



Pacific Asia Journal of the Association for Information Systems

Transition from Offline to Online through Digital Resource Bricolage in A Health Crisis: A Case Study of Two Primary Schools

Miao Cui¹, Jinfang Qian², Xin Dai^{3,*}, Mengjun Liu⁴

¹ Dalian University of Technology, China, cui_miao@dlut.edu.cn

² Dalian University of Technology, China, judy_jf@mail.dlut.edu.cn

³ Huazhong University of Science and Technology, China, daixin_hust@126.com

⁴ Hubei University, China, lmj_w hu@163.com

Abstract

Background: *Health crisis responses underline maintaining normal operations. By utilizing digital resources, organizations are able to maintain essential operations through transiting their operations from offline to online during a health crisis. However, little is known about how organizations rapidly adapt to online operations. By taking resource bricolage as the theoretical lens, this study investigates the process that organizations rapidly transit from offline to online through digital resource bricolage during health crises.*

Methods: *A case study of two primary schools that maintained operations during COVID-19 was conducted, with a focus on the utilization of digital resources and resource bricolage. Secondary data collection, interviews and coding strategy were utilized to collect and analyze data to reveal the process that organizations rapidly transit from offline to online through digital resource bricolage.*

Results: *The findings reveal a sequential three-step resource bricolage process, including redeploying digital resource functions, combining digital and non-digital resources, and coordinating interaction among participants, as well as the corresponding resource bricolage behaviors and domains.*

Conclusions: *This study contributes to information systems (IS) studies on crisis responses by identifying the sequential steps of digital resource bricolage to transit from offline to online during health crises. In addition, this study contributes to the development of resource bricolage perspectives by identifying new resource bricolage actions that suitable for the health crisis response.*

Keywords: Health Crisis Response, Resource Bricolage, Pandemic.

This research article was submitted on 11-Jun-2021 and under two revisions, accepted on 07-Dec-2021.

Citation: Cui, M., Qian, J., Dai, X., & Liu, M. (2021). Transition from Offline to Online through Digital Resource Bricolage in A Health Crisis: A Case Study of Two Primary Schools. *Pacific Asia Journal of the Association for Information Systems*, 13(4), 69-96. <https://doi.org/10.17705/1pais.13403>

Copyright © Association for Information Systems.

Introduction

Public health crises, especially outbreaks of infectious diseases, can imperil the health of humans and severely threaten social and economic development (Guo et al., 2021; Papagiannidis et al., 2020). The impacts of infectious diseases on health, economy, work, and home life are manifold (Venkatesh, 2020). A critical impact of infectious disease outbreaks is the stagnation of social activities, such as work, shopping, and socializing, due to social distancing (De et al., 2020). During the COVID-19 pandemic, many organizations have slowed down or shut down their operations due to a lack of orders, raw materials, and employees caused by lockdowns (Wang et al., 2020). Organizations must rapidly adapt to social distancing.

Digital resources are able to support organizations to cope with social distancing and maintain essential operations during a health crisis (Pan et al., 2020; Papagiannidis et al., 2020) by assisting organizations in conducting activities online, e.g., remote working, online learning, e-commerce, and e-government (Chan et al., 2011; Liu et al., 2021; Pan et al., 2020). However, organizations are used to offline operations and have little knowledge about operations online.

Information system studies are dedicated to contributing to crisis response, especially natural disaster response. Previous studies explore roles of information technologies (Leong et al., 2015; Palen & Hughes, 2017; Tim et al., 2018), information systems (Nan & Lu, 2014; Pan et al., 2012), information resources (Pan et al., 2020), etc. in responding to crises, in particular saving lives suffered from disasters. However, the existing studies lack attention to health crisis response. The response to health crises differs from that to natural disasters. The latter emphasizes rescuing victims, while the former, in addition to healing the sick, also underlines the importance of maintaining normal operations (Papagiannidis et al., 2020; Wang et al., 2020). However, it is not clear how organizations use digital resources to maintain operations during health crises. Some studies propose that organizations are required to use digital technologies to transit their operations from offline to online and call for studies to examine how organizations rapidly adapt to online operations during a health crisis (Pee et al., 2021).

This study adopts resource bricolage as the theoretical lens. Resource bricolage, defined as making do by applying combinations of the resources at hand to new problems and opportunities (Baker & Nelson, 2005), reflects a critical manner for organizations to cope with resource constraints (Hota et al., 2019; Senyard et al., 2014). Faced with a sudden and emergent crisis, organizations often do not have plans and cannot prepare resources in advance. Thus, using the resources at hand becomes a prevalent way for organizations to maintain continuous operations during health crises. Prior crisis response studies note that resource bricolage enables organizations to overcome resource restrictions and unavailability during emergent crises (Stone et al., 2019; Tierney, 2003). Existing research indicates that resource bricolage is appropriate for investigating crisis response questions (Anwar & Clauß, 2021; Kuckertz, 2020; Tsilika et al., 2020). Therefore, this study aims to answer the research question **"How do organizations rapidly transit from offline to online through digital resource bricolage during health crises?"**

Against the backdrop, using a case study method, we selected two primary schools as our case samples, which offer a typical example of organizations that utilize entirely digital resources and resource bricolage to transit from offline to online during the COVID-19 pandemic. This study contributes to crisis response studies in the IS field and the resource bricolage perspective by revealing sequential three steps of digital resource bricolage to transit from offline to online during health crises. In addition, this study provides organizations with practical references to rapidly adapt online operations during a sudden health crisis.

Literature Review

Crisis Response in IS Research

The existing crisis response studies in the IS field focus on rescue and the alleviation of disruptions during or after earthquakes (Nan & Lu, 2014; Palen & Hughes, 2017), hurricanes (Pan et al., 2012), flood (Tim et al., 2017) and other natural disasters (Mirbabaie & Zapatka, 2017; Roshan et al., 2016). The use of digital technologies is believed to be an important tool to respond to crises (Devadoss et al., 2005; Leidner et al., 2009; Tim et al., 2018). These studies investigate the role of digital resources, such as social media (Guo et al., 2021; Palen & Hughes, 2017; Stieglitz et al., 2018; Tim et al., 2017), big data analytics (Abdel-Basset et al., 2020), and location-based systems (Akter & Wamba, 2019), in crisis response. They explain how diverse organizations, including governments (Miao et al., 2021), crisis response agencies (Pan et al., 2012; Stieglitz et al., 2018), and communities (Pan et al., 2020), take advantage of digital resources to coordinate rescue resources (Marx et al., 2018; Pan et al., 2012; Roshan et al., 2016) and organize and distribute information (Tim et al., 2017) using top-down or bottom-up approaches.

Transition from Offline to Online in A Health Crisis

The outbreak of COVID-19 has triggered studies of health crisis responses, which can be categorized into two types. In the first category, prior research examines the victim rescues and virus defenses, which were supported by digital resources (Doyle & Conboy, 2020; Kumar et al., 2020; Kummitha, 2020; Sipiior, 2020) and non-digital resources (Halpern & Tan, 2020; He et al., 2021). In the second category, existing research pays attention to maintaining organization operations in health crises. These studies emphasize that urgently transiting from offline to online is crucial for organizations to maintain continuous operations during health crises (Papagiannidis et al., 2020; Richter, 2020; Taghipour & Merimi, 2021; Wang et al., 2020). Digital resources, such as information resources (Pan et al., 2020; Pang et al., 2019) and information technologies (He et al., 2021; Pee et al., 2021; Standaert et al., 2021), play a critical role in allowing organizations conducting online operations. Existing studies also indicate influence factors on the performance of transiting from offline to online, such as task–technology fit (Isaac et al., 2019), habit (Jin et al., 2021; Sun et al., 2017), learning convenience (Jin et al., 2021), and leader attitude and response (Jin et al., 2021; Papagiannidis et al., 2020). However, it is not clear how organizations rapidly transit from offline to online. There is an urgent need for further research to find the approach (Agostino et al., 2021; Pee et al., 2021).

In all, prior IS research focused on life rescue in natural disasters. Different from natural disaster response, health crisis response also focuses on maintaining organization operations. Recently, IS studies have begun to take highlighted attention on health crisis response and indicate that digital resources play crucial roles in switching from offline to online to maintain organizational operations during a health crisis. However, the detailed execution steps for organizations to switch from offline to online to maintain continuous operations have not been examined.

