



# Modeling the factors that influence schoolteachers' work engagement and continuance intention when teaching online

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## Abstract

Providing online instruction has become a normal part in primary and secondary education. The teachers' work engagement and intention are critical to the sustenance of high-quality online teaching. Therefore, this mixed-methods study proposed and validated a theoretical model from the perspective of the Job Demands-Resources Model to shed light on what drives teachers' online teaching work engagement and its consequent effect on continuance intention. The partial least squares structural equation was applied to 1066 primary and secondary school teachers' valid self-reported questionnaires to examine the proposed model. We found that it is the perceived usefulness of technology, rather than the ease of use, that affects teachers' online teaching engagement and intention; institutional support has the most influence on sustaining teachers' online teaching; urban teachers focus more on the perceived usefulness of technology, while rural teachers are concerned with their online teaching readiness. The follow-up qualitative research further yielded three major themes, including the availability of technical equipment and guidance constitutes teachers' online teaching basic needs, teachers emphasize the institutional support from parent, and teachers are not troubled by the use of technology but focus on its functions. These themes provided rich details and in-depth knowledge regarding the key aspects that influence teachers' online teaching work engagement and continuance intention in quantitative study. This study extends our understanding of the theory of work engagement in the context of online education and provides practical guidance for online teaching instruction in primary and secondary education.

**Keywords** Online teaching · Work engagement · Continuance intention · The JD-R model

## Abbreviations

COVID-19      Corona Virus Disease 2019  
The JD-R model      The Job Demands-Resources Model

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MGA	Multigroup analysis
HTMT	Heterotrait–Monotrait ratio of correlations
PLS-SEM	Partial Least Squares Structural Equation Modelling
CR	Composite reliability
AVE	Average variance extracted
ICTs	Information and communication technologies

## 1 Introduction

In recent years, there has been an increasing trend of integrating technology into education. The COVID-19 pandemic has further created an unprecedented need for education to embrace information technology (Sofi-Karim et al., 2023), which has left a long-term impact on numerous facets of schooling (Reuge et al., 2021). For primary and secondary schools in many regions, compared to higher education, online education was rarely implemented as regular schooling before the COVID-19 pandemic (Martin et al., 2022; Nikolopoulou & Kousloglou, 2022). And most previous studies of online education were conducted in higher education (Chiu, 2021). Nowadays, few people will deny that primary and secondary education is on the path of incorporating online teaching in the teaching routine in order to flexibly adapt to various future situations (Adedoyin & Soykan, 2020; Wang et al., 2022). Therefore, the online teaching in primary and secondary schools should be given full attention. Teachers as the main driver of the educational process (Alhumaid et al., 2020) are forced to swiftly cope with the new mode of delivery (Lim, 2022). However, little is known regarding teachers' psychological state when teaching online, and whether they have the intention to continue teaching online (Khong et al., 2022).

Work engagement has recently emerged as an important element that reflects individuals' positive psychological state (Schaufeli, 2017). An engaged teacher is one who intrinsically motivates themselves to take advantage of teacher-related opportunities, absorb teaching, and effectively tackle teaching challenges to boost their willingness to continue the work (Burić & Macuka, 2017; Chen, 2017). So, in order to sustain online teaching intention, the most significant task is motivating primary and secondary teachers to engage in online teaching.

According to the Job Demands-Resources Model (the JD-R model), job resources and personal resources can be considered the chief factors that determine teachers' work engagement across a range of situations (Bakker & Demerouti, 2008, 2017; Collie et al., 2018; Schaufeli, 2017). And the job and personal resources are most beneficial in maintaining work engagement under conditions of high job demands (Bakker, 2011). As mentioned previously, the sudden COVID-19 pandemic has forced a shift to online teaching and learning in schools across the globe, requiring teachers to adapt their teaching in a very short time (Scherer et al., 2021). However, it has been widely reported that teachers faced various challenges regarding gain access and become familiar with new technologies (Adedoyin & Soykan, 2020; Crompton et al., 2021; Lim, 2022). In such circumstances, this shift constituted high job demands for teachers, which makes the role of personal and job resources more obvious in supporting teachers' online teaching. However, few researchers have used

this claim to explain teachers' psychological state in the online teaching context. Research is needed to corroborate the preliminary understanding that how job and personal resources intertwined with the foremost technology characters to support teachers engaging in their online work and the consequent effect on continuance intention.

Moreover, the existing literature has considered that online teaching has the potential to narrow the educational gaps between urban and rural regions (Hohlfeld et al., 2017; Khan et al., 2018; Robinson, 2008). It is clearly that online teaching greatly depends on the supporting of digital technology resources. However, in many regions, discrepancies exist between urban and rural education with regard to accessing and utilizing digital technology, social resources, and personal resources (Gu, 2021). This makes online teaching potentially exacerbate urban–rural education inequity. Consequently, it is essential to investigate whether the factors that impact teachers' online teaching work engagement and continuance intention have comparable efficacy due to urban–rural educational variations. By doing so, we can further support for multilevel appropriate initiatives to facilitate equal benefits from online teaching across rural and urban teachers.

In light of the above information, the current study conducted a mixed-methods design (Creswell & Clark, 2017) to provide a more thorough understanding of how primary and secondary school teachers' online teaching work engagement is stimulated and its consequent effect on continuance intention. In the quantitative study, the theoretical model was proposed and validated with a larger sample by employing partial least squares structural equation modeling, and using the multigroup analysis (MGA) method to reveal significant and meaningful differences in the relationships defined by the model across urban and rural primary and secondary school teachers. Based on the key findings identified in the quantitative study, a follow-up qualitative study was conducted through interviews to further explain in more depth. Specific objectives of the mixed-methods study are: (1) to explore the factors that impact primary and secondary school teachers' online teaching work engagement and continuance intention from the perspective of the JD-R model; (2) to investigate the differences impact effects of these factors from the perspective of urban–rural comparisons.

## 2 Theoretical background and hypotheses

### 2.1 Work engagement and the JD-R model

Work engagement is recognised as a positive work-related state that includes multi-dimensional notions of vigour, dedication, and absorption in the workplace (Burić & Macuka, 2017; Schaufeli et al., 2002). Specifically, work engagement refers to someone's persistent and pervasive focus on any particular object, event, individual, or behaviour (Moreira-Fontán et al., 2019), which shows a high level of energy, strong dedication, and fully concentrated with work (Bakker et al., 2008).

