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Exploring the effects of sudden institutional coercive pressure on digital transformation in colleges from teachers' perspective

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Abstract

While past technology acceptance studies focus on organization readiness, little is known about the acceptance behavior under sudden institutional coercive pressure. Against COVID-19 and distance teaching, this study explores the relationship between digital transformation readiness, adoption intention, digital transformation success, and sudden institutional coercive pressure based on the readiness research model and institutional theory. Surveying 233 college teachers who participated in distance teaching under COVID-19 in Taiwan for model and hypothesis validation using the partial least square structural equation modeling (PLS-SEM) approach. This result shows that (1) Teacher, social/public, and content readiness are crucial to distance teaching. Individuals, organizational resources, and external stakeholders influence distance teaching success and adoption; and (2) Sudden institutional coercive pressure has a negative moderated effect on teachers' readiness and adoption intention. When teachers are unprepared to implement distance teaching, this unanticipated epidemic and sudden institutional coercive pressure will accelerate and enhance their intention. The study provides government, educational policymakers, and teachers with a better understanding of distance teaching during the COVID-19 pandemic.

Keywords Digital transformation · Distance teaching · Digital transformation readiness · Institutional theory · Sudden institutional coercive pressure

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1 Introduction

The outbreak of novel coronary pneumonia (COVID-19) has caused governments to suddenly implement zero-contact policies to avoid large concentrations of infected individuals, disrupting established systems, industries, and lifestyles worldwide. All industries must use information technology (IT) tools or platforms to maintain basic organizational operations, especially higher education (Crawford et al., 2020; Soto-Acosta, 2020). Most advanced countries, such as the United States, South Korea, and Japan, have temporarily closed educational institutions to implement distance teaching. There has been an increase in sudden institutional coercive pressure on universities to change, resulting in digital transformation in higher education affecting all areas of society (Zawacki-Richter, 2021). Therefore, the success of digital transformation in higher education is crucial (Rof et al., 2022).

Distance teaching has been prepared for 24 years since the Massachusetts Institute of Technology (MIT) proposed a knowledge-sharing plan at the Educational Technology Conference in 1999. Distance teaching symbolizes the transformation of higher education in the digital age. The change in teaching methods, forms, and spaces from the classroom to distance teaching require detailed planning, design, and long-term investment in relevant resources for the entire teaching ecosystem and program push (Hodges et al., 2020). Due to the sudden epidemic, schools are urgently forced to change their teaching plans. Teachers must implement distance teaching in a short time when unprepared for supporting measures and related resources (Daniel, 2020; Iivari et al., 2020). However, the implementation of distance teaching during the epidemic has already reflected that higher education institutions in many countries lag (Nurhas et al., 2021). Although the long-awaited teaching vision has been quickly achieved in the past, the promotion of distance teaching in higher education is still a mile away.

Sudden institutional coercive pressure is the catalyst for digital transformation in the era of the epidemic. Although schools still need to prepare supporting measures and related resources and immediately force the implementation of comprehensive distance teaching due to the pandemic (Iivari et al., 2020). It reflects the institutional environment that forces organizations to adopt IT/systems without supporting measures and readiness, indicating that the adoption of technology and forecasting by organizations are affected by sudden institutional policy from the government. When distance teaching became the only formal education in colleges and universities during the epidemic, many teachers could only implement distance teaching courses with the resources provided by the school. To facilitate successful distance teaching transformation, schools and teachers must ensure that students are willing and ready to learn in online courses (Fidalgo et al., 2020). The critical transformation that occurred due to the pandemic makes it necessary to discuss the effectiveness of distance teaching and the problems that have arisen (Adarkwah, 2021; Almaiah et al., 2020). Thus, the study against the backdrop of COVID-19 and distance teaching explores the organization faced with external factors, such as new technological forecasts and unpredictable new

environments, and the readiness of the organization for digital transformation and resulting transformation success, including (1) pre-epidemic comprehensive assessment of readiness; (2) the impact of sudden institutional coercive pressure during the epidemic; and (3) post-epidemic empirical research investigation of adoption intentions and transformation success. Specifically, three major research objectives were addressed in this study:

1. To investigate the current state of digital transformation in higher education.
2. To explore the relationship between digital transformation in higher education of readiness, adoption, and success.
3. To explore the moderating effects of sudden institutional coercive pressures on the readiness, adoption, and success of digital transformation in higher education based on institutional theory.

2 Literature review

To understand the current research on digital transformation in higher education, we survey digital transformation and distance teaching. We explore the relationship between readiness factors, adoption, and digital transformation success. Then, we examine the sudden institutional coercive pressure extending from institutional theory. A comprehensive literature review is used to develop this research framework and empirical research methodology.

2.1 Digital transformation

Digital transformation is transformational change driven by digital technologies (Hess et al., 2020). It transforms the world market and the entire industrial environment, with impact levels ranging from corporate and industry to nationally competitive levels (Gurbaxani & Dunkle, 2019). It accelerates national and corporate strategies related to digital transformation, such as key digital transformation issues for G20 countries, the digital economy outlook, and plans to go digital. Nearly 90% of business leaders in the US and UK expect IT and digital technologies to contribute to their business operations in the next decade (Hess et al., 2016). It shows that digital transformation is an irreversible development trend.

As the topic of digital transformation continues to heat up, its definition is constantly being reviewed and discussed by the government, industry, and academia. Digital business strategist David L. Rogers argues that digital transformation is not essentially about updating technology but upgrading an organization's strategic thinking (Rogers, 2016). It can be considered a complex IT-enabled transformation, digital innovation, and service innovation (Lundberg et al., 2020). Compared with information technology transformation, digital transformation focuses on applying technology to assist business process reengineering (BPR). Digital transformation disrupts current business thinking and market boundaries, bringing companies disruptive innovation and organizational models. The structure

change also brings a new strategic response and management thinking to companies, an important topic for information systems research (Kutzner et al., 2018).

However, the scope of digital transformation is broad, and the effects of various industry sizes are different (Berghaus & Back, 2016). It is related to the development of corporate strategy and future vision. Some factors may be ignored (Weritz et al., 2020). It is necessary to conduct a long-term investigation to understand the process and achievements of the organization's promotion of digital transformation. Based on the organization's situation, it assists the organization in conducting a comprehensive review to understand its thinking, social system, and the digital transformation relationship between the organizations. It provides organizations genuinely facing digital transformation and designing organizational strategies, operations, and technology applications in response to changes in digital transformation to keep pace with the times (Hess et al., 2020).