Resource Bricolage

During a health crisis, resource bricolage offers organizations a solution to cope with the inability to gain resources as usual or prepare resources in advance (Stone et al., 2019; Tierney, 2003). The term “bricolage” can be defined as making do by applying combinations of resources at hand to solve new problems and meet opportunities (Baker & Nelson, 2005; Hota et al., 2019). There are three characteristics of resource bricolage: a reliance on resources at hand, a combination of resources for new purposes, and making do (Baker &

Nelson, 2005; Lévi-Strauss, 1967). *Resources at hand* refer to resources that are available very inexpensively or for free and maybe physical artifacts, skills, or ideas accumulated in principle (Baker & Nelson, 2005; Fisher, 2012; Senyard et al., 2014). *The use of a combination of resources for new purposes* serves as a mechanism that drives the discovery of innovations in new services from existing resources (Baker & Nelson, 2005; Fisher, 2012; Senyard et al., 2014). *Making do*, a form of creative reinvention, involves emphasizing action and active engagement with problems or opportunities rather than lingering over questions about whether a workable outcome can be created from what is at hand (Baker & Nelson, 2005; Fisher, 2012; Senyard et al., 2014).

The resource bricolage perspective has been adopted in entrepreneurship (Fisher, 2012; Hota et al., 2019; Janssen et al., 2018) and innovation (Senyard et al., 2014; Witell et al., 2017). Previous studies have investigated the antecedent and outcome factors of resource bricolage. The outcome factors include innovation capabilities (Senyard et al., 2014; Witell et al., 2017), opportunity exploitation (Jeff et al., 2011), and organizational performance (Yu et al., 2019). The antecedent factors include organizational memory (Witell et al., 2017); environments characterized by low munificence and organizations with little prominence (Desa & Basu, 2013); and the ability to apply available resources, improvise, actively address resource scarcity, and network with external partners (Janssen et al., 2018; Witell et al., 2017).

Previous studies have also explored how entrepreneurs or organizations conduct business and solve societal problems in the context of resource constraints by identifying and drawing conclusions about resource bricolage activities (Hota et al., 2019). Studies of resource-related activities investigate two constructs of resource bricolage, namely, resource bricolage behavior and domains. Resource bricolage behavior includes reusing, repackaging, transposing, and recombining (Fisher, 2012; Linna, 2013; Witell et al., 2017). Resource domains involve physical inputs, labor inputs, skill inputs, customers providing products or services, and institutional and regulatory environments (Baker & Nelson, 2005; Fisher, 2012; Hota et al., 2019; Janssen et al., 2018).

Resource bricolage is an appropriate theoretical lens for investigating how organizations transit from offline to online during a health crisis. Resource bricolage refers to making do by applying combinations of the resources at hand to new problems and opportunities (Baker & Nelson, 2005). Resource bricolage is considered a critical manner for organizations to cope with resource constraints (Hota et al., 2019; Senyard et al., 2014), which is one of the main challenges organizations face during crises (Stone et al., 2019; Tierney, 2003). Faced with a sudden and emergent crisis, organizations often do not have plans and cannot prepare resources in advance. Thus, using the resources at hand becomes a prevalent way for organizations to maintain continuous operations during health crises. For example, Anwar and Clauß (2021) emphasized the strong impact of resource bricolage capability in organizations sustain operations during the COVID-19, and Tsilika et al. (2020) explained the critical role of resource bricolage for organizations to deal with resource constraints after the shock of crises.

Methodology

We selected the case study method for two reasons. First, the case study method is suitable for investigating “how” questions (Pan & Tan, 2011; Walsham, 1995). This study aims to answer the following question: “How do organizations rapidly transit from offline to online through digital resource bricolage during health crises?” Second, the case study method enables the presentation of rich details on a phenomenon and the extraction of insights from detailed descriptions (Pan & Tan, 2011).

We employed theoretical sampling and selected two primary schools as the case samples to study how they responded to COVID-19 through resource bricolage. Schools offer a typical

example of organizations affected by the pandemic and provide us with an opportunity to learn *how do organizations rapidly transit from offline to online through digital resource bricolage during health crises*. First, schools offer a typical example of organizations that utilize entirely digital resources to transit from offline to online during health crises. The sudden outbreak of COVID-19 resulted in a time emergency for the transition from offline to online education. At the beginning of the COVID-19, the Ministry of Education (MOE) of the People's Republic of China instantly issued a notice to "suspend classes, not suspend learning", to avoid delaying students' learning. Schools were commanded to shut down and to carry out online education by February 10. Therefore, schools completely overturned their education activities from offline to online. Before the pandemic, the schools conducted traditional onsite education. The teaching and learning activities were mainly performed with physical learning materials, face-to-face communication, and teacher supervision. However, during the pandemic, they thoroughly utilized electronic devices and digital resources to learn in a virtual world. Therefore, the two cases allow us to explore their utilization of digital resources to adapt online operations during a health crisis.

Second, schools offer a typical example of organizations that bricolage resources to transit from offline to online during health crises. The selected schools are located in the city where COVID-19 was first reported in early 2020. The virus instantly spread within the town through person-to-person transmission. Many people were infected and even lost their lives every day in this city. All people were gripped by fear and anxiety. People were afraid to go shopping or shop online for fear of being infected. Teachers were lack of teaching materials and equipment due to inaccessible online shopping and lockdown. In addition, the sudden switch from offline education to online education made the teachers, students, and parents have no idea about what to do and how to do it. For instance, the teachers even did not know what Apps they could use to deliver online courses. For elementary school students, most of them had never learned online. Junior students were even unable to operate laptops or pads. For parents, they did not know how to play their assistant role in helping and managing their children's learning. Without preparation and knowledge, people must leverage existing resources to explore online education gradually. Therefore, the two cases allow us to examine their transition from offline to online through resource bricolage.

Data Collection

Data were collected in three steps. First, research access was negotiated and granted in April 2020. Second, to accurately determine the appropriate data collection approach and facilitate interviews, we comprehensively collected secondary data from various sources, including internal data, news reports, and the Internet. Third, we conducted interviews through Tencent Meeting, an online meeting app, in June 2020. In total, we interviewed 35 informants, including 22 teachers, six students, six parents from the two primary schools, and the officers of the JH District Education Bureau in the city. The detailed information and interview questions of informants for each school are shown in Appendix.

We established a research team consisting of four professors, six associate professors, two lecturers, one postdoctoral fellow, and five Ph.D. students. The research team was divided into two groups, and each group included four main interviewers. On June 8, 2020, two groups interviewed SY Primary School synchronously. During the on-site interviews, we used the snowball sampling method, first interviewing the vice principal to know how the school carries out online teaching; second interviewing directors of the teaching and information department to see the design, development, and work arrangement of online courses; third interviewing group leaders and course teachers to know the detailed operations of online teaching, and then interviewing students and parents to understand their challenges and activities during online education. On the evening after the interviews, the research team held a meeting to discuss the stage, challenges, and actions of online education during the COVID-19 and to optimize the questions for the following stage interview.

On June 10, 2020, two groups interviewed DX Primary School simultaneously. During the on-site interviews, we adopted the same strategy as the previous interviews. The interviews focused on how teachers, students, and parents transitioned to novel online education from previously accustomed offline education. We began with easy questions to relieve tension, which led to more productive and comfortable interviews.

In interviews of both schools, we heard that all the teachers mentioned online course videos provided by the district education bureau. To know about online course videos, the research team conducted a supplementary interview of a JH District Education City Bureau officer on June 18, 2020. In total, we conducted interviews for more than 35 hours. We digitally recorded the conversations with the permission of the informants and then transcribed them for analysis. The transcriptions and other materials exceeded 350 pages.