The JD-R model originally assumed that engagement resulted from a balance between positive (resources) and negative (demands) job characteristics

(Schaufeli & Taris, 2014). Job resources for teachers are physical, social, or organisational support that may reduce job demands (e.g., physiological and psychological costs) and aid in sustained engaged work (Bakker, 2011; Bakker & Demerouti, 2007; Chen, 2017). Later, the JD-R model was extended to include personal resources (Bakker et al., 2006; Christian et al., 2011). Personal resources refer to an individual's positive perception of their ability to control and impact the environment successfully (Hobfoll et al., 2003), which emphasises the intrinsically motivational process of promoting engagement (Bakker & Demerouti, 2017). The job demand has been the component of the JD-R model. However, considering that the context of this study was a sudden arrival of online teaching. The obvious characteristic of this context was that it brought a high level of job demand for teachers, as most teachers were not prepared to deal with online teaching. Therefore, the job demand in this study was not specifically considered as an influencing factor. In addition, we are more inclined to explore the conditions or drivers that promote teachers' online teaching work engagement.

To conduct online teaching, teachers need to combine job resources and personal resources. Job resources such as technical tools and organizational aspects of the context. Personal resources such as self-efficacy toward technology usage (Moreira-Fontán et al., 2019). As a result, the job resources and personal resources are intertwined with technology characters. It is therefore concluded that the combined configuration of personal, institutional, and technological factors can provide a better explanation for the variance in teacher engagement than any of them individually (Whiteoak, 2020; Zou et al., 2021). These rationalistic claims can be employed as the underlying theoretical perspective for this study to identify the factors and their relationships with regard to achieving primary and secondary school teachers' online teaching engagement and enhancing continuance intention.

## 2.2 Institutional support

After analysing previous empirical research findings, Hew and Brush (2007) explained that institution was one of the most frequently foundational conditions, which appeared to directly affect the adequacy of teachers' knowledge, skills, and attitudes toward technology use. The appropriate facilities for instruction and adequate support from administrations, schools, colleagues, and parents create a supportive environment for teachers' implementation of technology in teaching, which is in accordance with the definition of institutional support (Henkin & Holliman, 2009). Previous studies have also proven that institutional support as a noticeable job resource that was positively correlated to work engagement (Bakker & Demerouti, 2008, 2017; Robson, 2018). Institutional support can sustain the availability of high-quality technology and its use (Potyrala et al., 2021). The barriers in accessing technology and supports for its use will undermine teachers' positive beliefs and attitudes toward technology integration (An et al., 2021). Based on the foregoing discussion, we propose the first hypothesis as follows:

H1: Institutional support will positively affect teachers' online teaching work engagement.

### 2.3 Teachers' readiness

Lacking of familiarity with technological knowledge and skills may become a barrier to the actual application of technology innovations (Hew & Brush, 2007), which will further cause stressful and time-consuming for teachers when teaching online (Khlaif et al., 2023). Teachers need to have a good command of technological knowledge and skills when planning and implementing effective teaching online (Crompton et al., 2021). Therefore, teachers' readiness is a prominent personal characteristic that should be included in this study. Readiness can be defined as "the state of faculty preparation", representing a multifaceted aspect, including a mixture of attitude and experience (Martin et al., 2019). Teachers' readiness to use technology is explored in relation to perceptions of confidence to teach with technology (Scherer et al., 2021) and willingness to engage in change in teaching (Kukulska-Hulme, 2012). Consequently, when exhibiting high readiness, teachers may be qualified to meet challenges posed by online teaching and demonstrate higher online teaching work engagement. However, in the context of primary and secondary teachers' online teaching, there is insufficient empirical evidence to show that teachers' readiness is a significant predictor of their intention to continue. It is also notable that recent literature has explored institutional support's impact on personal resources based on a variety of evidence and confirmed that institutional support is a strong positive predictor of teachers' readiness (Almusawi et al., 2021; Krishnan et al., 2020; Scherer et al., 2023). Consequently, we believe that further investigation of the relationship between institutional support and teachers' readiness will lead to more systematic and comprehensive understanding of teachers' work engagement. Based on these findings, we propose the following hypotheses:

H2: Teachers' readiness positively predicts online teaching work engagement.

H3: Institutional support positively predicts teachers' readiness.

### 2.4 The technical characters: task-technology fit, perceived ease of use, and perceived usefulness

Earlier studies reported that the technology adoption model (TAM), as a well-established model describing individual-level technology acceptance featured by two technical constructs: perceived ease of use that reflects the people's internal perceptions of using technology would be free of effort, which is vital for perceived usefulness (Davis, 1989); and perceived usefulness that is a construct that relatively robust in explaining the enhanced performance (Venkatesh & Davis, 2000; Yen et al., 2010). Some researchers have argued that technology acceptance as a resource can increase employees' work engagement by fostering the motivational process (Shamsi et al., 2021). The perceived ease of use and usefulness can be defined as one's perceived belief (Yao et al., 2022) that

technology may contribute to teacher teaching and achievements (Davis, 1989; Lu et al., 2019). Therefore, it is expected that perceived technology usefulness and ease of use promote teachers' online teaching work engagement.

Information systems researchers have noted that individuals may adopt a particular technology not only because of their own personal persuasions but also because of the views of some external variables (Abdullah & Ward, 2016). Factors related to institutional support have appeared in several models of user acceptance of information communication technology (Alkis et al., 2014; Al-Nuaimi & Al-Emran, 2021), and empirically, it has received strong support as an antecedent of perceived technology ease of use and usefulness (Lu et al., 2019). Tondeur et al. (2019) has further confirmed that institutional support can motivate teachers to adopt new teaching approaches with technology. This implies that institutional support entails teachers' perceived technology ease of use and usefulness. Based on these findings, we propose the following hypotheses:

- H4: Perceived ease of use has a positive influence on perceived usefulness.
- H5: Perceived ease of use has a positive effect on teachers' online teaching work engagement.
- H6: Perceived usefulness has a positive effect on teachers' online teaching work engagement.
- H7: Institutional support has a positive effect on perceived ease of use.
- H8: Institutional support has a positive effect on perceived usefulness.