2.2 Distance teaching

In 1999, the Massachusetts Institute of Technology (MIT) proposed a knowledge-sharing plan at an educational technology conference, which opened the door to global knowledge dissemination. Not only did educational institutions adopt distance teaching, but enterprises also adopted distance teaching for on-job training. Knowledge learning can occur through digital platforms, and more learners can repeatedly practice without being limited by time and space. Distance teaching is an appropriate educational method compared to traditional teaching, where learners can learn at their own pace with less interaction with peers and tutors (Neroni et al., 2019). Business owners hope employees can continue learning and improving through distance courses to avoid knowledge barriers. Distance teaching can be seen as a milestone in the digital transformation in higher education.

There is a wide range of research on distance teaching, including barriers to distance teaching, sustained adoption, students' perceptions, personal characteristics, and how distance teaching has responded to COVID-19. To understand the status of promoting distance teaching in the world, previous studies have investigated the success or failure of implementing distance teaching in many countries (Rovai & Downey, 2010). For example, from 1999 to 2023, the global effectiveness of distance teaching varies among schools. The current preparation, adoption, and implementation of distance teaching in schools are still being investigated, which shows that the promotion of distance teaching is not as good as expected. A research gap exists due to a need for a formal assessment of the teacher's readiness associated with the abrupt shift to distance instruction caused by the COVID-19 pandemic (Lockee, 2021). This study fulfills this research gap by examining the current status of teacher-distance teaching.

2.3 Digital transformation readiness

Many studies have pointed to complex changes in digital transformation as one of the reasons that organizations need more time to be ready for digital transformation (readiness). Organizational readiness involves the company's internal

structure and operational processes (Gürdür et al., 2019). Organizations with adequate infrastructure, employee expertise, and financial readiness are more likely to adopt digital technologies, and whether the organization has the core organizational capabilities to apply and coordinate to lead the organization to digital transformation success (Lokuge et al., 2019).

Many companies are looking for various methods to increase the possibility of successful digital transformation (Li, 2020). With a pre-transformation resource assessment, the manager can understand the organization's status, relevant people, and technical resources for digital transformation. Industry consultants and researchers have developed relevant metrics given the digital transformation issues. For example, PWC has developed a metric system to rank companies on their digital operational maturity and assess key capabilities for digital transformation in Taiwan's manufacturing industry, assisting companies in reviewing their digital transformation readiness from strategy to organizational process readiness. Recent academic research has also developed related digital transformation issues. Gurbaxani and Dunkle (2019) developed six dimensions of digital transformation to measure the development and implementation of digital transformation in companies. Mittal et al.(2018) developed smart manufacturing maturity levels. Berghaus and Back (2016) developed digital transformation maturity levels and dimensions to examine organizational digital transformation readiness. Rossmann (2018) developed digital maturity scales to examine the digital maturity of companies through eight competencies, including strategic competencies, leadership competencies, market competencies, operational competencies, governance competencies, people and professional skills, cultural competencies, and technological competencies. It shows that the measurement of digital transformation today is no longer only about evaluating technological readiness but also includes other aspects of comprehensive evaluation. The above measurement criteria and indicators provide companies with a perspective on different aspects that can be used as a reference for evaluating the development of digital transformation and the application of new technologies.

Successful higher education transformation is urgent and essential during the COVID-19 pandemic (Rof et al., 2022). We must explore distance teaching and understand the factors that lead to courses not being successfully transferred online (Koçoglu & Tekdal, 2020). Therefore, this study examines the readiness, adoption, and success of digital transformation in higher education using distance teaching and the COVID-19 pandemic as examples. The assessment of teachers' distance teaching readiness can be operationalized as a pre-assessment of teachers' preparedness to develop and implement distance teaching. Scholars have illuminated various dimensions (individual, organization, technology, environment) of readiness (Cutri et al., 2020). Nwagwu (2020) indicated that factors influence teachers to promote distance teaching, including teacher's readiness, public/society readiness, students' readiness, human resources readiness, financial readiness, training readiness, information communication technology (ICT) readiness, and content readiness (Nwagwu, 2020). Thus, this study adopted those factors as distance teaching readiness before COVID-19.

2.4 Institutional theory

The institutional theory, which originated in the mid-twentieth century, found that society has many expectations that guide and regulate individual or organizational behavior, reflecting the sensitivity of organizations to society. DiMaggio and Powell (1983) distinguished institutional pressure into three types of stresses: normative, mimetic, and coercive (DiMaggio & Powell, 1983). Krell et al. (2016) illustrated three institutional pressures based on institutional theory as follows:(1) Normative pressure refers to the institutional definition and promotion of norms in the corporate environment, such as compliance with government agency regulations and companies with laws and regulations. (2) Imitative pressure refers to copying with competitors or complementary have successfully solved similar problems when the company does not have enough information to solve a problem. (3) Coercive pressure refers to regulatory stress and competitive anxiety due to regulators or fear of losing competitive advantage.

Recent research focused on the study of digital innovation and transformation. For example, Hinings et al. (2018) discussed the development of current digital innovation and digital transformation from an institutional perspective. The study notes that digital innovation and transformation have brought about emerging business models, structures, values, and beliefs. It changes the existing game rules in organizations and industries through changes, threats, alternatives, or complementary institutions. Digital transformation includes three types: digital organizational structures (e.g., Airbnb, Uber, GalaxyZoo), digital system architecture (e.g., product platforms, blockchain, Bitcoin), digital system building blocks (e.g., ERP suites, WordPress), impacting how digital transformation of a business gains social acceptance (e.g., legitimacy) and how it interacts with the cooperation between enterprise organization and the existing industrial system. Faik et al.(2020) explored the connection research between technology and social change from the institutional logic perspective, developed a research model of information technology and society with institutional logic, and proposed perception, transformation, and decoupling mechanisms. Information technology has become an element of social change through these mechanisms, benefiting or inhibiting social change. Gupta and Maurya (2022) took MOOCs online teaching as an example and emphasized the impact of external pressure on MOOCs online learning, such as normative, coercion, imitative pressure, social influence, peer influence, and subjective norms. These factors determine the willingness of learners to adopt MOOCs (Gupta & Maurya, 2022). Under the promotion of MOOCs, students may face mandatory pressure from universities or teachers to adopt MOOCs (Gao & Yang, 2015). Recent research shows that institutional theory is extensive, and the relationship between information technology and organizational change has been discussed. In contrast, there has been little theoretical research on the relationship between social changes and adoption.