Data Analysis

We analyzed the data case by case. We first analyzed data of the SY school. The data analysis was guided by the approach proposed by Pan and Tan (2011). First, as we analyzed the initial data, we developed an understanding of the schools' necessity to initiate unprecedented online education rapidly. We also identified their resource actions to conduct online education. Then, we chose resource bricolage as the theoretical lens. Second, after the interviews, we organized the data to prepare for subsequent analyses and theory building. Third, by utilizing an open coding strategy (Strauss & Corbin, 1998), we derived 1st concepts based on topics that emerged in the initial interviews (Du & Mao, 2018) (Figure 1). Our research team met regularly to review emergent 1st order concepts and to ensure the consistency of the coding (Pan & Tan, 2011). In this step, we focused our attention on identifying resources and actions that utilized existing resources. For instance, when we captured information about the existing resources that were applied to online education and how teachers operated online education by leveraging these resources during the pandemic, we derived concepts "changing the purpose of social media software such as QQ and WeChat for learning", "creating an online board writing device by a desk lamp, mobile phone, and white paper", "short recording video strengthen knowledge absorption", "setting up several functional student groups such as homework group", and "parents assist teachers in supervising students".

In the next step, we conducted axial coding (Strauss & Corbin, 1998) by further comparing the codes with the existing themes of resource bricolage to identify more congregated concepts, clustered the emergent 1st order concepts into 2nd order themes, and compared these themes against the theoretical lens (Du et al., 2019; Pan & Tan, 2011). For instance, the above resource activities in 1st order concepts were clustered into "repurposing existing resources", "adapting to new resource utilization", "integrating resources", "stretching resource utilization capability", "establishing new virtual resources", and "cooperating with stakeholders". Finally, to create a model that ascertains the phenomenon theoretically, we conducted selective coding by integrating 2nd themes into a coherent model (Du & Mao, 2018). In this phase, we continuously compared the theory, data, and emergent model to achieve theory-data-model alignment as we reached theoretical saturation when we finalized the analysis (Pan & Tan, 2011).

To ensure credibility and validity, and the triangulation strategy during the data collection, after the first round of data analysis, we adopted the same strategy and process to analyze the data of the other school. The data analysis results were consistent with the previous analysis, which further verified the case analysis.

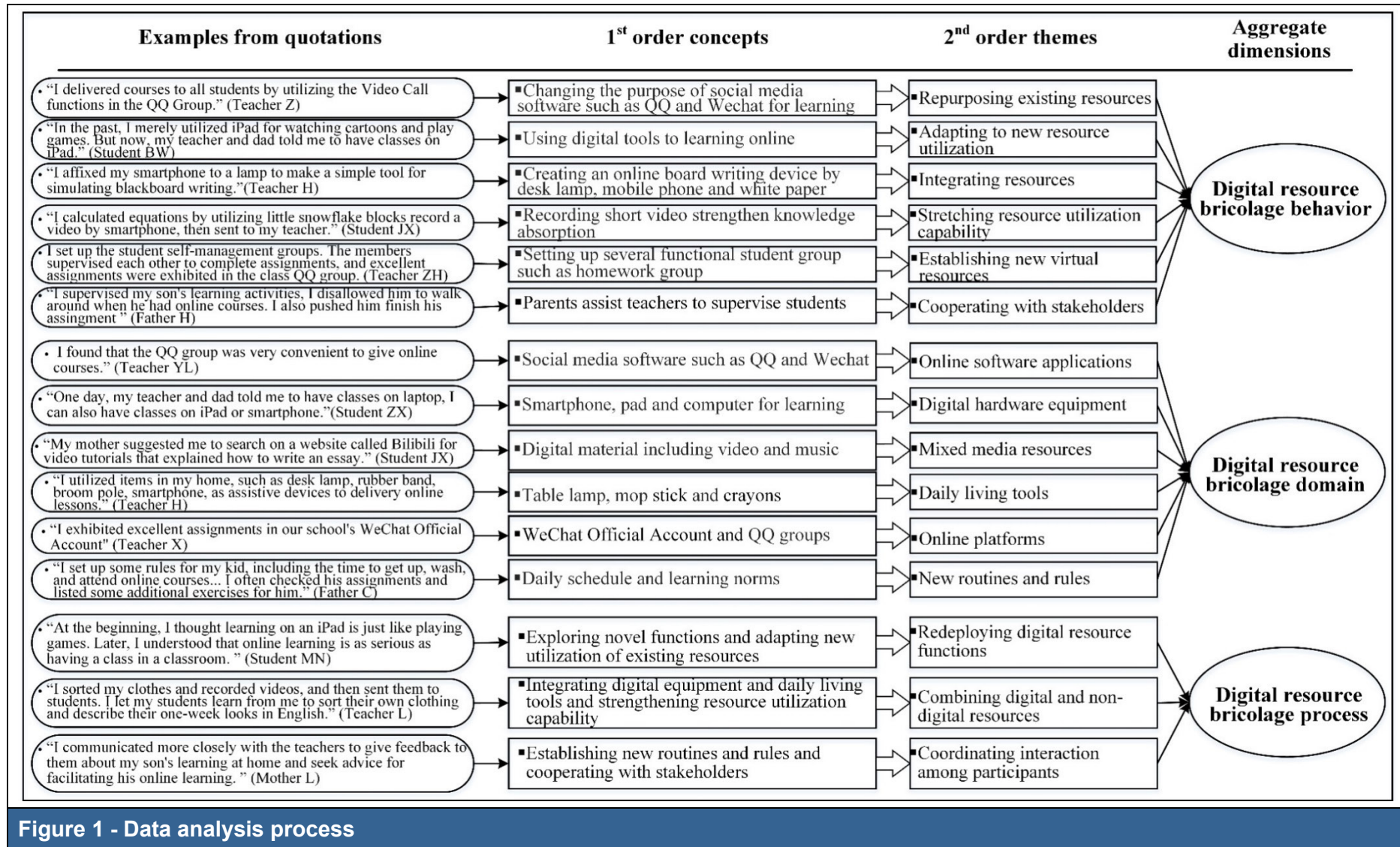


Figure 1 - Data analysis process

Result

We found that the sudden shutdown and transition to online posed significant challenges for schools. Digital resources can support schools to conduct online operations rapidly. The digital resources that were utilized in online education are shown in Table 1. This study identified a series of resource bricolage behaviors and resource bricolage domains. By further analyzing the resource bricolage behaviors and domains, we conceptualized a sequential three-step resource bricolage process, including redeploying digital resource functions, combining digital and non-digital resources, and coordinating interaction among participants (Figure 2). The three-step resource bricolage allowed organizations to transit from offline to online during health crises.

Table 1 - List of digital resources in online education during COVID-19

Tools	Descriptions	Roles in adapting online operations
QQ group	An instant message group that allows multi-person to communicate simultaneously.	QQ group provided a platform for delivering online courses.
Education Cloud	An educational information platform, which the city's Education Bureau provides, offers education information, policy announcements, and supplementary educational resources.	The Education Cloud provided video courses that involved essential knowledge points for teachers and students.
Smartphone/iPad	Digital equipment that install various software and access to the Internet.	Smartphones and iPads played the carrier role of carrying out online teaching and learning.
XiaoHeiBan APP	Family-school communication software that allows teachers to release notices, check assignments, and collect information from parents.	The app offered channels of interaction among teachers and parents to cope with social distancing.
WenJuanXing APP	A platform that is used to collect data for scientific research.	The app offered the tool for taking online exams.
Multimedia materials	Image, cartoon books, animation, video, and audio materials that can deliver content vividly.	Multimedia materials provided a vivid form to deliver knowledge and assist teaching and learning.
Official WeChat Account of the school	A platform that allows the school to set up various content modules and release school information.	School's official WeChat account provided an incentive platform to exhibit students' excellent performances.

