3 for the adoption factor loading prior to the pandemic.

Table 3

Adoption Factor Loading: Pre-pandemic Perceptions

Survey Items	Factor 1 Performance Expectancy	Factor 2 Facilitating Conditions	Factor 3 Social Influence	Factor 4 Effort Expectancy	Factor 5 Voluntariness
I believe that online teaching does as good or better job in helping students reflect on and evaluate their learning.	0.8792				
I believe that online teaching achieves knowledge outcomes equal (or greater) than face-to-face classes.	0.8740				
I believe that online teaching can be as, or more, successful than face-to-face classes.	0.8565				
I believe that online teaching can provide an equal or greater sense of intellectual challenge than face-to-face classes.	0.8528				
I believe that online teaching does as good or better job in helping students set learning goals.	0.8487				
I believe that online teaching is (would be) as satisfying for me as teaching face-to-face classes.	0.8465				
I believe that online teaching can provide equivalent or better lecture presentations than face-to-face classes.	0.8403				
I believe that online teaching achieves an equal or greater sense of a learning community than face-to-face classes.	0.7827				

I believe that online teaching can provide equal or better opportunities for students to rehearse materials than face-to-face classes.	0.7246				
I believe that the effort it takes to teach online is worth it.	0.7245				0.4141
I believe that the flexibility provided by online teaching is worthwhile for students.	0.6335				0.4810
I believe that the flexibility provided by online teaching is worthwhile for me.	0.5782				0.5668
Prior to the COVID-19 crisis, time and resources were allocated for me to learn about online teaching issues.		0.8455			
Prior to the COVID-19 crisis, customized training was available when I was building an online class.		0.8177			
Prior to the COVID-19 crisis, good training was available about the learning platform at my campus.		0.7936			
I do or have received incentives for teaching online classes.		0.3890			0.3237
Prior to the COVID-19 crisis, many of my colleagues throughout the university taught online.			0.8711		
Prior to the COVID-19 crisis, many of my colleagues in the department taught online.			0.8591		
Prior to the COVID-19 crisis, the university was supportive of online teaching.		0.4265	0.5403		
I believe that online teaching requires the same or less effort than teaching face-to-face classes.				0.7930	
I believe that online teaching requires a significant investment of additional time even after the first time you teach a class.				0.7871	
I believe that online teaching requires a significant investment of additional time initially.				0.6979	
Teaching beyond my standard load (e.g., summer) may require online teaching.					0.7570

*Five factors explain 68% of the variance. Decimal places and loadings less than .30 omitted.

**All factors produce a Cronbach alpha value of over 0.7, passing the standard threshold of reliability.

In terms of the parameter estimates, only two factors reached appropriate levels of significance without adjustment: *performance expectancy* and *effort expectancy*. However, since voluntariness moderates social influence, resulting in statistical cancellation, the interaction of the two factors resulted in a *p*-value of 0.0095. In the adjusted model, four of the five factors reached levels of significance. See Table 4 for the nominal logistic fit statistics.

Table 4

Summary of Nominal Logistic Fit of Faculty Adoption

Whole Model Test				
Source	**-Log Likelihood**	**DF**	**Chi-Square**	**Prob > Chi Sq**
Difference	10.0600	6	20.1200	0.0026
Full	61.4734			
Reduced	71.5334			
Square (U)	0.1406			
AICc	137.6690			
BIC	158.6030			
Observations (for Sum Wgts)	163			
Lack of Fit				
Source	**DF**	**-Log Likelihood**	**Chi-Square**	
Lack Of Fit	156	61.4734	122.9468	
Saturated	162	0.0000	**Prob > Chi Sq**	
Fitted	6	61.4734	0.9764	
Parameter Estimates				
Term	**Estimate**	**Std Error**	**Chi-Square**	**Prob > Chi Sq**
Intercept	-2.0527	0.2891	50.42	<.0001***
Performance Expectancy	0.9437	0.2835	11.08	0.0009***
Facilitating Conditions	0.0322	0.2261	0.02	0.8868
Social Influence	0.0392	0.2476	0.03	0.8742
Effort Expectancy	0.4974	0.2219	5.03	0.0250***
Voluntariness	0.0050	0.2216	0.00	0.9821
Social Influence × Voluntariness	-0.6289	0.2425	6.72	0.0095***