2.5 Sudden institutional coercive pressure

The COVID-19 pandemic is a metaphorical Black Swan event - a surprising, unpredictable event of great significance and serious consequences that dramatically alters the social environment (Winston, 2020). We face sudden institutional policy from

government, industries, and institutions (Kuckertz et al., 2020). It forces we must do something or change immediately. For instance, the school decided to implement distance teaching in a few days, which brought "sudden institutional coercive pressure" to teachers and students. Sudden institutional coercive pressure can view as a sudden and unpredicted policy that forms forced pressure to change in a few days during the uncontrollable situation. It accelerated the digital process and helped build the foundation for digital transformation (Gabryelczyk, 2020).

External assistance (e.g., incentive mechanisms and regulations) will be critical before, during, and after COVID-19 (Kuckertz et al., 2020). Governments and organizations need to comprehensively understand and develop policies and related incentive mechanisms that allow them to understand the sudden institutional environment factors that drive unpredicted digital transformation and assist the organization in successfully moving forward. If governments succeed in providing immediate relief to the organization under pressure in a way that remains in line with the long-term objectives of "promoting health, equity, and environmental protection", the COVID-19 crisis may even contribute to a better future (Winston, 2020; Wyns, 2020). However, most studies have examined the impact of COVID-19 on issues such as COVID-19 disruption and crisis but have ignored the sudden institutional coercive pressure.

According to the COVID-19 scenario and institutional theory, we extend "coercive pressure" to "sudden institutional coercive pressure". This study fulfills the gap in examining sudden institutional coercive pressure from schools and explores the effect on teachers' readiness to accept distance teaching during the COVID-19 pandemic from the institutional theory perspective.

3 Research methodology

This study reviewed the literature on digital transformation, distance teaching, digital transformation readiness, institutional theory, and sudden institutional coercive pressure and derived a research framework. This study's objects were teachers who were college professors and implemented distance teaching during the epidemic. We used the empirical survey method to test the research model. This method allows a broad quantitative description and analysis of hypotheses and assures enhanced generalizability of the findings.

3.1 Research framework

When distance teaching is fully implemented in schools, there are changes from personal, organizational, technological, and environmental readiness to adoption and success and the sudden institutional coercive pressure of moderation from schools. Therefore, we developed this research framework (see Fig. 1 for details) based on Nwagwu (2020) research. We divided three stages by COVID period. Schools' digital transformation readiness factor of Nwagwu (2020) as a digital transformation readiness as the independent variable in the readiness stage. To explore the degree to

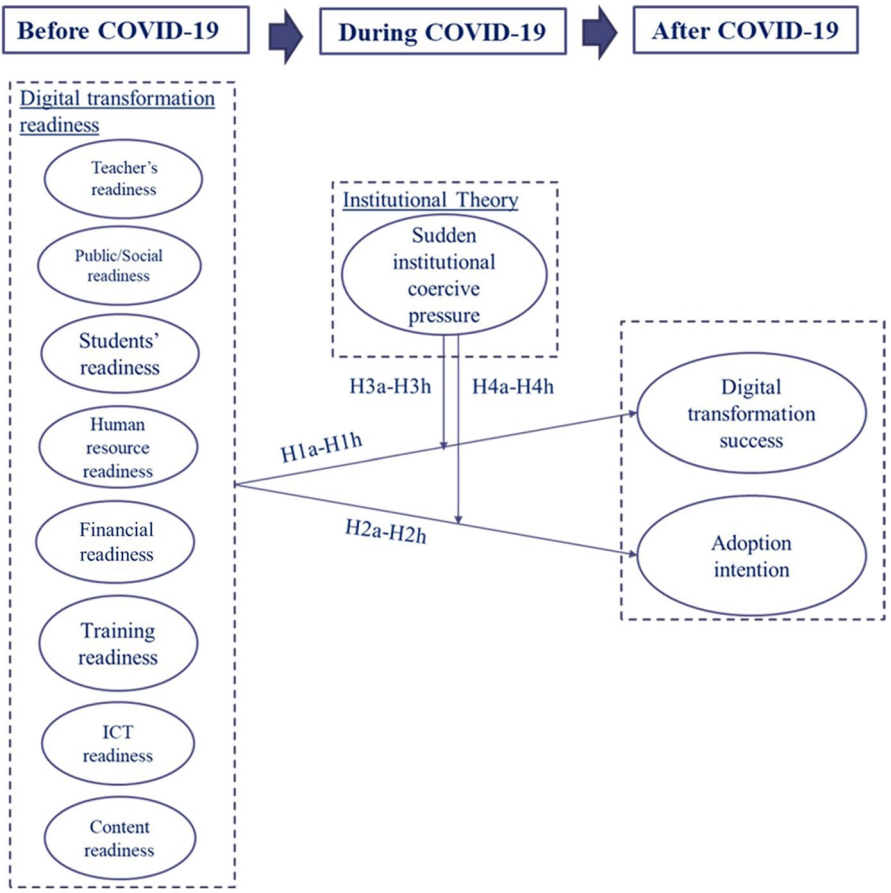

Fig. 1 Research framework

which schools and teachers prepare to distance teaching before COVID-19. Teachers' adoption intention and digital transformation success are dependent variables in the adoption stage. To evaluate the degree to teachers' adoption intention of distance teaching and benefit after COVID-19. Schools' sudden institutional coercive pressure is moderating variable. To examine the degree of sudden institutional coercive pressure from schools that implemented distance teaching during COVID-19.

3.2 Hypothesis development

3.2.1 Digital transformation readiness, adoption and success in distance teaching

The implementation of distance teaching involves stakeholders such as the government, society, students, teachers, and organizations. With the support of government policies, teachers and students have sufficient information skills to conduct

distance teaching (Nwagwu, 2020). Good Internet and hardware and software equipment, learning management system, and digital content materials are required for the course (James & Christian, 2016). Additionally, organizations are more likely to adopt digital technologies because of adequate infrastructure, professional knowledge, and a high degree of readiness for financial support (Gürdür et al., 2019). These complex and interrelated situational factors also determine the success of teachers' distance teaching (Liu et al., 2020). Therefore, we propose the following:

H1a-H1h: Schools' digital transformation readiness will have a significant positive impact on teachers' digital transformation success in distance teaching.
H2a-H2h: Schools' digital transformation readiness will have a significant positive impact on teachers' adoption intention in distance teaching.