Digital resource bricolage process	Digital resource bricolage behavior	Digital resource bricolage domain
Step 1 Redeploying digital resource functions	<input type="checkbox"/> Repurposing of existing digital resources <input type="checkbox"/> Adapting to new utilization of existing digital resources	<input type="checkbox"/> Online software applications <input type="checkbox"/> Digital hardware equipment
Step 2 Combining digital and non-digital resources	<input type="checkbox"/> Integrating existing resources <input type="checkbox"/> Stretching resource utilization capability	<input type="checkbox"/> Digital hardware equipment <input type="checkbox"/> Mixed media resources <input type="checkbox"/> Daily living tools
Step 3 Coordinating interactions among participants	<input type="checkbox"/> Establishing new virtual resources <input type="checkbox"/> Cooperating with stakeholders	<input type="checkbox"/> Online platforms <input type="checkbox"/> New routines and rules

Figure 2 - Digital resource bricolage processes for transiting from offline to online

Preparatory Phase: Redeploying Digital Resource Functions

To agilely adapt to online education, teachers, students, and other school stakeholders needed to use the existing resources, such as online software applications and digital hardware equipment at hand. Because of COVID-19, education was hindered by social distancing and had to be moved online. However, the stakeholders lacked an online education platform, elaborate procedural plan, and professional content such as audio and video materials due to the suddenness and emergent nature of the pandemic. Therefore, they had to take advantage of the resources they already had to perform online education activities.

For teachers, before COVID-19, all teaching activities were performed offline. To maintain uninterrupted student learning, the Ministry of Education issued a "suspend classes, not suspend learning" order a week before the new semester. Teachers were aware that they needed a platform to deliver courses to students. QQ groups, a service of QQ, an instant messaging software that allows multi-person communication, were the first software they thought of. Previously, every class had a QQ group to facilitate communication between teachers and parents. Teachers used the QQ app to send activity information, information about parent meetings, examination results, and other information to parents. Then, the teachers tried to explore how to utilize their existing QQ groups for online teaching. After exploration and discussion, they found that many QQ group functions could be utilized for online education. First, the video call and voice call functions allowed teachers to explain knowledge points to all students simultaneously. Second, the screen sharing function enabled teachers to show their electronic courseware. In addition, the file function helped teachers sort and manage various files they uploaded to the group, including learning materials and homework in the video, audio, and text formats. As Ms. Z, a Chinese teacher, explained,

"At first, we were learning by doing and sharing methods of online teaching. I found that the QQ group was very convenient to give online courses. When I conducted online courses, the list of online group members allowed me to see the number of online students and to find out who was not attending courses... Therefore, after I introduced the functions of the QQ group to my colleagues, most of them decided to adopt the software to deliver online courses."

Students had to adapt to the new utilization of digital tools, such as iPad and smartphones, to carry out online learning. Although online learning was already popular in some adult education and extracurricular training before the pandemic, primary and high school students seldom engaged in online education. Students perceived digital equipment, such as laptops, iPads and smartphones, to be tools for entertainment, e.g., watching cartoons and playing online games. To begin online learning for six hours a day, five days a week, the students had to transform their understandings of the equipment (Figure 3). As MN, a fifth-grade primary school student, described,

"At the beginning, I thought learning online was very amazing. Learning on an iPad is just like playing games. I imagined that I could play while learning or watching cartoons on the iPad as usual. During the online class, I could play games on the iPad whenever I didn't understand or had no interest in the topics...Later, my mom talked to me. I understood that online learning is as serious as having a class in a classroom."

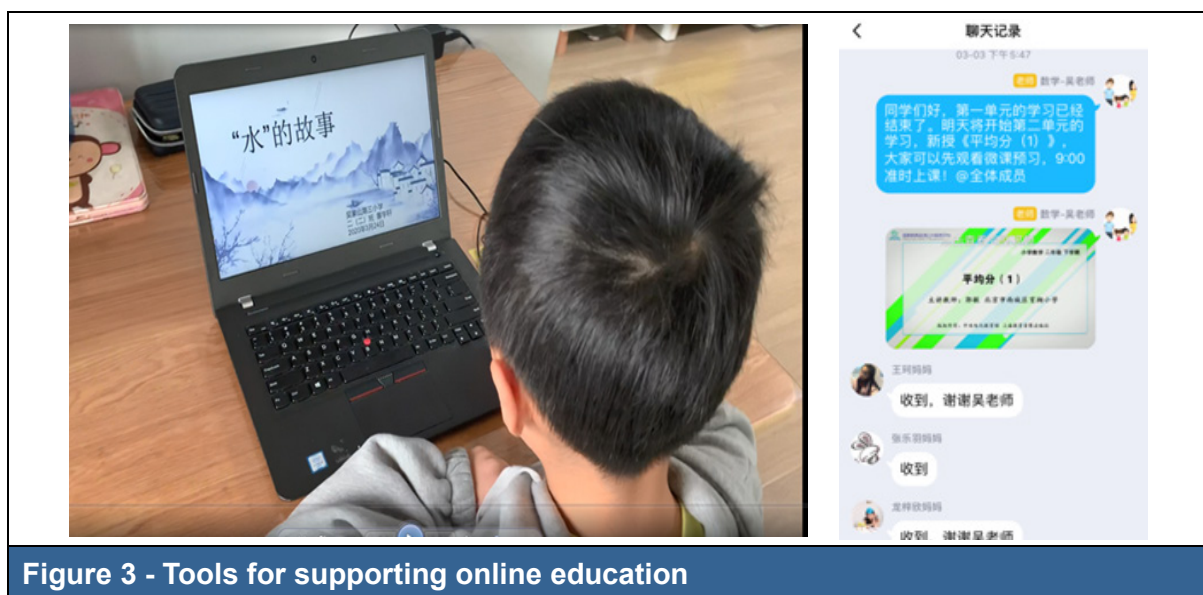


Figure 3 - Tools for supporting online education

The analysis of the resource activities in this phase indicates that redeploying digital resource functions is the first step of the resource bricolage process in transiting from offline to online in a health crisis. Redeploying digital resource functions refers to exploring novel functions and adapting to new utilization of existing digital resources due to the unavailability of new resources. By exploring novel functions of online software applications and adapting to digital hardware equipment, the basic tools for online activities can be established. The emergence of a health crisis forces organizations to change their activities. Before a crisis, most activities are usually offline. However, a sudden health crisis forces them to switch to online (Pan et al., 2020) quickly and without preparation (Iivari et al., 2020; Lily, 2020; Wang et al., 2020). It is disruptive to shift activities online in a matter of days. In general, a complete set of online activities requires an elaborate procedural plan, professional content, such as audio and video materials, and technology support (Bao, 2020; Bromberg et al., 2013). However, the suddenness of a health crisis does not allow organizations to prepare in advance. They cannot develop a plan or a stock of resources and must utilize the resources at hand. However, most of the resources at hand cannot meet the requirements of online activities directly because they are initially used for other purposes. To support immediate online activities, organizations must redeploy digital resources to establish a fundamental platform. For instance, in the two schools, the teachers taught online using the QQ group video call and voice call functions. The students developed new understandings of the usage of laptops and iPads, shifting from their use for entertainment to their use for learning. By redeploying digital resource functions,

a digital resource, e.g., the QQ group that allowed teachers to deliver online courses, was established to meet the requirements to switch from offline to online.

Experimental Phase: Combining Digital and Non-digital Resources

Although QQ provided a platform for online education, the schools faced difficulties imparting knowledge online. To facilitate online courses, the Education Bureau of JH district organized some experienced teachers to record online courses to deliver basic knowledge points. Students could log on to the Education Cloud website to watch online courses. According to teachers' front-line teaching experience, the sustained attention of primary students can merely last 15-20 minutes. In the previous on-site teaching, teachers play the role of supervision and restraint to prevent students from distracting. But online teaching is divorced from the supervision of teachers, and students will be distracted over 20 minutes. To improve the learning without the supervision of on-site teachers, the duration of each online class video is limited to 20 minutes. However, the short course videos offered by the education bureau were unable to meet the diverse requirements of students with different learning abilities, atmospheres and habits. For example, on the first day of conducting online education, most students had a variety of questions when watching twenty-minute courses. They typed a variety of questions in the QQ group chat. Consequently, the messages sent by the students quickly refreshed page by page. The teachers were unable to answer these diverse questions simultaneously. After reflecting and summarizing the first day of online teaching, the teachers decided to supplement the videos with other teaching materials to improve the online teaching activities. They first summarized the potential questions that the students would have in common and recorded a video to answer the questions so that they could avoid a chaotic situation in the QQ group (Figure 4). As Ms. L, an English teacher, recalled,

"To effectively deliver knowledge points, I integrated unit 2 and unit 3 and created a situational topic of a 'daily fashion show'. I sorted the clothes in my wardrobe and made seven outfits for Monday, Tuesday, Wednesday...I recorded videos and sent them to students. I let my students learn from me to sort their own clothing and design their own outfits for a week and describe their one-week looks in English. In this way, students could achieve individualized learning."