*p < .10 **p < .05 ***p < .01

Perceptions of Post-pandemic Adoption

The pool of items for the EFA for the post-condition was different from the pre-condition in two ways. First, it included the seven items related to training, resources, pressure, and positive collegial influence, but with different wording (i.e., "since" rather than "prior"). For example, one item was "*Since* the COVID-19 crisis, good training has been available about the learning platform on campus." Besides, five items (i.e., concerns about being perceived as incompetent, lack of contribution, outdated, online teaching becoming normal, and pressure because of the crisis) were added to the analysis because of the dramatic change in exposure to online teaching. Given the nearly universal exposure to online teaching, the possible assumption by many respondents that higher levels of online teaching in the future would likely be expected was tested. That is, the authors wanted to investigate whether negative social influence plays a role.

A six-factor solution in the post-condition was chosen because it matched the theoretical model very well and explained 70% of the variance. The new factor, as hypothesized, was the negative social influence. Four of the five negative social influence factors loaded cleanly. The item—"I have serious concerns that online teaching will be a new normal practice in the future"—also loaded negatively on performance expectations in addition to negative social

influence. Positive social influence is loaded as a separate factor. Another key difference was that flexibility loaded on voluntariness, using the 0.3 Cronbach alpha threshold. See Table 5 for the factor loadings for post-COVID teaching perceptions.

Table 5

COVID-19 Affected Factors Loading

Survey Items	Factor 1 Performance Expectancy	Factor 2 Facilitating Conditions	Factor 3 Negative Social Influence	Factor 4 Effort Expectancy	Factor 5 Social Influence	Factor 6 Voluntariness
I believe that online teaching does as good or better job in helping students reflect on and evaluate their learning.	0.8866					
I believe that online teaching achieves knowledge outcomes equal (or greater) than face-to-face classes.	0.8809					
I believe that online teaching does as good or better job in helping students set learning goals.	0.8606					
I believe that online teaching can provide an equal or greater sense of intellectual challenge than face-to-face classes.	0.8575					
I believe that online teaching can be as, or more, successful than face-to-face classes.	0.8563					
I believe that online teaching is (would be) as satisfying for me as teaching face-to-face classes.	0.8465					
I believe that online teaching can provide equivalent or better lecture presentations than face-to-face classes.	0.8386					
I believe that online teaching achieves an equal or greater sense of a learning community than face-to-face classes.	0.7906					
I believe that online teaching can provide equal or better opportunities for students to rehearse materials than face-to-face classes.	0.7227					
I believe that the effort it takes to teach online is worth it.	0.7119					0.4696
I believe that the flexibility provided by online teaching is worthwhile for students.	0.6192					0.5118
Since the COVID-19 crisis, good training has been available about the learning platform at my campus.		0.8719				

Since the COVID-19 crisis, customized training has been available when I am building an online course.		0.8649				
Since the COVID-19 crisis, time and resources have been allocated for me to learn about online teaching issues.		0.8142				
Since the COVID-19, the university has been supportive of online teaching.		0.5669				
I do or have received incentives for teaching online classes.		0.3739				0.3140
I have serious concerns that my colleagues will think that I am not making a sufficient contribution if I do not teach online.			0.8975			
I have serious concerns that my colleagues will think that I am less capable if I do not teach online.			0.8858			
I have serious concerns that my teaching style will be outdated if I am not teaching online.			0.7292			
Since the COVID-19 crisis, there has been pressure on me to teach online.			0.5635			
I have serious concerns that online teaching will be a new normal practice in the future.	-0.5657		0.3583			
I believe that online teaching requires a significant investment of additional time even after the first time you teach a class.				0.7899		
I believe that online teaching requires the same or less effort than teaching face-to-face classes. 2				0.7608		
I believe that online teaching requires a significant investment of additional time initially.				0.7147		
Since the COVID-19 crisis, many of my colleagues throughout the university are teaching online.					0.8991	
Since the COVID-19 crisis, many of my colleagues in my department are teaching online.					0.8846	
Teaching beyond my standard load (e.g., summer) may require online teaching.						0.6702
I believe that the flexibility provided by online teaching is worthwhile for me.						0.6146

*Six factors explain 70% of the variance. Decimal places and loadings less than 0.30 omitted.
**All factors produce a Cronbach alpha value of over 0.7, passing the standard threshold of reliability.