Furthermore, it is necessary for teachers to incorporate task-oriented actions into their schemes of work. The technology functions that support tasks for teaching staff are of particular importance (Marchlik et al., 2021). It means that we must consider not only individual interactions with the technical system but also task-oriented actions related to that technical system (Wu & Chen, 2017). The task–technology fit is defined as how the capabilities of technology match a particular task (Goodhue et al., 2000). Researchers suggested that technological functionalities should have an appropriate fit with users' tasks demanded, because it will lead to benefits such as improve performance (McGill & Klobas, 2009; Wu & Chen, 2017; Zigurs & Khazanchi, 2008). The literatures show that engaged employees are often individuals with higher job performance (Schaufeli, 2012; Shamsi et al., 2021). Meanwhile, many empirical studies have confirmed that the task–technology fit can be the basis for forming perceptions of usefulness and ease of use (Kim & Song, 2022; Klopping & McKinney, 2004; Wu & Chen, 2017; Yen et al., 2010). Therefore, three hypotheses were developed:

- H9: Task-technology fit has a positive influence on perceived ease of use.
- H10: Task-technology fit has a positive influence on perceived usefulness.
- H11: Task-technology fit has a positive effect on teachers' online teaching work engagement.

## 2.5 Continuance intention

Teachers' online teaching continuance intention is another essential construct as it determines the eventual success use of information technology in education (Bhattacharjee, 2001) and is essential for the ongoing digital transformation of education (Zhou & Song, 2022). Various theoretical frameworks are utilized to study the relationships between these variables. The most popular ones are the TAM and its expansions. The major premise of these models is that perceived technology usefulness is significantly related to continuous intention (Al-Nuaimi & Al-Emran, 2021). Additionally, better conditions of continuance intention, such as engagement, were identified, emphasising the need to incorporate more variables. As previously mentioned, research informed us that engagement is more likely to be motivated to carry out further persistence (Chen, 2017). Although teachers' engagement has been applied to explain continuance intention, hardly any attempts have been made in its quantification. The relationship between teachers' online teaching readiness and continuance intention is also investigated, as teachers are required well prepared on the way to shift to online teaching across the globe. Results from previous studies have revealed that readiness is a significant predictor of intentions toward the use of technologies (Al-Furaih & Al-Awidi, 2020; Durst et al., 2023). Based on these findings, we propose the following hypotheses:

H12: Perceived usefulness positively predicts teachers' online teaching continuance intention.

H13: Teachers' work engagement positively predicts their online teaching continuance intention.

H14: Teachers' readiness positively predicts teachers' online teaching continuance intention.

Drawing on the pieces of evidence reviewed, the relationships between these constructs are integrated into the conceptual model depicted in Fig. 1. The perpetuating rural–urban divide makes rural schools and urban schools varied in terms of reliable infrastructures, adequate technological facilities, teachers' technologies skills or knowledge, technological utilization, and passion for technology (Li & Ranieri, 2013; P.-Y. Wang, 2013; Yang et al., 2018). We speculate that relationships between the research variables may be slightly different with the

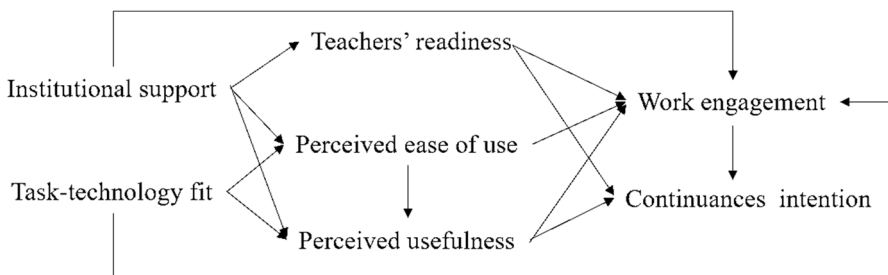


Fig. 1 Proposed research model

unequal educational circumstantial quality between rural and urban education systems. The relationships between the variables toward urban and rural teachers are further compared and discussed concretely.

### 3 Method

To enable triangulation and meaningful interpretation of the empirical data, this study employed a mixed-methods research design to collect both quantitative and qualitative data. Researchers collected quantitative data in the form of questionnaire, supplemented by qualitative data in the form of semi-structure interviews to provide more information to support or explain the quantitative findings. The interviews allowed participants to expand on their thoughts and personal experiences as well as for the interviewer to probe further on certain points raised by participants. The quantitative and qualitative data were merged during data interpretation to gain a deeper understanding of how primary and secondary school teachers' online teaching work engagement is simulated and its consequent effect on continuance intention.

#### 3.1 Context

The research was conducted in Hubei Province, an inner province located in central China. We selected this province for two reasons. Firstly, this region was the first to implement online teaching, and its teachers have gained extensive experience over time, which could enhance the explanatory power of the collected data. Secondly, educational resources in this province are unevenly distributed as it boasts a vast territory that encompasses both impoverished areas and booming cities, offering us an opportunity to investigate the disparity in online teaching between urban and rural areas. All school types were represented, including not only teaching sites and primary schools in rural but also primary and secondary schools in urban.

#### 3.2 Quantitative phase

##### 3.2.1 Participants

We recruited participants through an online survey website. The survey link was sent to the school teachers, and study participation was voluntary. Of the 2106 teachers approached, 1066 (50.6%) returned a valid questionnaire. Among the valid responses, 824 (77.3%) were from female teachers, and 242 (22.7%) were from male teachers. Urban and rural teachers accounted for 60.7% and 39.3% of the sample, respectively. Primary school and secondary school teachers were 59.8% and 40.2% respectively. These distributions reflected the typical characteristics of the overall teacher structure in China's primary and secondary education, featured by the unequal gender ratio among teachers and the gradual reduction in the number of rural teachers (Ministry of Education of the People's Republic of China, 2021, 2022).



### 3.2.2 Questionnaire

Except for the demographic information of participants, the questionnaire used in the quantitative study included measurement of seven research variables that originated from the existing reliability and widely recognized instruments. Teacher work engagement was evaluated with the Utrecht Work Engagement Scale (Schaufeli et al., 2006). The scale includes three subscales (including vigour, dedication, and absorption), each of which has three items. The scale is a shortened version of the original 17-item Utrecht Work Engagement Scale, which has been widely accepted and has high reliability. Reliability coefficients were determined to be high for each subscale of this scale, ranging from 0.85 to 0.92 across 10 countries. Regarding continuance intention, we adopted items from Liaw (2008). To perform a more detailed estimation, another two items were added, including statements of ‘I intend to use information technology to assist my teaching assessment’ and ‘I intend to take online teaching as a regular teaching way’. The perceived ease of use and perceived usefulness were measured based on the work of Davis (1989). Considering we focus on how technological tools improve teachers’ teaching rather than the speed of task completion, the item “Using X in my job would enable me to accomplish tasks more quickly” was not included. Therefore, six items of perceived ease of use and five items of perceived usefulness were selected for this study. Task–technology fit was measured with four items from Wu and Chen (2017). For assessing institutional support and readiness, the first section of the Teacher Technology Questionnaire (Lowther et al., 2004) was applied. The measurement of institutional support consisted of two subscales of overall support for technology and technical support.