Figure 4 - Supplementary teaching materials

A second significant challenge that the teachers faced was that they were unable to visually deliver knowledge to students due to the absence of body language or physical teaching tools, e.g., blackboard writing, in a virtual education context. They needed teaching tools to facilitate knowledge delivery. The unavailability of new teaching tools due to fear of infection and the shutdown of operations forced teachers to use every available daily living tool at hand to make them simple teaching tools (Figure 5). For example, Teacher W attached several white papers to the back of a glass door to simulate a whiteboard and used a mop stick as a pointer. This homemade tool was utilized as a simple blackboard writing device. Ms. H, a math teacher, shared her practices using a variety of resources,

"I made simple equipment for simulating blackboard writing in order to enable students to understand every knowledge point, especially the difficult points. I affixed my mobile phone to a desk lamp with a rubber band and lit the desk lamp, then turned on the mobile phone camera to film an A4 white paper so that the students could see what I was writing on the A4 paper on their screens. I wrote, calculated, and explained equations to students."

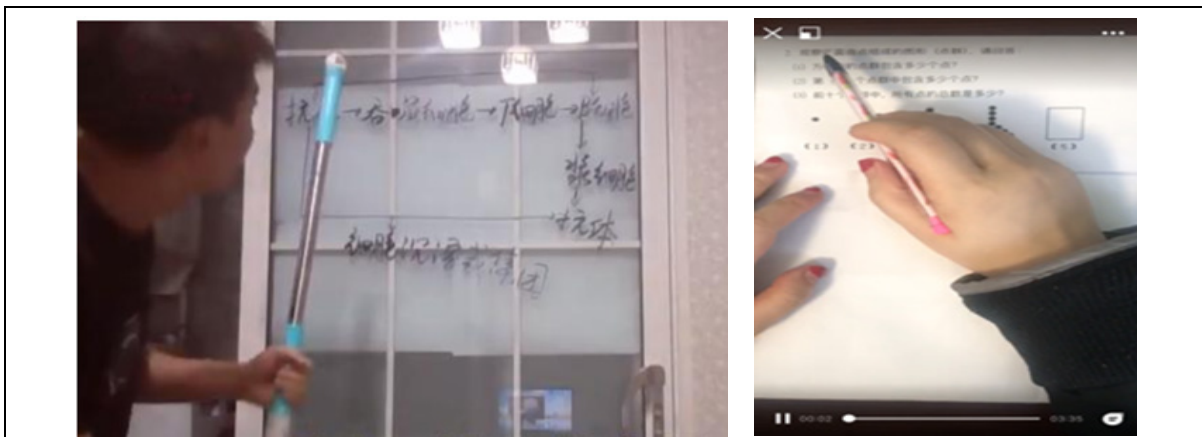


Figure 5 - Improvised teaching equipment

Students were required to learn several new skills, such as recording, typewriting, and searching the Internet. Before the pandemic, students were able to ask teachers any questions and receive immediate explanations. In contrast, online learning introduced difficulty for timely interactions between teachers and students. When confusing issues arose after playing the videos, to avoid simultaneous questions from multiple students, the teachers asked the students to rewatch the videos and to try to explain the questions by themselves. Then, students tried their best to search for answers in the videos and on the Internet and to analyze questions by utilizing items at hand, such as blocks and crayons. In addition, they shot videos to record the process of analysis and explanation (Figure 6) and compared their explanations with those of the teacher presented in the course video. As a second-grade primary school student, ZX told us,

"I didn't know how to calculate equations. Teacher H let me try by myself and record a video. At first, I didn't want to record the video because I thought I couldn't explain it clearly. My mom encouraged me. Then, I tried to calculate the equations by utilizing some little snowflake blocks. My mom helped me record the video."

JX, a second-grade primary school student, described his experience of searching for information online as follows:

"I struggled with exaggeration and metaphor that our Chinese teacher taught us in writing class. After class, I read excellent examples in writing books to understand the

writing methods, but I still could not utilize the two methods to write essays. At that moment, my mother suggested me search on a website called Bilibili (one of largest online cultural communities and video platforms in China) for video tutorials that explained how to write an essay. At first, I was unable to type. My mum taught me how to type. I could only type very slowly. Nevertheless, now I can search for any information from the Internet."

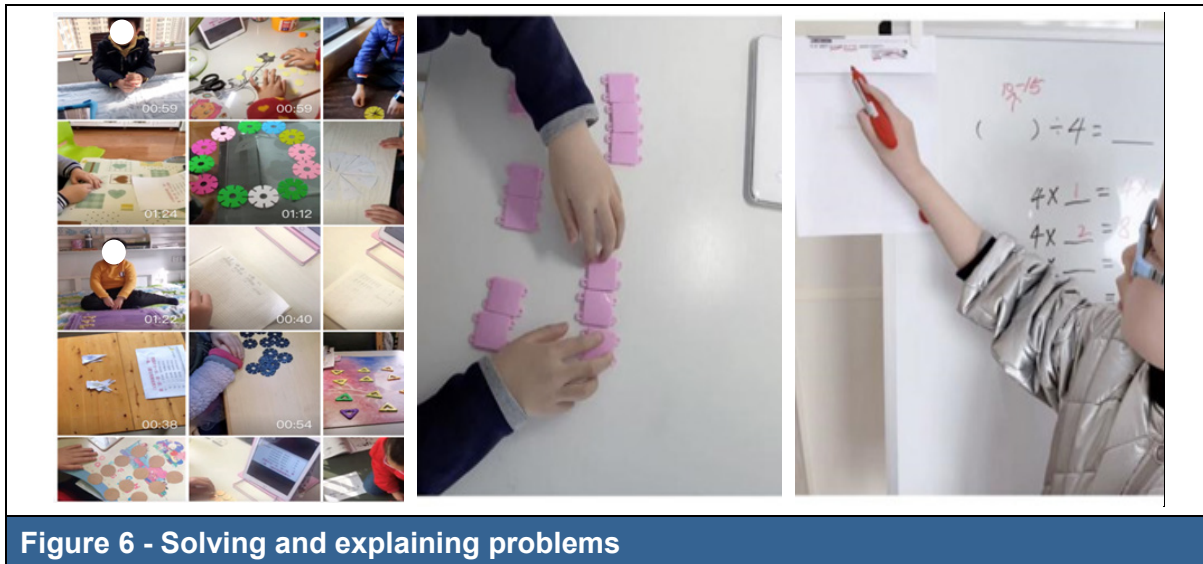


Figure 6 - Solving and explaining problems

The analysis of the resource activities used to perform online education indicates that combining digital and non-digital resources is the second step of the resource bricolage process in transiting from offline to online in a health crisis. Combining digital and non-digital resources refers to integrating available digital hardware equipment, mixed-media resources, and daily living tools and strengthening resource utilization capability to supplement critical elements to achieve the continuous improvement of online operation performance during a health crisis. Although basic online activities can be initiated by redeploying digital resource functions, there are still some flaws. It is difficult to achieve a satisfactory effect by merely relying on basic tools. First, the transition to online activities involves diverse requirements for concrete practices. Basic online facilities cannot fully meet every requirement of online activities. Second, in a traditional on-site context, physical tools, body language, facial expressions, and the communicator's voice are all important interaction tools (Bao, 2020). However, when activities are switched to online, access to the abovementioned elements is restricted. Therefore, organizations must optimize existing online resources to compensate for the missing functions of basic equipment. They need to creatively combine available digital hardware equipment, mixed-media resources (Bromberg et al., 2013), physical materials, and tools (Mason, 2020) to achieve the desired functions. For instance, one teacher attached a smartphone to a lamp to make a simple tool to simulate blackboard writing. A student recorded videos to explain issues by rewatching course videos, searching for information from the Internet and using items at hand. By combining digital and non-digital resources, the existing resources were customized and revised to meet diverse requirements, supplement critical units, and improve online activity performance.