3.2.2 Effect of sudden institutional coercive pressure from schools

Effective distance teaching uses the various resources provided by the teaching activity participants (e.g., individuals, organizations, and the environment), which are the key to implementing distance teaching. In preparation for distance instruction, teachers have often spent time assessing possible courses' operational, software, and hardware installation and implementation feasibility (Iglesias-Pradas et al., 2021). The sudden epidemic outbreak has forced schools to take urgent solutions, budgeting for distance teaching and purchasing equipment related to distance teaching. Students use existing computers and mobile devices for learning, and teachers can only rely on ready-made digital tools to facilitate rapid adaptation (Iglesias-Pradas et al., 2021). Preference for teaching tools they already know and use to reduce problems in teaching and reconfigure the curriculum while allowing schools to strengthen their educational systems and prepare for possible future emergencies (Secundo et al., 2021). Therefore, we propose the following:

H3a-H3h: Sudden institutional coercive pressure from schools will have a moderating effect on the relationship between schools' digital transformation readiness and teachers' digital transformation success in distance teaching.
H4a-H4h: Sudden institutional coercive pressure from schools will have a moderating effect on the relationship between schools' digital transformation readiness and teachers' adoption intention in distance teaching.

3.3 Measures

For the measuring items, we refer to Nwagwu (2020), Gao and Yang (2015), Nordin et al. (2015), Al-Emran and Teo (2019), and Al-Fraihat et al. (2020) questionnaire. The questions were modified according to the situation of distance teaching. According to the research hypothesis and scope, this study converts the digital transformation readiness factors, success, adoption intention, and sudden institutional coercive pressure to the operational definition and related measure items into the content of this research questionnaire. This questionnaire is divided into two survey items

according to different research purposes. The first part is the primary data survey, and the second is the survey on readiness, sudden institutional coercive pressure, and performance. The survey on the current situation of teachers' use of distance teaching uses the 5-point Likert scale to represent the respondents' perception of the questions. Scale 1 = strongly disagree, scale 2 = disagree, scale 3 = no opinion, scale 4 = agree, scale 5 = strongly agree, and follow-up factor correlations are discussed by quantifying the data. The operational definitions and measurement questions of the variables in this study are shown in Table 1.

3.4 Data collection and participants

The research analysis is conducted in two stages. In the first stage, experts in the field are invited to examine the questionnaire items to determine the research hypotheses of this research and the content of the questionnaire development. After the questionnaire's content was confirmed, Taiwanese teachers who had received distance teaching were invited to conduct a pilot test. After initial verification of the observed variables, clarity of content, and reliability and validity of the scale, modifications were proposed to improve the questionnaire's face validity and content validity. A formal questionnaire follows the second stage. Sample data was through online questionnaires and collected 6,200 teachers' mail from each university and college website to send our questionnaire. We both adopt simple random and snowball sampling methods to collect data.

3.5 Data analysis method

According to the research purpose and hypothesis and considering the appropriateness of variable measurement scales and statistical analysis tools, this research analysis stage is divided into four stages: descriptive analysis, measurement analysis, structural analysis, and moderating test. This study used IBM SPSS 22 analysis software for descriptive statistical analysis. Smartpls 3.5 analysis software is used for measurement analysis, structural analysis, and moderating test. First, in the description data analysis stage, we explore the respondents' demographic information to understand sample structure and characteristic properties. Second, in the measurement analysis stage, Cronbach's alpha coefficient was used to test whether the measurements were internally consistent. Convergent validity was used to test whether the items were convergent. We determined that all items in this study measured the variables with consistency and maximum explanatory power by eliminating inappropriate observations through reliability and validity tests. Third, in the structural model analysis stage, we test Hypotheses 1a-1h and 2a-2h. The relationship between digital transformation readiness, adoption intention, and digital transformation success. Fourth, verified the moderating effect to test hypotheses 3a-3h and 4a-4h. Sudden institutional coercive pressure moderates the relationship between digital transformation readiness factor, adoption intention, and digital transformation success. To avoid the collinearity of variables (digital transformation readiness factors × sudden institutional coercive pressure). The digital transformation readiness factor, and

Table 1 The conceptualization of the constructs

Construct	Definition	Reference
Teacher's readiness	The degree to which teachers evaluated their ability to prepare for distance teaching before COVID-19	Nwagwu (2020)
Public/society readiness	The degree to which teachers evaluated government and society support for distance teaching before COVID-19	
Students' readiness	The degree to which teachers evaluated students' ability to prepare for distance teaching before COVID-19	
Human resources readiness	The degree to which teachers evaluated school staff's ability to prepare to distance teaching before COVID-19	
Financial readiness	The degree to which teachers evaluated school financial resources to prepare to distance teaching before COVID-19	
Training readiness	The degree to which teachers evaluated school training resources to prepare to distance teaching before COVID-19	
ICT readiness	The degree to which teachers evaluated school ICT resources to prepare to distance teaching before COVID-19	
Content readiness	The degree to which teachers evaluated school multimedia resources to prepare to distance teaching before COVID-19	
Sudden institutional coercive pressure	The degree to which teachers evaluated sudden institutional coercive pressure from school-implemented distance teaching during COVID-19	Gao and Yang (2015); Nordin et al. (2015)
Digital transformation success	The degree to which teachers evaluated the benefit of school-implemented distance teaching after COVID-19	Al-Fraihat et al. (2020)
Adoption intention	The degree to which teachers evaluated their intention to adopt distance teaching after COVID-19	Al-Emran and Teo (2019)

sudden institutional coercive pressure, these two variables were normalized and calculated by standardizing the Z-score effect. If there was a significant moderating effect, the sample was divided into two groups, high and low, based on the mean of the sudden institutional coercive pressure. A two-dimensional interaction diagram was drawn to describe the appearance of the moderating effect.

4 Results and Analysis

The questionnaire distribution period is from May 2021 to January 2022; for 8 months, 6,200 questionnaires were distributed, and 365 teacher samples were recovered. After deducting invalid samples, the number of valid questionnaires was 233, and the effective return rate was 63.84%.

4.1 Sample Characteristics

In the descriptive analysis, in terms of gender, males were the primary respondents (54.9%). Regarding age, the primary respondents in this study were the 51–60 age group (48.07%), while the 41–50 age group was the secondary subject of this study (32.62%). Regarding teaching schools, teachers in private schools were the primary respondents (50.2%). Associate professor-level teachers were the primary respondents (37.34%). Non-part-time teachers were the primary respondents (74.2%), and non-IT background teachers were the primary respondents (68.7%). Regarding the user experience of distance teaching before the epidemic, teachers with no experience using it were the primary respondents (60.5%). During the epidemic, teachers mainly used Google Meet (56%), while Microsoft Teams (42%) was the leading software for distance teaching. The demographic data of the participants are shown in Table 2.