The questionnaire was initially constructed in English and then translated into Chinese by two researchers of the team to ensure comprehension for teachers. All the items were measured with a five-point Likert-type scale, ranging from 1 for strongly disagree to 5 for strongly agree. The content of the questionnaire and the research protocol were inspected and endorsed by the ethics committee of the Department of Psychology, Central China Normal University. An overview of the questionnaire and their constituting items can be found in Appendix 1.

### 3.2.3 Data analysis

Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to verify the proposed model by making use of the software Smart PLS 3. The use of the PLS technique was justified where the theory is insufficiently grounded and the variables do not conform to a rigorously specified measurement model or fit a certain distribution (Fornell & Bookstein, 1982). First, the reliability and validity of different model variables were assessed to confirm the quality of the outer model. Second, the relationships within the inner model were assessed by testing their significance. Finally, we used the function of multigroup analysis to assess if there is a significant difference between urban teachers’ and rural teachers’ path coefficients.

### 3.3 Qualitative phase

#### 3.3.1 Research design and informants

The research design of the qualitative phase was informed by the case study methodology as described by Yin (2009), as it has been commonly used to investigate a social phenomenon in naturalistic contexts through in-depth examination of the critical incidents or selected informants. In this study, we considered online teaching as the phenomenon of interest and carefully selected 18 teachers as our informants for in-depth semi-structured interviews. The interviews took place remotely, and the informants' responses were recorded using the platform recording software with their permission. The duration of each interview was approximately 40 min. The interview questions were designed to collect teachers' experiences, attitudes, and concerned factors during online teaching, as can be seen in Appendix 2.

Several measures were taken to ensure the trustworthiness and transferability of qualitative results as suggested by Lincoln and Guba (1985). First, we cross examined data from multiple sources to achieve data triangulation: a total of 18 teachers who taught different subjects (mainly Chinese language, mathematics, music, art, and information technology courses) in seven different schools (X primary schools and Y secondary schools, X rural schools and Z urban schools) were purposefully selected for cross verification. Second, we actively seek contradictive evidence such as disagreeing voices and anomalies to avoid subjective bias or *cherry-picking* of data. Lastly, we continued to collect data from interviews until data saturation was reached to ensure the collected data have captured the diversity, depth, and nuances of the phenomenon studied (Francis et al., 2010; Glaser & Strauss, 2017).

### 3.4 Data analysis

After reviewing all transcripts, transcriptions were then divided into units of analysis ('quotations') that consisted of discrete ideas expressed by the participants. The data was coded line by line with an open attitude toward all possible directions (Charmaz, 2006). Subsequently, the initial codes were further analysed to find out the most significant and frequent codes to generate some more general categories or themes (Merriam & Tisdell, 2015). We borrowed several coding techniques such as initial coding and focused coding from the grounded theory approach. We used the qualitative data analysis (QDA) software, NVivo version 11, to organize source data and codes, and enable extraction of data into categories, sub-themes, and main themes. The coding process was conducted by two researchers independently. According to Raskind et al. (2019), such method could meet to resolve discrepancies. And then the disputed themes were negotiated through going back and forth between data and codes until a consensus was reached, which requires researchers constantly interact with data to be aware of the dynamic nature of the data and its thematic connectivity. This is a defined and rigorous procedure commonly used by researchers in order conform with validity and reliability standards associated with qualitative research (Williams & Moser, 2019). The main coding techniques used in this study, as profiled by Saldaña (2013), are elaborated in Table 1. These coding

**Table 1** Definitions, operations, and examples of the coding techniques used in this study

Technique	Definition	Operation	Example Codes
Structural Coding	Preexisting concepts applied to data to address specific research questions	It consists of a list of preconceived theoretical constructs such as benefits, problems, inner states, and technical usage experience	TEACHER-STUDENT RELATIONSHIP, PSYCHOLOGICAL STATE, TECHNICAL, ISSUES
In Vivo Coding	Verbatim phrases in participants' own language with symbolic meanings	Indigenous terms were extracted from interviews to valorize the voices and experiences of teachers	"SISTER IN NEED", "THE CLASS WAS TIRING AND EMPTY", "EXPERT", "BABYSITTER"
Versus Coding	Dichotomous codes that suggest strong conflicts or mutually exclusive divisions	It emphasizes the incongruency of teachers' expectations and reality regarding the gap between the resources and capabilities required to handle stress and the resources and capabilities teachers can access	UTILITY VS. USABILITY, EXPECTATION VS REALITY, INPUT VS. EFFECT
Evaluation Coding	Codes that assign judgments about merit, worth, or significance of programs or policies	Derived from interviews, it assesses the pros and cons of online teaching initiatives, and makes recommendations for change	ONLINE INTERACTION (+ ENGAGEMENT, - INEFFICIENT), REC (recommendation): ENHANCE THE REAL-TIME INTERACTION

techniques could allow us to further access participants' beliefs and conflicts about the online teaching programs and organization, prioritize the participants' voice to form the indigenous understandings, and extract the content or conceptual phrases that closely related to the quantitative research findings.

## 4 Results

### 4.1 Quantitative results

#### 4.1.1 Outer model assessment

The outer model describes the association between constructs and their indicators. Convergent validity and discriminant validity of the outer model need to be assessed to ascertain the goodness of fit of the outer model (Garson, 2016). Table 2 illustrated that all reflective indicators have loadings higher than 0.70 (Hair et al., 2021), which confirmed the reliability. In testing the internal consistency of measures, results show that the Cronbach's alpha values of each scale ranged between 0.887 and 0.970, higher than the recommended level of 0.7 (Hair et al., 2019). Further, the composite reliability (CR) of all constructs ranged from 0.919 to 0.974, exceeding the recommended cut-off value of 0.60 (Hair et al., 2021), which indicated that the items of each construct had better internal consistency. Average variance extracted (AVE) values were greater than 0.60, meeting the recommended value of 0.50 (Hair et al., 2021). The square root of the AVE of each latent construct was higher than the correlations with other latent constructs based on the Fornell–Larcker criterion. The results indicated that the convergence validity was acceptable.