Multiple regression analysis was used to examine future teaching adoption, indicating the intention to *continue* teaching online versus indicating *increased* online teaching after the pandemic. Both dependent variables are on a five-level Likert scale. The factors that were significantly varied in the two outcomes.

Some aspects of all five Venkatesh factors were significant in the *continuing outcome*. However, only negative social influence was significant; positive social influence was no longer significant. Only three factors were significant in the "teach more online" outcome: voluntariness, performance expectancy, and facilitating conditions. Neither type of social influence nor effort expectancy was significant in planning on increasing the amount one teaches online. See Table 6 for the regression analysis results related to the post-condition outcomes.

Table 6

Continue Versus More Online Teaching: Summary of Multiple Regression Analysis

Analysis of Variance	**Continue Teaching Online**				**Teaching More Online**			
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**
Model	7	100.20	14.31	21.95	7.00	99.44	14.21	13.73
Error	159	103.70	0.65	**Prob > F**	158.00	163.50	1.03	**Prob > F**
C. Total	166	203.90		<.0001***	165.00	262.94		<.0001***
Parameter Estimates								
Term	**Estimate**	**Std Error**	**t Ratio**	**Prob > |t|**	**Estimate**	**Std Error**	**t Ratio**	**Prob > |t|**
Intercept	1.9619	0.0625	31.38	<.0001***	2.2939	0.0790	29.04	<.0001***
Performance Expectancy	0.6037	0.0628	9.61	<.0001***	0.6474	0.0794	8.15	<.0001***
Facilitating Conditions	0.1428	0.0624	2.29	0.0234**	0.1329	0.0788	1.69	0.0937*
Fear (Negative Social Influence)	-0.2182	0.0628	-3.47	0.0007***	0.0413	0.0791	0.52	0.6021
Effort Expectancy	0.1110	0.0629	1.76	0.0797*	-0.0151	0.0807	-0.19	0.8517
Social Influence (Positive)	-0.0298	0.0651	-0.46	0.6477	-0.1067	0.0820	-1.30	0.1951
Voluntariness	0.4083	0.0625	6.53	<.0001***	0.3987	0.0788	5.06	<.0001***
Social Influence X Voluntariness	-0.0559	0.0726	-0.77	0.4421	-0.1258	0.0914	-1.38	0.1707

*p < .10 **p < .05 ***p < .01

Discussion

Research Questions Associated with the Effectiveness and Structure of the Venkatesh Model in Online Faculty Adoption Patterns

The first four research questions had to do with the model's overall fit and how various factors were articulated in EFA. The first research question was whether the Venkatesh model could achieve a high degree of explanatory power since this was not the case in earlier studies. Using questions that were customized to the faculty online teaching environment and Beta-tested led to explanations of variance at 68% and 70% for the pre-and post-pandemic conditions. This was a substantial improvement over previous studies; the first hypothesis was supported.

The second research question asked if any difference existed between positive and negative social influences in how they load on the Venkatesh factors. Positive social influence

was evident in the pre-pandemic case, but negative social influence did not load as an item. That is, faculty were influenced when they saw colleagues teach online and the university provided a positive environment for teaching online. However, only negative social influence (i.e., concern about negative perceptions of others or the presence of social pressure) became significant in determining the likelihood of continuing to teach online to a modest degree. Neither positive nor negative social influence affected decisions related to increasing online teaching levels after the pandemic. Therefore, the second hypothesis that social influence is of two different types (i.e., positive, and negative) was strongly supported.