4.2 Analysis of the measurement model

In terms of reliability and convergent validity, this study used the judgment criteria proposed by Hair et al.(2010), considering the reliability of individual observed variables (Individual Item Reliability) and the reliability of latent variables (CR), Cronbach's α, Average Variation Extraction (AVE), and other three indicators, and the validation results are as follows: (1) The reliability of individual observation variables. The factor loadings of all observed variables in the study are more significant than 0.5, indicating that the observed variables in this study have good reliability. (2) Reliability (CR) of latent variables and Cronbach's α: Hair et al. (2010) suggested that the CR value is more significant than 0.6, and if Cronbach's α value coefficient is between 0.35 and 0.7, it is an acceptable reliability value. If it is between 0.7 and 0.98, it is a high-reliability value (Nunnally & Bernstein, 1994). The CR value of the latent variable in this study is between 0.77 and 0.96, all greater than 0.7. Cronbach's α between 0.65 and 0.94, indicating that in this study, the latent variables have good internal consistency. (3) Average Variation Extraction (AVE): The value

Table 2 Demographic information of the respondents

Characteristics	Item	Sample size	%
Gender	Female	105	45.1
	Male	**128**	**54.9**
Age	31 ~ 40 years old	19	8.15
	41 ~ 50 years old	76	32.62
	51 ~ 60 years old	**112**	**48.07**
	Over 60 years old	26	11.16
School institution	Public school	116	49.8
	Private school	**117**	**50.2**
Level	Assistant Professor	70	30.04
	Associate Professor	**87**	**37.34**
	Professor	76	32.62
Concurrent administrative position	Administrator	60	25.8
	Teacher	**173**	**74.2**
ICT-related major	ICT	73	31.3
	non-ICT	**160**	**68.7**
Experiences with distance teaching before COVID-19 pandemic	Have experiences	92	39.5
	No experiences	**141**	**60.5**

Bold entries emphasized the highest percentage of sample features.

of the percentage of latent variables that can be measured by the observed variables, which can not only be used to judge the reliability but also represent the discriminant validity. Fornell and Larcker (1981) suggested that the AVE value greater than 0.5 indicates convergent validity. The AVE values of the latent variables in this study ranged from 0.58 to 0.90, all greater than 0.5, indicating that the potential variables of this study have good convergent validity (see Table 3 for details).

In terms of discriminant validity, Hair et al. (2010) recommend that the root value of the latent variable's mean variation extraction (AVE) should be larger than the correlation coefficient between other variables. The root value of each variable AVE in this study ranges from 0.872 to 0.974. Its value is greater than the correlation coefficient value between the potential variables. It indicates that the potential variables in this study should be significantly different and have good discriminant validity (see Table 4 for details).

4.3 Analysis of the structural model

Smartpls 3.5 was used for structural model analysis and verification in this study. This study used bootstrapping method to construct sufficient sample to represent the population (The teachers at all Taiwan colleges and universities who implemented distance teaching during the epidemic). We set the number of resamples to 500. R^2 of the structural model of digital transformation success was 0.25, and R^2 of the adoption intention was 0.226. The path analysis results show that (1) Teacher's readiness (H1a, $\beta=0.178$,

Table 3 Scale statistics and correlations of the constructs ($N=233$)

Construct	Item	Factor loading	Cronbach's α	CR	AVE
Teacher's Readiness(TR)	3	0.61 ~ 0.92	0.77	0.86	0.69
Public/society Readiness(PR)	3	0.61 ~ 0.90	0.66	0.80	0.58
Students' Readiness(SR)	3	0.77 ~ 0.91	0.83	0.88	0.72
Human Resources Readiness(HR)	2	0.95	0.89	0.95	0.90
Financial Readiness(FR)	3	0.75 ~ 1.00	0.90	0.88	0.71
Training Readiness(TRR)	2	0.91 ~ 0.97	0.89	0.94	0.89
ICT Readiness(ICTR)	3	0.91 ~ 0.97	0.94	0.96	0.89
Content Readiness(CR)	3	0.85 ~ 0.92	0.86	0.91	0.78
Sudden institutional coercive pressure (SCP)	2	0.55 ~ 1	0.65	0.77	0.65
Digital Transformation Success(DTS)	3	0.92 ~ 0.93	0.92	0.95	0.85
Adoption Intention(AI)	3	0.91 ~ 0.95	0.91	0.94	0.85

Table 4 Discriminant validity

Construct	TR	PR	SR	HR	FR	TRR	ICTR	CR	SCP	DTS	AI
TR	**0.910**										
PR	0.262	**0.872**									
SR	0.309	0.523	**0.921**								
HR	0.203	0.398	0.503	**0.974**							
FR	0.18	0.308	0.274	0.576	**0.919**						
TRR	0.295	0.344	0.36	0.601	0.587	**0.943**					
ICTR	0.234	0.216	0.287	0.598	0.608	0.623	**0.972**				
CR	0.363	0.285	0.356	0.617	0.542	0.683	0.717	**0.939**			
SCP	0.096	0.038	-0.01	0.028	0.12	0.13	0.25	0.156	**0.896**		
DTS	0.243	0.239	0.172	0.116	0.083	0.137	0.134	0.213	0.254	**0.961**	
AI	0.232	0.206	0.079	0.053	0.049	0.061	0.065	0.16	0.214	0.797	**0.960**

Bold entries emphasized the root value of AVE.

t-value = 2.889) and content readiness (H1h, β = 0.219, t-value = 1.807) positively and significantly impact digital transformation success. (2) Teacher's readiness (H2a, β = 0.217, t-value = 3.283) and content readiness (H2h, β = 0.269, t-value = 2.185) positively and significantly impact adoption intention, respectively. (3) Public/social readiness (H2b, β = 0.162, t-value = 1.986) positively and significantly impacts teachers' adoption intention. Even if students, financial, human resources, training, and technology are not fully ready, distance teaching solutions can maintain teaching during the epidemic. The result is summarized in Table 5, Figs. 2 and 3.