Following Hair et al. (2021), who suggested that the Heterotrait–Monotrait ratio of correlations (HTMT) gives more accurate results of discriminant validity, this study used this ratio to assess discriminant validity. The results in Table 3 showed that all the HTMT values were under 0.85 (Hair et al., 2021), which indicated that the constructs were truly distinct from one another and the discriminant validity was adequate in this study.

#### 4.1.2 Inner model assessment

Once the construct measures were confirmed to be reliable and valid, the results of the inner research model were to be evaluated. The direct path coefficients of the initial structural model, as well as their significance and the R-squared ( $R^2$ ) value for each endogenous variable, were summarised in Table 3 and Fig. 2. According to Table 2, the participants had generally positive feelings about their online teaching experiences, with ratings of all aspects (from 3.090 to 3.522) above the neutral point on a five-point Likert scale. However, when compared to other factors, the rating of perceived usefulness (Mean = 3.090) appeared to be low.

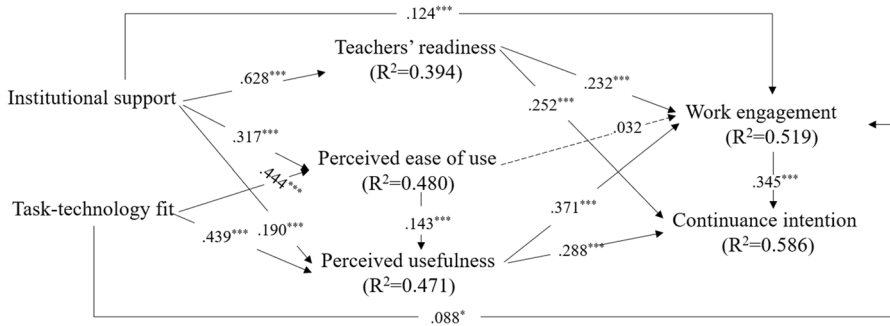
**Table 2** The reliability and convergence validity of the outer model

	Factor loading	Cronbach's $\alpha$	CR	AVE	IS	TTF	RE	PEU	PU	UWES	BI
IS	0.805–0.878	0.890	0.919	0.694	<b>0.833</b>						
TTF	0.807–0.887	0.892	0.925	0.757	0.652	<b>0.870</b>					
RE	0.805–0.907	0.947	0.958	0.790	0.628	0.602	<b>0.889</b>				
PEU	0.873–0.909	0.935	0.950	0.793	0.606	0.650	0.716	<b>0.890</b>			
PU	0.858–0.905	0.887	0.922	0.747	0.562	0.655	0.586	0.543	<b>0.865</b>		
UWES	0.868–0.920	0.970	0.974	0.808	0.555	0.573	0.604	0.532	0.652	<b>0.899</b>	
BI	0.765–0.908	0.915	0.937	0.749	0.537	0.575	0.629	0.512	0.661	0.685	<b>0.866</b>
Mean					3.495	3.490	3.467	3.522	3.090	3.467	3.520

Diagonal elements in bold are the square root of average variance extracted (AVE) by constructs from their indicators; under-triangle is the correlation of the Latent variables; IS = institutional support, TTF = task-technology fit, RE = readiness, PEU = perceived ease of use, PU = perceived usefulness, UWES = work engagement, BI = continuance intention (the same is true for Table 2)

**Table 3** The HTMT values

	BI	IS	PEU	PU	RE	TTF
IS	0.594					
PEU	0.548	0.654				
PU	0.716	0.614	0.575			
RE	0.692	0.702	0.783	0.641		
TTF	0.637	0.732	0.707	0.718	0.676	
UWES	0.727	0.596	0.553	0.684	0.646	0.616



**Fig. 2** Path analysis of the research model established in this study

In terms of the specific relationships among variables, institutional support ( $\beta=0.124$ ,  $t=3.598$ ,  $p<0.001$ ), task–technology fit ( $\beta=0.088$ ,  $t=2.403$ ,  $p<0.05$ ), readiness ( $\beta=0.232$ ,  $t=5.961$ ,  $p<0.001$ ), and perceived usefulness ( $\beta=0.371$ ,  $t=11.246$ ,  $p<0.001$ ) had positive impacts on work engagement, whereas the effect of perceived ease of use was insignificant. Additionally, teachers who experienced higher readiness ( $\beta=0.252$ ,  $t=7.449$ ,  $p<0.001$ ), perceived usefulness ( $\beta=0.288$ ,  $t=9.110$ ,  $p<0.001$ ), and engagement state ( $\beta=0.345$ ,  $t=9.898$ ,  $p<0.001$ ) exhibited greater frequently technology usage intention.

As the JD-R model defined, job resources are the basis for personal resources. Institutional support is found to have a significant positive effect on readiness ( $\beta=0.628$ ,  $t=24.737$ ,  $p<0.001$ ). Institutional support also positively predicted perceived ease of use ( $\beta=0.371$ ,  $t=9.829$ ,  $p<0.001$ ). Another important factor that has a substantial impact on predicting perceived ease of use is task–technology fit ( $\beta=0.444$ ,  $t=13.722$ ,  $p<0.001$ ). Perceived usefulness was positively determined by institutional support ( $\beta=0.190$ ,  $t=4.707$ ,  $p<0.001$ ), task–technology fit ( $\beta=0.439$ ,  $t=11.493$ ,  $p<0.001$ ), and perceived ease of use ( $\beta=0.143$ ,  $t=3.753$ ,  $p<0.001$ ). The combined effects of these exogenous predictors mentioned above explained 51.9%, 58.6%, 39.5%, 48%, and 47.1%, respectively, of the variance in work engagement, continuance intention, readiness, perceived ease of use, and perceived usefulness. A summary of the testing results is provided in Table 4. Overall, most of the paths are significant in the expected direction.