The third research question asked if there is any difference between the quantity of perceived effort versus the impact of effort in faculty adoption patterns? Yes, there is clearly a difference. The impact (when construed in a positive manner) consistently loads on performance expectancy. Therefore, hypothesis 3a was not supported regarding its loading as an additional factor, but hypothesis 3b was supported regarding its loading on another factor: performance expectancy.

The fourth research question asked, "Do flexibility and/or satisfaction load as a separate factor?" Flexibility is loaded on both performance expectancy and voluntariness in the pre-condition and solely on voluntariness in the post-condition. Hypothesis 4a was not supported. Satisfaction is loaded solely on performance expectancy in both the pre-and post-conditions. Hypothesis 4b was not supported.

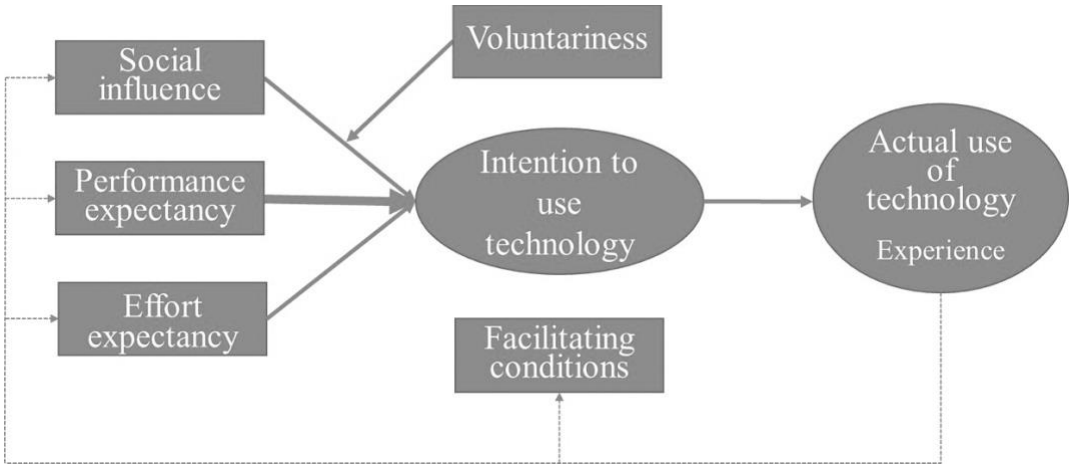
The Research Question Regarding the Factor Significance Changes during the Course of the Pandemic

The fifth research question was how the factors might be affected by the rather dramatic changes associated with the pandemic (i.e., pre-pandemic, during the pandemic, post-pandemic). As the regression analyses show, there was dramatic factor variation. Thus, the hypothesis that the significance of the various factors will vary depending on the phase of the pandemic was strongly supported. The data provided a rich opportunity for interpretation, as discussed below.

Prior to the Pandemic

Adoption across the institution was at a very low proportion of all courses prior to the pandemic. In the pre-condition, *performance expectancy* is significant and the most important factor. Except for early adopters, performance expectancy is primarily based on non-experiential perceptions, or limited experiences, which may have been in the past, partial, rushed, or from receiving rather than providing online education. *Effort expectancy* is of medium importance and generally focused on the extra effort it might take to transform courses. *Voluntariness* and *social influence* have an inverse relationship. The stronger the mandate to teach online, the less positive social influence matters, and vice versa. In the pre-condition, they are statistically insignificant separately but taken together; they are of medium importance. Facilitating conditions are not significant in adoption in the *prior to* condition. For the most part, they are not a part of the adopter's calculus and have had little ability to evaluate the quality of support in any case. See Figure 2 for a visual presentation.