Coordination Phase: Coordinating Interactions Among Participants

Even though the schools could carry out online education by redeploying existing digital resources and combining the available resources at hand, they were still confronted with the challenges of the discordance in online education caused by the need to establish new rules to support it. Before the health emergency, the local education bureau commanded primary schools to set up tutorial courses every weekday afternoon. In the tutorials, students could do

exercises, complete after-class assignments, and ask their teachers for help when they met with difficulties. Teachers were able to help students check assignments during tutoring and determine students' mastery of knowledge. During the pandemic, however, the place where students learn and absorb knowledge were moved from school to home, which led to teachers being unable to conduct on-site guidance and supervision with students. Teachers were unable to surveil students in the completion of their assignments on time and had to create new rules to motivate students to finish exercises carefully at home and encourage parents to play a supervisory role in students' online learning. For example, the teachers created a series of new forms to perform tasks. The students were asked to draw mind maps and record short videos to inspire their interests and build parent-child companionship. Groups led by excellent students were established to achieve self-monitoring, self-organization, and mutual progress among students. Excellent work was exhibited to parents in the WeChat Official Account of primary school and QQ groups (Figure 7) to motivate parents to supervise students in completing tasks seriously and actively. In addition, the teachers adopted online testing by using WenJuanXing, a platform that was used for data collection for scientific research before the pandemic. Ms. Z, a Chinese teacher, recalled the challenges of online teaching during the pandemic:

"Online teaching extremely differs from previous on-site learning in school. In the past, we had a lot of time to guide students face-to-face to do exercises in school, and we could know about common problems. I was unable to take the same approach when conducting online teaching as in the offline classroom. Each online course was only 20 minutes. It was difficult to do exercises during this period. We had to assign some tasks. However, many students could not submit their assignments on time for various reasons. For instance, children in lower grades were unable to operate on a laptop."



Figure 7 - Online assignment exhibition

Teacher X described her experiences of online teaching as follows:

"I divided the students into several groups. The members supervised each other to complete and submit assignments on time. Then, excellent assignments were exhibited in the class QQ group and listed on the honor list. Students could gain a sense of honor and a sense of achievement. As a result, they all finished their tasks actively and earnestly. This approach also encouraged parents to actively participate in monitoring and assisting students in finishing online learning at home."

The roles and responsibilities of parents also changed. They were required to actively participate in assisting their children in learning online effectively and were indispensable in assisting teachers to create new educational rules and facilitating communication between students and teachers. Parents were actively motivated by the teachers to establish detailed

rules and schedules to help children learn online and assist them in developing self-directed learning habits. Mr. C, a fifth-grade primary school student's father, described,

"At the beginning, my kid always wanted to play on a laptop or an iPad and was unable to concentrate on the online courses. The teacher suggested that I set up some rules for him. I set out the same schedule as before [the pandemic], including the time to get up, wash, and attend online courses. In addition, I checked my kid's assignments and listed some additional exercises for him if he had leisure time."

Mrs. L, a mother of a first-grade primary school student, shared her experience:

"I am happy to see that my son's assignments are excellent and receive commendations. Thus, I try my best to help with his learning. I communicated more closely with the teachers to give feedback to them about my son's learning at home and seek advice for facilitating his online learning. I read a series of e-articles about how to help children study from education apps, such as XiaoHeiBan, a popular software for family-school communication and management."

ZX, a second-grade primary school student, described his gains through online learning as follows:

"Through online learning, I have learned many things. First, I learn to use a laptop, such as typewriting, searching for information on websites, and running a variety of software. Second, I have more self-discipline than before. In the past, I often wanted to play when I saw my iPad. But now, I always want to finish the task assigned by my teachers as soon as possible. Third, I felt very happy when my mother told me that my assignment was listed in the excellent tasks."

The analysis of the resource activities in the coordination stage of online education indicates that coordinated interaction among participants within an organization is the last step of the resource bricolage process in transiting from offline to online in a health crisis. Coordinating interaction among participants within an organization means establishing new routines and rules and cooperating with stakeholders through online platforms to achieve optimum operational efficiency. After the first two steps, resources for online activities have been found. Organizations are already able to perform online activities. However, performance is still unsatisfactory due to a lack of new coordinated routines and cooperation among various stakeholders (Bryson & Andres, 2020). The establishment of routines requires organizations to coordinate interaction (Iivari et al., 2020; Venkatesh, 2020) through a period of trials. To achieve coordination and improve online operation performance, organizations can provide novel incentives and supervisory measures and take online platforms, such as social media and online communities, as the platform to present excellent work results (Bromberg et al., 2013). For instance, the teachers in this study established a new incentive to exhibit excellent assignments in the WeChat Official Account of their school. Parents were motivated to participate in online learning activities and assist teachers in achieving a supervisory role in student learning. Coordination among teachers, students, and parents allowed the formation of new routines for online learning.

Discussion

This study examines organizations and their rapid transition from offline to online in a health crisis. We conducted a case study of two primary schools and explored their activities in switching from offline education to online education during COVID-19. In detail, we investigated the resource bricolage actions executed by the stakeholders of the schools, i.e., the teachers, students, and parents, in the period of the sudden switch from offline to online

education. This study reveals a sequential three-step resource bricolage process, as well as the resource bricolage behavior and domains. Our findings develop the context of crisis response from focusing on rescuing victims to focusing on how organizations leverage digital resources to maintain operations. This study has both theoretical and practical implications for health crisis response in IS studies.

First, this study reveals an approach for conducting digital resource bricolage to urgently transit from offline to online, to maintain essential operations during an emergent global health crisis. Previous IS studies of crisis response have paid more attention to natural disasters, and findings emphasize rescuing victims during natural disasters by utilizing external resources (Tim et al., 2017; Pan et al., 2012). However, the response to health crises differs from that to natural disasters. In addition to healing the sick, health crisis response also underlines the importance of maintaining organizational operations (Papagiannidis et al., 2020; Wang et al., 2020). Although prior IS research indicates that digital resources can support organizations to switch from offline to online, to maintain essential operations during a health crisis (Pan et al., 2020; Papagiannidis et al., 2020). They had little explanation of how organizations utilize digital resources to transit from offline to online during health crises.

This study identifies digital resource-focused resource bricolage as a primary tool to enable organizations to rapidly switch from offline to online and maintain an essential operation. We develop a sequential three-step process model. The three steps are redeploying digital resource functions, combining digital and non-digital resources, and coordinating interaction among participants, respectively. The first step supports organizations to rapidly launch online activities and coordinate information during an emergent health crisis. The second step complements the first step by improving the functions and performance of online activities implemented in the first step. The third step aims to coordinate separated online activities formed in the first two steps and develop routines.

Specifically, each of three steps respectively plays an important role to facilitate organizations switch from offline to online. First, redeploying digital resource functions enables organizations to generate a basic platform to perform online activities. Existing studies explored the efficient organization and distribution of relief resources supported by digital technologies. Our findings indicate that exploring and adapting to the new functions of existing digital resources to create something from nothing is essential to cope with the lack of resources due to unpreparedness and the emergent nature of a health crisis. Second, combining digital and non-digital resources improves existing resources to achieve critical functions that traditional tools cannot perform. Previous IS studies focused on coordinating rescue resources enabled by digital resources (Pan et al., 2012; Tim et al., 2017). This study reveals that achieving continuous organization operations deals with social distancing during health crises by bundling digital resources with other resources. Third, coordinating interaction among participants enables multiple stakeholders within organizations to act concertedly to perform online activities through efficiently forming new routines. Prior research reported that rescue organizations, such as governments, agencies, and communities, played the important role of focal actors that commanded disaster relief actions. Our findings indicate that establishing new routines and rules and motivating cooperation among stakeholders, which are executed on the online platforms, are essential for switching offline to online during health crises.

Second, by elucidating the three-step resource bricolage process, this study further contributes to the literature on resource bricolage. The first one is the development of digital resource-focused resource bricolage by expanding existing resource bricolage behavior and domain. In detail, our findings identify new resource bricolage behaviors, i.e., adapting, stretching, establishing, and cooperating, and new resource bricolage domains, i.e., online software applications, digital hardware equipment, mixed-media resources, and online platforms.