We also followed Hair et al. (2021) to assess the predictive relevance of the research model. The cross-validated redundancy (Q-squared) values of the endogenous variables (RE=0.297, PEU=0.375, PU=0.371, UWES=0.413, and BI=0.429) were all above zero, indicating that the research model can be used to explain the relationships among these research variables. Furthermore, as shown in Table 3, four relations have a small effect size, seven relations have a medium effect size, and the rest of the path has large effect sizes (Chin, 1998).

To see if there was a significant difference in path coefficients between urban and rural teachers, a non-parametric multigroup analysis (MGA) was used. Table 4 shows that three paths (PU effects on UWES, RE effects on BI, and REU effects on WES) differed significantly between the two groups, even though these paths were significant for both. The path coefficient of readiness has a significantly greater impact on rural teachers' work engagement than on urban teachers. The impact of readiness on technology usage intention differs significantly between the two groups. However, the path coefficient of perceived usefulness influences the work engagement of urban teachers significantly more strongly than that of rural teachers, which is an interesting finding. This means that for rural teachers, personal resources are more important in technology-based teaching.

**Table 4** Path coefficients among variables and their MGA

Path	Path coefficients					Urban–rural multigroup analyses	
	Std beta	Std error	T statistics	P values	f-squared	Path coefficients-diff (urban–rural)	p-value (urban–rural)
IS→PEU	0.317	0.032	9.829	***	0.111 <sup>b</sup>	-0.013	0.838
IS→PU	0.190	0.040	4.707	***	0.035 <sup>b</sup>	-0.051	0.525
IS→RE	0.628	0.025	24.737	***	0.651 <sup>a</sup>	-0.048	0.309
IS→UWES	0.124	0.035	3.598	***	0.015 <sup>c</sup>	0.077	0.283
PEU→PU	0.143	0.038	3.753	***	0.02 <sup>c</sup>	0.101	0.215
PEU→UWES	0.032	0.043	0.756	0.449	0.001 <sup>c</sup>	-0.121	0.167
PU→BI	0.288	0.032	9.110	***	0.104 <sup>b</sup>	0.007	0.908
PU→UWES	0.371	0.033	11.246	***	0.144 <sup>b</sup>	<b>0.159</b>	*
RE→BI	0.252	0.034	7.449	***	0.087 <sup>b</sup>	<b>-0.146</b>	*
RE→UWES	0.232	0.039	5.961	***	0.045 <sup>b</sup>	<b>-0.163</b>	*
TTF→PEU	0.444	0.032	13.733	***	0.218 <sup>a</sup>	0.025	0.708
TTF→PU	0.439	0.038	11.493	***	0.172 <sup>a</sup>	-0.033	0.675
TTF→UWES	0.088	0.037	2.403	*	0.006 <sup>c</sup>	0.047	0.537
UWES→BI	0.345	0.035	9.898	***	0.144 <sup>b</sup>	0.114	0.095

\*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ ;

<sup>a</sup>large effect size

<sup>b</sup>medium effect size

<sup>c</sup>small effect size

## 4.2 Qualitative results

### 4.2.1 The availability of technical equipment and guidance constitutes teachers' online teaching basic needs

Access to devices was the most common factor that concerned teachers in relation to online teaching engagement. The unexpected pandemic outbreak in 2020 initiated an education emergency, resulting in school closures and a transition to online teaching. 'Without swift remedial action, energy has been delayed by seeking appropriate ways of organising online teaching until devices and resources are available', Teacher 18 stated, which symbolised the common phenomenon of inadequate support in all aspects of the early stage. The support from experts and colleagues for the use of devices and the production of online resources further helped teachers solve problems and alleviate their anxiety, which gradually boosted their positive experiences (Teachers 2). These comments revealed that teachers who were not initially comfortable with online teaching became more engaged at the possibility of being offered essential equipment and guidance.

### 4.2.2 Teachers emphasize the institutional support from parent

Interestingly, all of the participating teachers said that parental engagement was beneficial. Many schools advocated the home-school collaboration. Parents as the stakeholder in the education system showed multifaceted roles, including keep positive beliefs toward students' learning, support for providing devices, and participation in students' online and offline learning processes to guide-aided. As shown in the following quotes, 'It is difficult to say that meaningful teaching has taken place if students do not possess learning devices' (Teachers 7 and 14). Many teachers also expressed: 'I always worry that students are wandering'. As is implicit in this statement, parents' scaffolding could alleviate teachers' worries. Some younger students could not attend online classes spontaneously, because their underdeveloped self-management ability cannot well resist disturbance in the informal learning environment. Unquestionably, it is a considerable basis for parents' appropriate acceptance of technology and recognition of the value of home-school co-education (Teacher 11). Adequate support from parents creates a supportive institutional environment for teachers' implementation of online teaching.

### 4.2.3 Teachers are not troubled by the use of technology but focus on its functions

Although earlier studies reported that teachers face the challenge of integrating information technology into teaching, this did not seem to be the case for the teachers in our study, as they all had obtained relevant skill training regularly. In the beginning, participants' readiness in using online teaching strategies was not adequate and caused further anxiety. However, in a short time, the participants developed a state of faculty preparation and seemed to have become empowered in implementing online teaching (Teachers 3, 4, and 14). For many of these teachers,



the reason they looked for ease of usage technologies was to minimize the time needed for students to learn how to use the technology, allowing the focus to remain on internalizing knowledge, which was also seen in a previous study (McCulloch et al., 2018).

Teachers' focus is always premised on the technical characteristics related to pedagogical activities. According to the responses, it can be grouped primarily into three categories: integrated multi-function, facilitating instructional organisation, and corresponding to students' cognition. For example, three teachers commented that it is so difficult to track individuals that attendance needs to be processed manually, which takes up teaching time (Teachers 1, 3, and 6). Other teachers (Teachers 4 and 7) also expressed concerns about the characteristics of the technology, 'Most of technologies emphasised the interest of design, so that they are not suitable for higher grade students who need logical thinking training'. Teachers are more likely to expend effort to engage if they feel that the use of technologies is beneficial. It was also noted that, for many teachers, activities to be carried out needed to be under the cooperative use of multiple technology platforms. In other words, teachers' energy was distributed among different technologies and even in the integration of them, which distracted them from teaching.