4.4 Moderation test

This study's moderating effect verification process references Memon et al. (2019). The independent variable was multiplied by moderating variable and standardized to reduce the possibility of collinearity. The resampling was set to 500 to

Table 5 Path analysis results ($N = 233$)

Path			Path coefficients (t-value)	Result
H1a	TR	DTS	0.178**(t-value = 2.889)	Supported
H1b	PR		0.097(t-value = 1.224)	Not supported
H1c	SR		0.074(t-value = 0.882)	Not supported
H1d	HR		-0.010(t-value = 0.102)	Not supported
H1e	FR		0.001(t-value = 0.011)	Not supported
H1f	TRR		-0.095(t-value = 0.91)	Not supported
H1g	ICTR		-0.077(t-value = 0.758)	Not supported
H1h	CR		0.219*(t-value = 1.807)	Supported
H2a	TR	AI	0.217**(t-value = 3.283)	Supported
H2b	PR		0.162*(t-value = 1.986)	Supported
H2c	SR		-0.044(t-value = 0.504)	Not supported
H2d	HR		0.018(t-value = 0.169)	Not supported
H2e	FR		0.006(t-value = 0.054)	Not supported
H2f	TRR		-0.170(t-value = 1.48)	Not supported
H2g	ICTR		-0.131(t-value = 1.221)	Not supported
H2h	CR		0.269*(t-value = 2.185)	Supported

*$p < 0.1$, **$p < 0.01$, ***$p < 0.001$

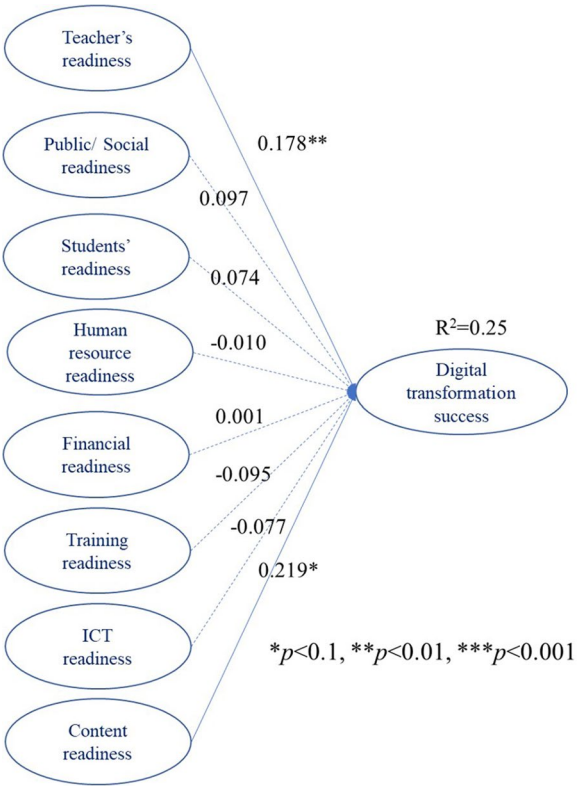

Fig. 2 Path analysis results (Digital transformation readiness→Digital transformation success)

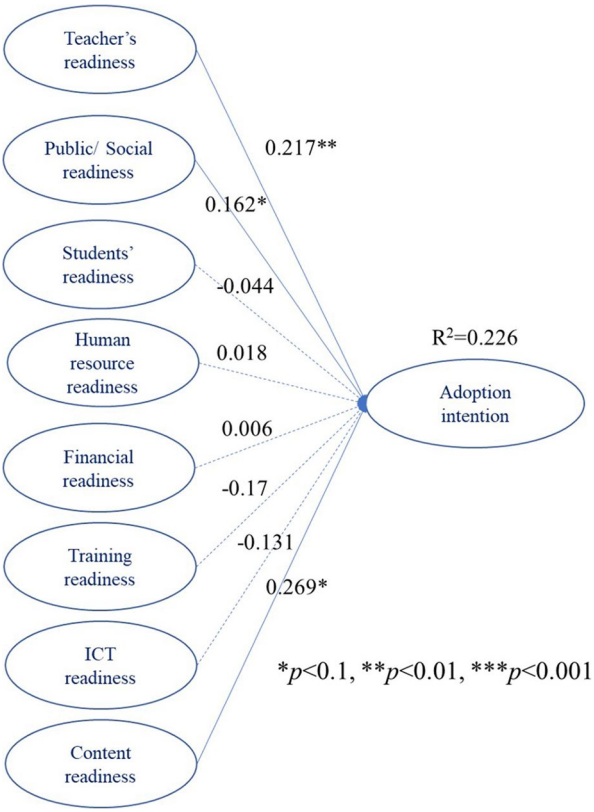

Fig. 3 Path analysis results (Digital transformation readiness→Adoption intention)

verify the moderating effect. Sudden institutional coercive pressure has a moderating effect (negative) on teacher's readiness and adoption intention (H4a, β = -0.191, t-value = 1.664), which can explain the implementation of distance teaching during the epidemic. To explore the form of interaction, we plotted Fig. 4, showing the relationship between the TR and AI for high (HSCP) and low (LSCP) pressure levels. The graph illustrates that when teachers were less prepared for distance teaching, HSCP teachers were more likely to adopt distance teaching than LSCP teachers. Conversely, when teachers were highly prepared for distance teaching, LSCP teachers were more likely to accept distance teaching than HSCP teachers. Even if teachers are not ready to implement distance teaching, the sudden institutional coercive pressure forces them to adopt it (see Table 6 for details).

5 Discussion

This study investigates the status of distance teaching in Taiwan's colleges and universities, explores the readiness, adoption, and success of unpredictable digital transformation, and extends the institutional theory to explore the moderating effects of sudden institutional coercive pressure. The results show that teacher and content readiness significantly