Figure 2
Actual Online Technology Adoption Model Prior *to Pandemic*

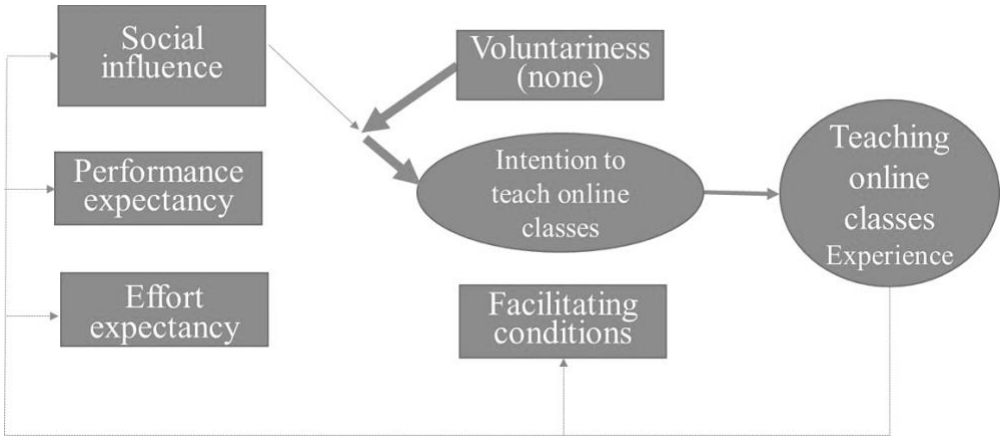


Note. The dotted line indicates the feedback loop.

During the Pandemic

The university and health authorities required all courses to go online during the pandemic except those with an exceptional need for a face-to-face presence, and even those courses were required to take extraordinary measures such as social distancing, reduced face-to-face time, etc., to protect students and faculty. Because of the online teaching mandate (high involuntariness), faculty adoption during the pandemic spikes up enormously, regardless of performance expectancy, social influence, effort, or facilitating conditions. See Figure 3. However, during this period (i.e., condition), experience occurs at vastly increased rates which affects post-pandemic adoption patterns since prolonged experience (even when neutral) is associated with increased long-term usage (McGee et al., 2017). *Performance expectancy* shifts from being largely conjectural to being based on experience, and positive "discoveries" during the pandemic can reshape opinions (Zhou, 2020). When contemplating when the involuntary condition is removed, performance expectancy is perceived not to be based on what online teaching is thought to be capable of (or not capable of), but rather on what instructors have achieved in their online courses in the rushed, and less-than-ideal, pandemic conditions. While *facilitating conditions* are not significant for adoption during the pandemic, the training and technical support received substantially affect performance capability projections once voluntariness is restored (i.e., the post-condition). During the pandemic, the ease/difficulties of teaching online also become experiential rather than conjectural. Substantial additional work and increased stress are generally experienced during this condition, which will affect later post-pandemic adoption decisions (Fox et al., 2021).

Figure 3
COVID-19 Effect on Online Teaching During *the Pandemic*

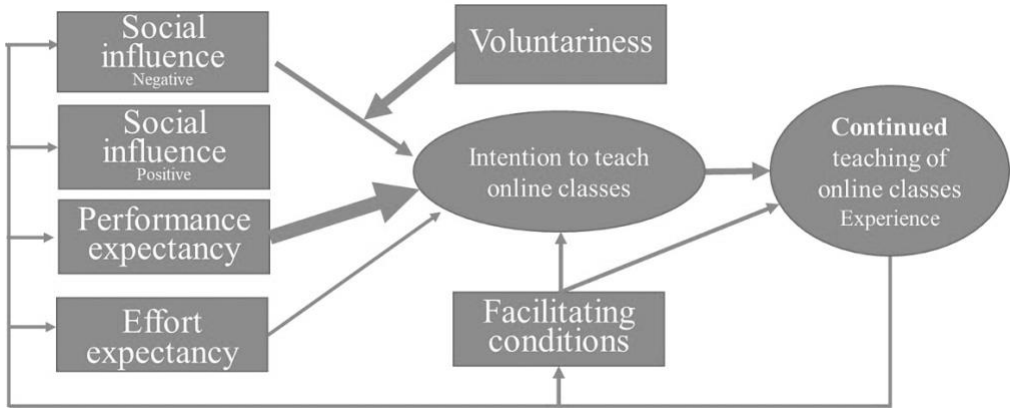


Significant Factors for those Planning to Resume Pre-pandemic Levels of Online Teaching.