## 5 Discussion

A mixed-method study was implemented to understand what drives primary and secondary school teachers' online teaching work engagement and continuance intention. PLS-SEM was adopted to quantitatively confirmed the factors that promote primary and secondary school teachers' online teaching work engagement and continuance intention. Then, supplemented with the semi-structured interviews, the quantitative findings were further interpreted. The most significant finding in correlating the quantitative and qualitative results is that it became clear that teachers who were more clearly perceiving institutional support, task–technology fit, readiness, and usefulness for online teaching had more intense engagement and continuance intention. In this section, we offer the following insights into the three contributions discussed in the following subsections.

### 5.1 Perceived technology usefulness rather than ease of use affects online teaching work engagement and continuance intention

Contrary to expectations, we found no evidence that teachers engaged in online teaching because of the perceived technology ease of use. However, the quantitative and qualitative results consistently show that the impacts of perceived usefulness on online teaching work engagement and continuance intention were found to be more pronounced. Since political action to promote the integration of information and communication technologies (ICTs) into education, as well as increasing experiences with technology usage and iteration of technology design, most developers have

taken steps to make information systems easier to use by employing strategies such as usability and user-centered design principles, which have relieved stakeholders' concerns. Teachers possessed more or less technological and pedagogical competencies as a result of the information literacy programs (Almerich et al., 2016). The qualitative results further explained that as one gains familiarity with the ICTs, the predictor of positive feelings towards online teaching may shift from perceived ease of use to perceived usefulness. Furthermore, it is understandable that, in an examination class (Mutambara & Bayaga, 2021), teachers would devote more time and effort to making the online environment more stimulating for students and their own performance.

Although, quantitative result indicated that teachers would not be hindered by the operation of technical tools during instruction, that is not to say technical tools' ease of use can be ignored. In fact, qualitative research revealed that teachers still need time to familiarise themselves with technical tools, and their concerns about technology stem more from student acceptance. This usually means that teachers are invested in their work because they want their students to be happy with the learning process supported by technology (Kangas et al., 2017; Linnenbrink et al., 2003).

## 5.2 Crucial role of institutional support for sustaining online teaching

The social identity theory (Tajfel, 2010) may be useful in explaining such institutional influences, as it argues that people tend to conform to groups with they identified (Bauwens et al., 2020). Education is a professional field with strong social attributes, and as such, teachers as employees tend to be susceptible to the influence of managers, supervisors, and colleagues (Kreijns et al., 2013). One teacher mentioned in the qualitative phase provided the justification: 'In the chat room, in addition to communicating organisation of teaching activities, we also encourage each other. We are sisters in need'. Online teachers are also eager for family-school collaboration, as they are separated from students physically and psychologically. Simultaneously, younger or weaker students lacked self-regulated skills to manage their learning online at home, particularly true for primary and secondary school students (Bai & Gu, 2022). Parental support could compensate the deficiency of teachers' supervision (German Ben-Hayun & Perry-Hazan, 2023).

For another perspective, the basic institutional support emphasizes administrations or schools' influence, which can be divided into three categories: (1) ensuring access to technological tools; (2) providing guidance for interacting with technology to develop the ability to modify technology to meet pedagogical needs (P.-Y. Wang, 2013); and (3) forming an incentive mechanism at the political policy and practical levels. The COVID-19 pandemic, in particular, pushed ICTs to the forefront of education (Barnes, 2020). During the pandemic, the administrations and schools' support was emphasised and provided at a significant level. The administrations and schools' support, however, may continue to a more impact after COVID-19.

### 5.3 Urban teachers emphasized usefulness of technology, while rural teachers were more concerned with their readiness

Teachers' ability to use relevant technology, compared to institutional and technical aspects, is the greater contributor to the differences. Although previous researchers have proved the significant differences in digital capabilities between urban and rural teachers (Wang et al., 2019), our study further specifies the differentiated reasons behind the work engagement and continuance intention in relation to online teaching. For urban teachers, the usefulness of technology is a more important factor to determine whether they should continue with online teaching, in comparison, for rural teachers, the level of readiness plays a significant role in influencing engagement in online teaching and determining the intention to continue.

Perceptions of online teaching readiness include a mixture of attitudes and experience, which is manifested in teachers' sense of knowledge, skills, and self-efficacy for technology-integrated teaching (Çınar et al., 2021). When discussing this result with participants, urban teachers frequently integrate innovative teaching strategies into technology and reach a level of 'familiarity and confidence', while rural teachers are more likely to use technology for drills and only stay at the level of 'understanding and application of the process' (Kormos, 2018; Wang, 2013). When faced with online teaching, rural teachers may be more worried about their lack of readiness. Another finding is that urban teachers have more expectations for the perceived usefulness of online teaching than rural teachers. Based on the observations and interviews, it can be concluded that urban and rural teachers have different instructional needs: for urban teachers, online teaching may assist in the creation of challenging instructional activities, whereas, for rural teachers, online teaching is used to deliver content. Furthermore, the majority of digital resources are created by qualified urban teachers. Online education does not meet the needs of rural schools and does not fully utilise the benefits of rural education.

These phenomena are due to a combination of factors that are interconnected through chain effects (Vermeulen et al., 2017). A persisting challenge facing rural education is that most rural teachers lack the capability of integrating ICTs into school teaching. Rural schools face more challenges than urban schools in terms of stricter bureaucratic management, flexible professional training, better performance incentives, and a positive competitive environment (Wang et al., 2019). Due to the limited training opportunities, rural teachers' teaching experience and ability based on information technology are insufficient. In addition, rural teachers struggle with poor maintenance and fading motivation toward technology integration and even professional identity, which are threatening the sustainable development of the ICT initiatives (Luo et al., 2022). The balanced development of urban–rural online teaching is defined in complex and multidimensional manners by demographic conditions or socioeconomic background, both of which are worthy of further investigation. Otherwise, online education will exacerbate the disparity between urban and rural in primary and secondary education.

## 5.4 Implications

The findings of this study provide several implications for both researchers and practitioners. Theoretical implications could be examined from the perspectives of bringing the JD-R model into the primary and secondary school's online teaching context. In doing so, we evaluate the effects of two different sets of constructs, both job and personal resources integrated with technology-related characteristics, on primary and secondary school teachers' work engagement, and established the theoretical model. These technology-related characteristics are also the foremost variables in the TAM. To some degree, this study can effective the integration of the JD-R model and TAM. In addition, informed by the established theoretical model, future research could attempt to extend the dimension of the JD-R model from the perspective of technological resources.