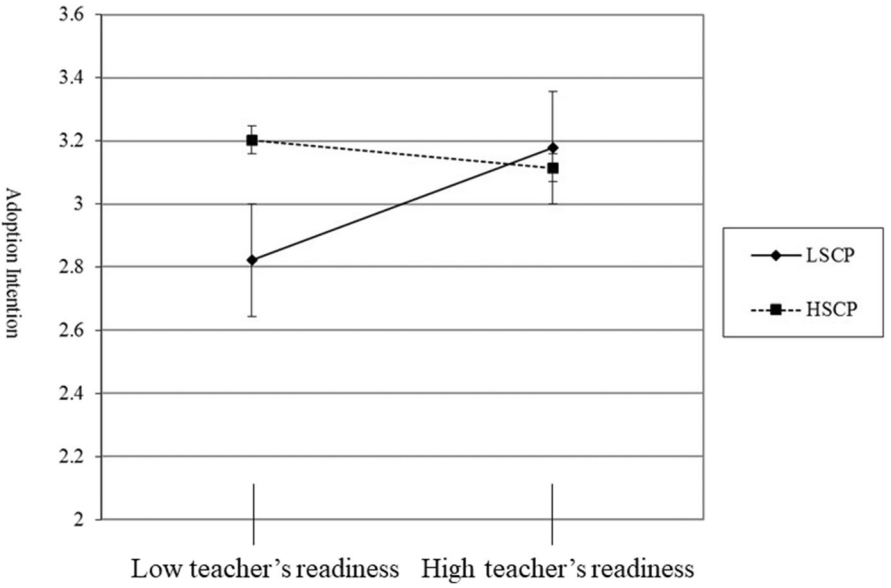

Fig. 4 Sudden institutional coercive pressure (SCP) as a moderator of the relationship between teacher's readiness (TR) and adoption intention (AI)

Table 6 Sudden institutional coercive pressure (SCP) as a moderator of the relationship between digital transformation readiness to digital transformation success and adoption intention ($N = 233$)

Path			Path coefficients (t-value)	Result
H3a	TR	DTS	-0.222(t-value = 1.275)	Not supported
H3b	PR		0.173(t-value = 1.391)	Not supported
H3c	SR		0.055(t-value = 0.524)	Not supported
H3d	HR		-0.007(t-value = 0.061)	Not supported
H3e	FR		-0.144(t-value = 1.166)	Not supported
H3f	TRR		-0.102(t-value = 0.977)	Not supported
H3g	ICTR		0.080(t-value = 0.653)	Not supported
H3h	CR		-0.028(t-value = 0.234)	Not supported
H4a	TR	AI	-0.191*(t-value = 1.664)	Supported
H4b	PR		0.116(t-value = 0.999)	Not supported
H4c	SR		-0.087(t-value = 0.807)	Not supported
H4d	HR		-0.000(t-value = 0.001)	Not supported
H4e	FR		0.175(t-value = 1.323)	Not supported
H4f	TRR		-0.160(t-value = 1.364)	Not supported
H4g	ICTR		0.108(t-value = 0.914)	Not supported
H4h	CR		-0.120(t-value = 0.884)	Not supported

*$p < 0.1$, **$p < 0.01$, ***$p < 0.001$

impact digital transformation success and adoption intention for distance teaching. We also confirm that public/society readiness significantly affects adoption intention, which is congruent with the findings of Nwagwu (2020). With the implementation of distance teaching in Taiwan's universities, we focus on government policies, the public, teachers,

and digital content resources to support the success of distance teaching. Teachers' assessment of distance teaching has expanded from an individual to a situational perspective which responds to Badiozaman (2021) and Scherer et al. (2021) research. Distance teaching activities and processes are complex and require more mental preparation on the part of teachers and related units(Martin et al., 2019). These challenging and related situational factors determine teacher preparation and distance teaching success (Liu et al., 2020). Without the support of relevant resources, it is challenging to demonstrate distance teaching benefits, assistance in teaching, and maintaining high-quality education (Scherer et al., 2021).

Furthermore, we confirm the sudden institutional coercive pressure impact on distance teaching and the COVID-19 scenario. Sudden institutional coercive pressure has a negative moderating effect on teacher's readiness and adoption intention. The main reason is that most teachers are facing the challenges of lacking distance teaching experience and preparation (Bao, 2020). It lets teachers implement distance courses from ready-to-use materials, tools, and expertise in education, even if they do not feel adequately prepared to do so (Hechinger & Lorin, 2020; McMurtrie, 2020). Under the continuous pressure of the epidemic, distance teaching is not ready. It is necessary to adapt and correct it and quickly formulate contingency plans to deal with emergencies on the education platform (Bao, 2020). Distance teaching is more likely to be achieved (Sailer et al., 2021).

6 Conclusion

This study uses distance teaching and COVID-19 as example to explore the readiness, adoption, and success of the unpredictable digital transformation. During the sudden epidemic outbreak, many teachers were forced to carry out distance teaching, and the content of many courses needed to convert to online courses content quickly in a few days. Thus, teachers and course materials are crucial to the adoption and digital transformation success in distance teaching. Teachers tend to use teaching tools they already know to reduce teaching problems. The more pressure the pandemic brings, the more teachers are forced to implement distance teaching. It increases their adoption of distance teaching tools, which invariably add to teachers' distance preparation. However, distance teaching differs from the urgent promotion of distance teaching in the epidemic. We cannot predict when COVID-19 and distance teaching will end. There may be numerous opportunities to implement distance teaching until the epidemic suddenly abates. Therefore, distance teaching needs to be re-normed and redefined to implement better to reduce implementation problems. Schools should assess teacher and curriculum readiness, support teachers in developing appropriate distance teaching content, and provide regular teacher training. It will help teachers be familiar with distance hardware and software operation, design relevant courses according to the distance format, and leverage the sudden epidemic environment to develop standardized distance teaching.

On the other hand, the institutional coercive pressure caused by emergencies that moderates readiness for digital transformation success and willingness to adopt information technology/systems. The sudden effect of the institutional environment makes the organization adopt information technology/system without formulating supporting measures

and preparations. The government policies and standard norms will exert institutional pressure on the organization, making the organization's irrational and coercive adoption not within the expected plan. In past studies on IT/system adoption, the three main paths of technology, organization, and environment were used to understand the adoption, but the sudden institutional pressure brought by the environment has added another new frontier path that affects IT/system readiness to adoption, and the sudden institutional coercive pressure accelerates the digital transformation of education. The information technology/system and the sudden institutional pressure will prompt the organization to rapidly develop a stable and socialized business/service model in an unstable environment.

Compared with previous studies on distance teaching and digital transformation, this study reveals how sudden institutional coercive pressure moderates schools' digital transformation readiness and teachers' adoption intentions. The study shows that sudden institutional coercive pressure has a negative moderating effect on schools' digital transformation readiness and teachers' adoption intention. When a sudden natural or man-made disaster strikes, it will accelerate the organizational digital transformation. Teachers' adoption intention of distance teaching can be enhanced by strengthening the schools' readiness.