After the pandemic, voluntariness might be largely restored, and faculty online teaching will either return to pre-pandemic levels (here labeled continuing) or increase. *Performance expectancy* is by far the most important factor affecting post-pandemic faculty adoption for continuance and an increase in online teaching. Those less impressed by their perceptions of the online modality performance will tend to plan to resume approximately the same level of online teaching that they did before the pandemic. Some with bad experiences will actively resist any online teaching (Botha-Raavyse & Blignaut, 2017). Others with mediocre experiences will resume past patterns or increase online adoption selectively. Such faculty may feel that they can use aspects of online teaching or use them in certain types of courses. They may not actively resist online teaching based on performance expectancy if online demand increases, but they do not actively seek to increase their online presence.

However, those who tend to resume former levels of online teaching can be influenced by its flexibility and opportunities for additional income. *Positive social influences* are of little effect on adoption decisions after the pandemic because essentially all faculty have the same exposure, so role-modeling is no longer pertinent. However, *negative social influence* does play a significantly negative role in the continuous use of online teaching after the pandemic. Faculty may adopt online teaching as influenced by both administrative pressure and concerns that colleagues will think less of them if they do not teach online (Dennis, 2020) during the pandemic. Yet, those who experienced more of those pressure and concerns are more likely to discontinue online teaching in the future. *Effort expectancy* is also a small factor, but much of the emphasis shifts from initial work in converting courses to online formats to maintaining such courses (e.g., the work of reviewing more student activities, more emails, etc.) and upgrading them (e.g., providing time-consuming, high-quality prerecorded lectures) (Fox et al., 2021). The quality of *facilitating conditions* also makes a small difference. Less likelihood of partial or total rejection of the online environment is more likely with good facilitating conditions. See Figure 4.

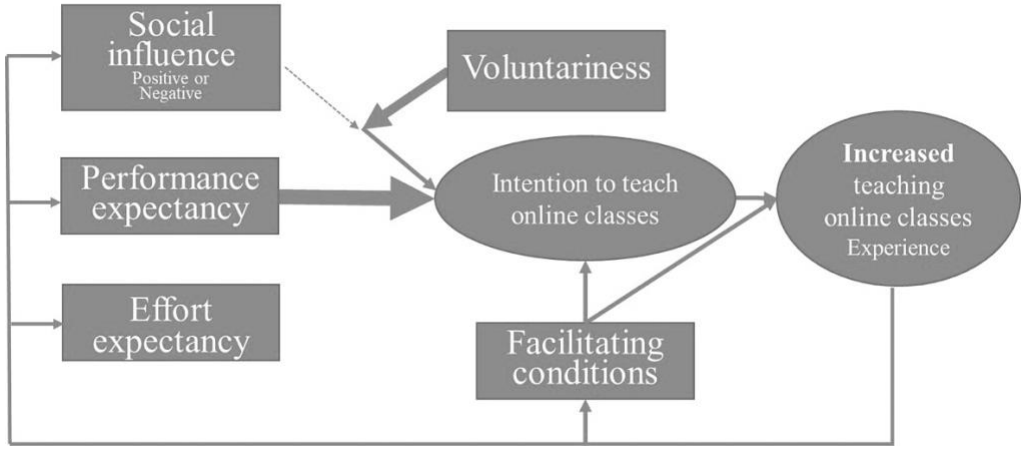
Figure 4
COVID-19 Projected Effect on Online Teaching After *the Pandemic:* Continued *Use*



Significant Factors for those Planning to Increase Pre-pandemic Levels of Online Teaching

After the pandemic, some faculty will adopt online teaching more extensively and tend to do so without social influence—positive or negative. They will do so even if they perceive the effort to be greater than teaching face-to-face (a nearly universal perception). *Facilitating conditions* are of little importance to their adoption decisions, most likely because they have achieved moderate to high levels of perceived success in online settings and have greater confidence levels. Like those planning on resuming previous adoption levels, they will be moderately affected by flexibility and additional income opportunities. *Performance expectancy* will again be the primary factor in driving faculty to make their decisions. However, in those increasing their level of adoption, they will have better perceptions of online courses' actual achievement and perception of even greater capacity, both with experience and over time. Poor or mediocre teaching performance experiences are relatively unlikely to change adoption patterns simply because of exposure, although they may be less actively resistant. Plans to increase online teaching use are primarily due to good performance capability perceptions during the temporary involuntary adoption period. Good support (i.e., facilitating conditions) is a significant if modest, factor in the intent to increase online teaching. See Figure 5.