The findings also contribute some implications for practitioners in the field of primary and secondary schools' online teaching. Firstly, as the task–technology fit, is more closely related to perceived ease of use and usefulness, we argue that information systems or tools with a broad range of functionality that is appropriate for tasks should be equipped and used. Meanwhile, technical developers should try to design and promote intelligent tracking or analysis technology to make teachers suffer from repetitive works, such as checking student attendance and task submission. Secondly, as a strategy to facilitate a supportive environment for teachers, access to qualified ICTs requires attention, and so do the ongoing and practice-oriented education programs at technical and instructional levels. We further advocate the ministry of education partner with training institutions and parents to share a positive common vision for technology integration that will help build teacher enthusiasm for online teaching. Thirdly, this study emphasises the importance of organising cooperation strategy planning embedded in deeper interaction around the authentic teaching–learning process among urban and rural teachers. It is also a crucial measure to fully stimulate the subjective initiative of rural teachers, as well as the urgent need for appropriate training. The institution's support in developing augmented interaction platforms and maintaining appropriate mechanisms is required for these measures to be implemented.

## 6 Limitation, future research, and conclusion

Although we carefully designed and undertook this study, some existing limitations must be reported, along with future research directions. Firstly, the study verified the importance of institutional context for predicting teachers' online teaching. However, in terms of interpretation, institutional support was from the perspective of teachers' overall perception of surroundings rather than focusing on a particular aspect. Therefore, we plan to add more specific constructs such as facilitating conditions, subjective norms, and parent engagement to improve institutional support's explanatory power. Secondly, we did not examine students' online learning effectiveness, although teachers indicated that it is a noteworthy concern. Future research should, therefore, fill this gap by assessing students' learning in the analysis while exploring teachers' online teaching experiences. Thirdly, there is a large

difference between the number of male and female participants. Gender has been affirmed as the key moderate determinant of user technology acceptance. Therefore, additional research should explore the differences in technology attitude or usage between male and female teachers. Lastly, our sample was teachers who implemented or practiced online teaching during COVID-19. However, only a few of primary and secondary school teachers implemented online teaching in regular schooling. This implies that different results may be obtained when steering teaching from completely online at home to blended at school. Consequently, we expect to study how and what influences teachers to integrate online teaching into primary and secondary formal education through the use of diary studies and experience sampling, which is a more profound matter that warrants further understanding.

Altogether, the mixed-method study enriched the core constructs from the perspective of the Job Demands-Resources Model, which is an important step toward developing a more comprehensive nomological network around work engagement and their subsequent continuance intention in the context of online teaching. We discovered that teachers who were more clearly perceiving institutional support, task–technology fit, readiness, and usefulness for online teaching had more intense vigour, dedication, and absorption, further enhancing continuance intention. We especially emphasized parents' engagement, flexibility and effective technology tools toward online teaching. In addition, teachers' technology integration capability is the contributor to the gap in urban–rural online teaching. This study provides recommendations on what to consider when encouraging primary and secondary school teachers to engage in online teaching and action plans to continue to penetrate the online teaching in primary and secondary education.

## Appendix 1

### Questionnaire

Greetings! We cordially invite you to complete an online survey based on your online teaching experiences during the suspension of the normal semester. The purpose of the survey is to understand online teaching in terms of perceived personal resources, social resources, online teaching engagement, and continuance intention. Your participation is completely voluntary. You are free to withdraw from the survey at any time without penalty.

Basic Information.

1. Your birth sex is

Male  Female.

2. Your school location is

Urban  Rural (Town).

3. What grade level you teach?

Primary school  Secondary school.

Institutional Support.

1. Parents and community members support our school's emphasis on online teaching.

2. Teachers receive adequate administrative support to carry out online teaching.

3. Our school has a well-developed plan that guides online teaching.

4. I can readily obtain answers to technology-related questions.

5. Most of our school computers are kept in good working condition.

6. Materials (e.g. software, printer supplies) for online teaching are readily available.

7. My students have adequate access to up-to-date technology resources.

Task–Technology Fit.

1. Technical tools are fit for the requirements of my teaching.

2. Carrying out online teaching fits with my educational practice.

3. It is easy to understand which tool to use in online teaching.

4. Technical tools are suitable for helping me complete online courses.

Readiness.

1. I know how to meaningfully integrate technology into lessons.

2. I am able to align technology use with my district's standardised curriculum.

3. I have received adequate training to incorporate technology into my instruction.

4. My computer skills are adequate to conduct classes that have students using technology.

Perceived Ease of Use.

1. Learning to operate online teaching platforms or software would be easy for me.

2. I would find it easy to get online teaching platforms or software to do what I want them to do.

3. My interaction with online teaching platforms or software would be clear and understandable.

4. I would find online teaching platforms or software to be flexible to interact with.

5. It would be easy for me to become skilled at using online teaching platforms or software.

6. I would find online teaching platforms or software easy to use.

Perceived Usefulness.

1. Online teaching platforms or software would improve my job performance.

2. Online teaching platforms or software in my job would increase my productivity.

3. Online teaching platforms or software would enhance my effectiveness on the job.

4. Online teaching platforms or software would make it easier to do my job.

5. I would find online teaching platforms or software useful in my job.

Work Engagement.

1. At my work of online teaching, I feel I am bursting with energy.

2. At my job of online teaching, I feel strong and vigorous.

3. When I get up in the morning, I feel like going to online teaching.

4. I am enthusiastic about my job of online teaching.

5. My job of online teaching inspires me.

6. I am proud of the online teaching that I do.

7. I feel happy when I am teaching online intensely.

8. I am immersed in my online teaching.
  9. I get carried away when I am teaching online.
- Continuance Intention.
1. I intend to use online teaching to assist my teaching.
  2. I intend to use online teaching content to assist my teaching.
  3. I intend to use online teaching as an autonomous tool to guide students' learning.
  4. I intend to use online teaching platforms or tools to assist my evaluation.
  5. I intend to take online teaching as a regular teaching mode.

## Appendix 2

### Interview protocol

1. Please introduce yourself and tell us something about your online teaching experience.
2. Have you encountered any problems in online teaching? When you encounter problems, what measures have you taken to solve them?
3. Can you describe your status of engagement when teaching online? Please elaborate.
4. What do you think of the effect of online teaching? Please elaborate.
5. What possible reasons for your decision about implementing online teaching?

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Third author: Analysis, Software, Investigation;

Fourth author: Methodology, Supervision, Writing-Reviewing and Editing.

**Data availability** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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