The other one is expanding the context of resource bricolage. We examined the resource bricolage process in a crisis context. Existing studies have investigated resource bricolage in the fields of entrepreneurship (Bacq et al., 2015; Desa & Basu, 2013; Fisher, 2012) and innovation (Hota et al., 2019; Senyard et al., 2014; Witell et al., 2017). Resource bricolage is adopted in the context of resource constraints. To support entrepreneurship or innovation, focal firms can utilize the resources of adjacent people and organizations. For instance, social capital has been recognized as a critical factor in resource bricolage studies (Bacq et al., 2015). In contrast, the context of health crises differs from those in entrepreneurship and innovation. During a health crisis, organizations can merely utilize resources that they already possess. Accessing novel resources from others, even for organizations with substantial social capital, is difficult due to social distancing and the shutdown of businesses. The context of a health crisis places greater restrictions on resource bricolage, and thus resource bricolage during a health crisis has distinct features. First, during a sudden health crisis, organizations must achieve a new purpose by utilizing their own existing resources, which forces organizations to redeploy the functions of existing digital resources rather than introduce new resources from adjacent people. Second, a focal firm acts as a resource bricoleur in entrepreneurship and innovation practices. In contrast, multiple stakeholders within an organization are all bricoleurs. Their resource bricolage activities must be synergized. Therefore, interactions between stakeholders need to be inspired and coordinated. In this study, we identified the coordination of interaction among participants as an essential step of resource bricolage in responding to a health crisis. Resource bricolage in entrepreneurship and innovation may not require the coordination of interaction among participants.

This study also has practical implications. We documented the resource bricolage behavior and domains of two schools in switching to online activities. The sequential three-step resource bricolage process provides organizations with practical references for rapidly switching from offline to online activities during a health crisis. First, in order to conduct online activities for which they were not prepared, organizations need to focus on human-centered, relieving affective anxiety and encouraging members to solve problems. Second, organizations should promote creativity and self-learning to combine digital resources and non-digital resources for achieving novel resource utilization. Third, to coordinate interaction among internal stakeholders, organizations should establish detailed and applicable rules and cultivate the self-management and self-regulated capabilities of organization members.

Conclusion and limitation

This study adopts resource bricolage as a theoretical lens to examine the utilization of digital resources in transiting from offline to online in health crises. More specifically, this study describes an in-depth analysis of how existing digital resources were utilized and organized to enable organizations to cope with resource constraints and achieve continuous operations during health crises. By investigating the sudden transition to online education by two primary schools, this study reveals a three-step resource bricolage process, including redeploying functions of digital resources, combining digital resources and non-digital resources, coordinating interaction among participants, and the corresponding resource bricolage behaviors and domains, to achieve continuous operations during health crises. The three steps are sequential. The first and second step provide essential facilities and tools for online activities, and the third step develops routines for coordinating online activities, which are conducted based on previous steps. In all, our findings address the research question and respond to the IS research call for examining how organizations switch their activities from offline to online during a health crisis.

This study analyzes a case that transited from offline to online to maintain normal operations in a health crisis and thus contributes to the crisis response literature, which attaches more attention to natural disaster responses. In addition, by taking resource bricolage as the

theoretical lens, we identified new resource bricolage behaviors and domains, and expand the context of resource bricolage, to make contribution on the development of resource bricolage perspectives. Nevertheless, we still need to collect and analyze cases of other types of organizations to identify their resource bricolage actions to transit from offline to online during health crises.

Acknowledgments

This work was supported by the National Natural Science Foundation of China [grant number 71972023, 71632004]; the Fundamental Research Funds for the Central Universities [grant number DUT20RW203], the Liaoning Province Social Science Planning Fund Office [grant number L19BSH003], and the National Social Science Fund of China [grant number 16ZDA013].

References

- Abdel-Basset, M., Mohamed, R., Elhoseny, M., & Chang, V. (2020). Evaluation framework for smart disaster response systems in uncertainty environment. *Mechanical Systems and Signal Processing*, 145(11), 106941.
- Agostino, D., Arnaboldi, M., & Lema, M. D. (2021). New development: COVID-19 as an accelerator of digital transformation in public service delivery. *Public Money & Management*, 41(1), 69-72.
- Akter, S., & Wamba, S. F. (2019). Big data and disaster management: A systematic review and agenda for future research. *Annals of Operations Research*, 283(1-2), 939-959.
- Anwar, M., & Clauß, T. (2021). Personality traits and bricolage as drivers of sustainable social responsibility in family SMEs: A COVID-19 perspective. *Business and Society Review*, 126(1), 37-68.
- Bacq, S., Ofstein, L. F., Kickul, J. R., & Gundry, L. K. (2015). Bricolage in social entrepreneurship how creative resource mobilization fosters greater social impact. *International Journal of Entrepreneurship & Innovation*, 16(4), 283-289.
- Baker, T., & Nelson, R. E. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, 50(3), 329-366.
- Bao, W. (2020). COVID and online teaching in higher education: A case study of Peking university. *Human Behavior and Emerging Technologies*, 2(2), 113-115.
- Bromberg, N. R., Techatassanasoontorn, A. A., & Andrade, A. D. (2013). Engaging students: Digital storytelling in information systems learning. *Pacific Asia Journal of the Association for Information Systems*, 5(1), 1-22.
- Bryson, J. R., & Andres, L. (2020). COVID-19 and rapid adoption and improvisation of online teaching: Curating resources for extensive versus intensive online learning experiences. *Journal of Geography in Higher Education*, 44(4), 608-623.
- Chan, C. M. L., Hackney, R., Pan, S. L., & Chou, T. C. (2011). Managing e-government system implementation: A resource enactment perspective. *European Journal of Information Systems*, 20(5), 529-541.
- De, R., Pandey, N., & Pal, A. (2020). Impact of digital surge during COVID-19 pandemic: A viewpoint on research and practice. *International Journal of Information Management*, 55(6), 102171.

- Desa, G., & Basu, S. (2013). Optimization or bricolage? Overcoming resource constraints in global social entrepreneurship. *Strategic Entrepreneurship Journal*, 7(1), 26-49.
- Devadoss, P. R., Pan, S. L., & Singh, S. (2005). Managing knowledge integration in a national health-care crisis: Lessons learned from combating SARS in Singapore. *International Conference of The IEEE Engineering in Medicine and Biology Society*, 9(2), 266-275.
- Doyle, R., & Conboy, K. (2020). The role of IS in the covid-19 pandemic: A liquid-modern perspective. *International Journal of Information Management*, 55(6), 102184.
- Du, W. D., & Mao, J. Y. (2018). Developing and maintaining clients' trust through institutional mechanisms in online service markets for digital entrepreneurs: A process model. *The Journal of Strategic Information Systems*, 27(4), 296-310.
- Du, W. D., Pan, S. L., Leidner, D. E., & Ying, W. (2019). Affordances, experimentation and actualization of FinTech: A blockchain implementation study. *The Journal of Strategic Information Systems*, 28(1), 50-65.
- Fisher, G. (2012). Effectuation, causation, and bricolage: A behavioral comparison of emerging theories in entrepreneurship research. *Entrepreneurship Theory and Practice*, 36(5), 1019-1051.
- Guo, J., Liu, N., Wu, Y., & Zhang, C. (2021). Why do citizens participate on government social media accounts during crises? A civic voluntarism perspective. *Information & Management*, 58(1), 103286.
- Halpern, N.A., & Tan, K.S. (2020). United states resource availability for covid-19. *Society of Critical Care Medicine*. Retrieved from <https://www.sccm.org/getattachment/Blog/March-2020/United-States-Resource-Availability-for-COVID-19/United-States-Resource-Availability-for-COVID-19.pdf>.
- He, W., Zhang J., & Li W. (2021). Information technology solutions, challenges, and suggestions for tackling the COVID-19 pandemic. *International Journal of Information Management*, 57(2), 102287.
- Hota, P. K., Mitra, S., & Qureshi, I. (2019). Adopting bricolage to overcome resource constraints: The case of social enterprises in rural India. *Management and Organization Review*, 15(2), 371-402.
- Iivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life – How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care. *International Journal of Information Management*, 55(6), 102183.
- Isaac, O., Aldholay, A., Abdullah, Z., & Ramayah, T. (2019). Online learning usage within Yemeni higher education: The role of compatibility and task-technology-fit as mediating variables in the IS success model. *Computers & Education*, 136, 113-129.
- Janssen, F., Fayolle, A., & Wuillaume, A. (2018). Researching bricolage in social entrepreneurship. *Entrepreneurship and Regional Development*, 30(3-4), 450-470.
- Jeff, V., Doan, W., Debra, M., Dougan, W. L., & James, B. (2011). Varieties of bricolage and the process of entrepreneurship. *New England Journal of Entrepreneurship*, 14(2), 53-66.
- Jin, Y. Q., Lin, C. L., Zhao, Q., Yu, S. W., & Su, Y. S. (2021). A study on traditional teaching method transferring to e-learning under the COVID-19 pandemic: From Chinese students' perspectives. *Frontiers in Psychology*, 12, 632787.
- Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Reyes, C. A. M., Prochotta, A., Steinbrink, K.M., & Berger, E. S. (2020). Startups in times of crisis—A rapid response to the COVID-19 pandemic. *Journal of Business Venturing Insights*, 13, e00169.