6.1 Theoretical implications

This study fulfills research gaps and provides the following academic contributions including (1) Based on digital transformation, readiness, adoption, success, and institutional theory to develop a research framework for the unpredictable digital transformation proposed; (2) The study has added an unexpected institutional perspective to assessing the adoption and success of digital transformation in contrast to previous studies on digital transformation that mostly focused on technology readiness and adoption. This empirical study complements Vial et al.'s (2019) study on unpredictable digital transformation and enhances the debate on digital transformation and institutional theory;(3) This study is based on the epidemic and institutional theory and extends the variables of sudden institutional coercive pressure and examining its moderating effect on adoption and digital transformation success. It enriches the issues and scope of digital transformation and institutional theory; (4) The study provides an empirical analysis of the current state of digital transformation in higher education in Taiwan and confirms the relationship between teachers' readiness for digital transformation and success; (5) This study provides a reference and theoretical basis for the planning and practice of digital transformation strategies in Taiwan's higher education by empirically analyzing the relationship between digital transformation readiness and adoption intention and negatively moderating the relationship between lecture's readiness and adoption intentions, to evaluate the current status and development priorities of higher education's digital transformation through this research framework and scale.

6.2 Managerial implications

COVID-19 has prompted national industries to turn to digital transformation as a solution and strategy. In this study, along with understanding the relationship between readiness,

adoption, and success of digital transformation in higher education in Taiwan, we further examine the impact of the sudden institutional coercive pressure on digital transformation in higher education triggered by the Black Swan incident. This study fulfills research gaps and provides management implications, including (1) Teacher's readiness, social/public readiness, and content readiness positively impact distance teaching adoption and influence digital transition success. Schools clearly understand and evaluate various dimensions of readiness before promoting distance teaching. From the individual perspective, identifying the teachers' readiness, ability, and knowledge to implement distance teaching is critical to successful distance teaching. From the organizational perspective, we suggest ensuring that the digital content resources provided by the school for distance teaching benefit the implementation. From the environmental perspective, the digital transformation in higher education is driven by stakeholders such as the government and society. The government and education industry promoters should focus on promoting distance teaching benefits and formulate relevant incentive policies so that more people can accept distance teaching as a regular practice in the future. (2) The sudden institutional coercive pressure has a significantly negative effect on the teacher's readiness and their adoption intention. This study suggests that organizations should pay attention to the effect of sudden institutional pressure, which can cause forced organizational changes and can be used to prevent unexpected events (black Swan). Nowadays, most organizations use information technology to respond to external environmental turbulence and should enhance organizational readiness, continue to strengthen operational resilience, and design and plan for contingency plans to improve organizational adaptability and overall operational system robustness in emergencies. We recommended that the resilience of the schools' curriculum system be built to defend effectively, respond, and develop against anticipated or unexpected changes or disruptions. The above situation of the school serves as a reference to formulate the policy and operation plan for digital transformation success.

7 Limitation and future work

Given the time limitation, this study can only investigate the readiness, adoption, and success of digital transformation at specific times and the impact of sudden institutional coercive pressure on unpredictable digital transformation in a cross-sectional manner, and it is recommended that related researchers should undertake a long-term and intensive observation and investigation. Further, the study's subjects are teachers. For future research, student perspectives can be added to the teaching activities. Moreover, this study focuses on the validation of the moderating effects of sudden institutional coercive pressure. In addition to sudden institutional coercive pressure, there may be other sudden institutional pressures in other scenarios, such as sudden normative pressure and sudden imitative pressure, that need to be further explored. Further research could be extended to other industries or service industries to compare across industries to enrich the theoretical models' integration and comprehensive implementation.

Appendix

Table 7 Measurement items used in the study

Items	Source
Teacher's readiness	Nwagwu (2020)
1. Before COVID-19, I knew what distance teaching was	
2. Before COVID-19, I was ready for distance teaching	
3. Before COVID-19, I was ready to integrate distance teaching into my teaching	
Public/Social readiness	
1. Before COVID-19, mass media created public awareness of distance teaching	
2. Before COVID-19, the government supported the use of distance teaching in teaching	
3. Before COVID-19, our society was ready for distance teaching	
Students' readiness	
1. Before COVID-19, students knew what distance teaching was	
2. Before COVID-19, students had enough IT skills to use distance teaching technologies	
3. Before COVID-19, students were ready for distance teaching	
Human resource readiness	
1. Before COVID-19, the university IT technicians had sufficient IT competency to support distance teaching	
2. Before COVID-19, the university had enough technicians to support distance teaching	
Financial readiness	
1. Before COVID-19, the university had a budget for distance teaching	
2. Before COVID-19, the university was willing to buy a computers for distance teaching purposes	
3. Before COVID-19, the university was willing to spend extra money on distance teaching	
Training readiness	
1. Before COVID-19, the university provided the right training opportunities for distance teaching	
2. Before COVID-19, the university provided enough training opportunities for distance teaching	
ICT readiness	
1. Before COVID-19, the university computer equipment and network facilities were stable and could carry out distance teaching smoothly	
2. Before COVID-19, the university had good IT infrastructure maintenance	
3. Before COVID-19, the IT infrastructure in my university could support distance teaching well	
Content readiness	
1. Before COVID-19, materials prepared by the university were useful for my teaching	
2. Before COVID-19, materials prepared by the university for distance teaching were available	
3. Before COVID-19, the university provided a variety of distance teaching materials for me to choose from	

Table 7 (continued)

Items	Source
Sudden institutional coercive pressure	Gao and Yang (2015), Nordin et al. (2015)
1. The sudden outbreak of the new coronary pneumonia generated coercive pressure to force schools to use distance teaching tools (e.g., Webex, Zoom, Teams, and so on.) for in-school courses	
2. The sudden outbreak of the new coronary pneumonia generated coercive pressure to force schools to use distance teaching tools (e.g., Webex, Zoom, Teams, and so on.) that can successfully teach many school programs	
Digital transformation success	Al-Fraihat et al. (2020)
1. After COVID-19, distance teaching has been very effective and has helped me to improve my teaching process	
2. After COVID-19, distance teaching tools have helped me to use distance teaching successfully	
3. After COVID-19, distance teaching has helped me to achieve my teaching goals	
Adoption intention	Al-Emran and Teo (2019)
1. After COVID-19, I think using distance teaching is a good idea	
2. After COVID-19, I would like to use more distance teaching	
3. After COVID-19, I prefer to use distance teaching in the future	

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Data availability The datasets generated and analyzed during the current study are not publicly available due to large-scale personal privacy information related to teachers but are available from the corresponding author upon reasonable request.

Declarations

Conflict of interests Not applicable

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