Figure 5
COVID-19 Projected Effect on Online Teaching After *the Pandemic:* Increased *Use*



Limitations and Conclusion

One limitation occurs whenever a single institutional setting is used. This was partially addressed by conducting a significant Beta test at a separate institution in which similar results were achieved. Yet, the sample's homogenous institutional setting may partly lead to the insignificance of the *Facilitating Condition* factor in the pre-pandemic adoption model. A more substantial limitation is the use of a single survey and asking participants to reflect on past perceptions. In addition, due to the lack of empirical insights into online teaching adoption as well as how historical events affect technological adoption in the literature, the constructs of various independent variables (i.e., the five or six factors) are mainly exploratory and demand more empirical testing and improvement in future research.

In conclusion, institutional responses prior to and during the pandemic will greatly affect post-pandemic faculty intentions (Dennis, 2020; Vincente et al., 2020). That is, mere exposure to increased online teaching modalities is unlikely to alone change faculty patterns substantially under adverse, involuntary conditions. Indeed, bad experiences could make the resistance stronger once voluntariness is reinstated. Institutions that were overwhelmed because of (a) weak online teaching infrastructure, (b) few existing role models across the institution, (c) modest technical and training support resources and inability to boost them during the teaching crisis, (d) poor administrative leadership leading to confusion, and (e) inability to mitigate some of the severity of work conditions are likely to experience the least change in post-pandemic adoption patterns relative to prior pandemic patterns. To remedy these deficiencies, they should look to the standard recommendations in the literature. Qualitative responses in the current study provide a range of recommendations that are found in Appendix 1.

On the other hand, those institutions or programs that already had a strong online teaching infrastructure, numerous models and, therefore, champions in place, and strong technical or training personnel in place, or those who added to them quickly during the pandemic and had a strong administrative plan to support faculty both empathetically as well as tangibly, are most likely to see substantially less resistance, as well as much higher levels of voluntary faculty-based online teaching adoption. It is also likely that institutional patterns and efforts will disproportionately affect long-term trajectories during the pandemic. Efforts to enhance truly voluntary faculty adoption will be far less efficacious after the pandemic when institutions did not rise to the occasion during it.

Declarations

The authors did not receive support from any organization for the submitted work.

The authors have no conflicts of interest to declare that are relevant to the content of this article.

The authors will provide data and material upon request.

The study has been approved by the IRB of the University of North Florida. The participants consented to participate in the study.

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Appendix A

Ways to Enhance Faculty Receptivity to Adoption of Online Teaching Based on the UTAUT Logic Model

Social Influence

- Recognize people for online teaching including online teaching awards
- Design online teaching initiatives at the department and college level
- Implement university, college, and departmental strategic planning to plan and improve online teaching over time
- Ensure that the support of online teaching is a top university priority with visibility of top administrators

Voluntariness

- Provide incentives for training and teaching online courses
- Provide and explain faculty choice among online options
- Ensure that online courses meet student demand
- Conduct student surveys regarding their interest and have faculty evaluate the data

Online Teaching Performance

- Disseminate best practice approaches for various disciplines
- Identify and address concerns of faculty related to online teaching as much as possible
- Provide training regarding the use of active learning approaches in online environments
- Ensure robust training is available for technology used in online teaching

Ease of effort

- Give reassign time for occasional redesign of online class
- Offer reassign time for design of initial class
- Promote group design efforts for frequently shared courses

Facilitating Conditions

- Ensure ample support for ad hoc training
- Ensure ample support for customized (one-on-one) training

Ensure robust just-in-time technology support