- Kumar, K., Kumar, N., & Shah, R. (2020). Role of IoT to avoid spreading of COVID-19. *International Journal of Intelligent Networks*, 1(1), 32-35.
- Kummitha, R. K. R. (2020). Smart technologies for fighting pandemics: The techno- and human-driven approaches in controlling the virus transmission. *Government Information Quarterly*, 37(3), 101481.
- Leidner, D. E., Pan, G., & Pan, S. L. (2009). The role of IT in crisis response: Lessons from the SARS and Asian Tsunami disasters. *Journal of Strategic Information Systems*, 18(2), 80-99.
- Leong, C. M. L., Pan, S. L., Ractham, P., & Kaewkitipong, L. (2015). ICT-enabled community empowerment in crisis response: Social media in Thailand flooding 2011. *Journal of the Association for Information Systems*, 16(3), 174-212.
- Lévi-Strauss, C. (1967). *The Savage Mind*. University of Chicago Press: Chicago.
- Lily, A. A. (2020). Distance education as a response to pandemics: Coronavirus in Arab countries. *Technology in Society*, 63(4), 101317.
- Linna, P. (2013). Bricolage as a means of innovating in a resource-scarce environment: A study of innovator-entrepreneurs at the BOP. *Journal of Developmental Entrepreneurship*, 18(3), 1-23.
- Liu, X., Zhou, Y. W., Shen, Y., Ge, C., & Jiang, J. (2021). Zooming in the impacts of merchants' participation in transformation from online flash sale to mixed sale e-commerce platform. *Information & Management*, 58(2), 103409.
- Marx, J., Mirbabaie, M., & Ehnis, C. (2018). Sense-giving strategies of media organisations in social media disaster communication: Findings from Hurricane Harvey. In *Australasian Conference on Information Systems*, Sydney.
- Mason, J. (2020). At-home learning resources for the covid-19 outbreak. *familyeducation*. Retrieved from <https://www.familyeducation.com/at-home-learning-resources-for-the-covid-19-outbreak>.
- Miao, Q., Schwarz, S., & Schwarz, G. (2021). Responding to COVID-19: Community volunteerism and coproduction in China. *World Development*, 137(1), 105128.
- Mirbabaie, M., & Zapatka, E. (2017). Sensemaking in social media crisis communication – A case study on the Brussels bombings in 2016. In *European Conference on Information Systems*.
- Nan, N., & Lu, Y. (2014). Harnessing the power of self-organization in an online community during organizational crisis. *MIS Quarterly*, 38(4), 1135-1158.
- Palen, L., & Hughes, A. L. (2017). Social media in disaster communication. In H. Rodríguez, W. Donner & J. E. Trainor (Eds), *Handbook of Disaster Research* (pp.497-518). Berlin, Germany: Springer.
- Pan, S. L., Cui, M., & Qian, J. (2020). Information resource orchestration during the COVID-19 pandemic: A study of community lockdowns in China. *International Journal of Information Management*, 54(5), 102143.
- Pan, S. L., Pan, G. S., & Leidner, D. E. (2012). Crisis response information networks. *Journal of the Association for Information Systems*, 13(1), 31-56.
- Pan, S. L., & Tan, B. (2011). Demystifying case research: A structured–pragmatic–situational (SPS) approach to conducting case studies. *Information & Organization*, 21(3), 161-176.
- Pang, N., Karanasios, S., & Anwar, M. (2019). Exploring the information worlds of older persons during disasters. *Journal of the Association for Information Science and Technology*, 71(6), 619-631.

- Papagiannidis, S., Harris, J., & Morton, D. (2020). WHO led the digital transformation of your company? A reflection of IT related challenges during the pandemic. *International Journal of Information Management*, 55, 102166.
- Pee, L. G., Pan, S. L., Wang, J., & Wu, J. (2021). Designing for the future in the age of pandemics: A future-ready design research (FRDR) process. *European Journal of Information Systems*, 30(2), 157-175.
- Richter, A. (2020). Locked-down digital work. *International Journal of Information Management*, 55(6), 102157
- Roshan, M., Warren, M., & Carr, R. (2016). Understanding the use of social media by organisations for crisis communication. *Computers in Human Behavior*, 63, 350-361.
- Senyard, J., Baker, T., Steffens, P., & Davidsson, P. (2014). Bricolage as a path to innovativeness for resource-constrained new firms. *Journal of Product Innovation Management*, 31(2), 211-230.
- Sipior, J. C. (2020). Considerations for development and use of AI in response to COVID-19. *International Journal of Information Management*, 55(6), 102170.
- Standaert, W., Muylle, S., & Basu, A. (2021). How shall we meet? Understanding the importance of meeting mode capabilities for different meeting objectives. *Information & Management*, 58(1), 103393.
- Stieglitz, S., Mirbabaie, M., Ross, B., & Neuberger, C. (2018). Social media analytics-Challenges in topic discovery, data collection, and data preparation. *International Journal of Information Management*, 39(2), 156-168.
- Stone, J. T., Waldman, S., & Yumagulova, L. (2019). Filling the gaps: The potential and limitations of emergent, ICT-enabled organisation in disaster- A case study of the Cajun Army. *Environmental Hazards*, 1, 1-15.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.
- Sun, Y., Liu, D., Chen, S., Wu, X., Shen, X. L., & Zhang, X. (2017). Understanding users' switching behavior of mobile instant messaging applications: An empirical study from the perspective of push-pull-mooring framework. *Computers in Human Behavior*, 75, 727-738.
- Taghipour, A., & Merimi, M. (2021). Digital Transformation of Supply Chains during Crisis: COVID-19. In *11th Annual International Conference on Industrial Engineering and Operations Management, IEOM 2021* (pp. 7493-7501).
- Tierney, K. (2003). Disaster beliefs and institutional interests: Recycling disaster myths in the aftermath of 9-11. In L. Clarke (Eds), *Terrorism and disaster: New threats, new ideas* (pp. 33-51). Bingley, United Kingdom: Emerald Group Publishing Limited.
- Tim, Y., Pan, S. L., Bahri, S., & Fauzi, A. (2018). Digitally enabled affordances for community-driven environmental movement in rural Malaysia. *Information Systems Journal*, 28(1), 48-75.
- Tim, Y., Pan, S. L., Ractham, P, & Kaewkitipong, L. (2017). Digitally enabled disaster response: The emergence of social media as boundary objects in a flooding disaster. *Information Systems Journal*, 27(2), 197-232.
- Tsilika, T., Kakouris, A., Apostolopoulos, N., & Dermatis, Z. (2020). Entrepreneurial bricolage in the aftermath of a shock. Insights from Greek SMEs. *Journal of Small Business & Entrepreneurship*, 32(6), 635-652.
- Venkatesh, V. (2020). Impacts of COVID-19: A research agenda to support people in their fight. *International Journal of Information Management*, 55(6), 102197.

- Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems*, 4(2), 74-81.
- Wang, Y., Hong, A., Li, X., & Gao, J. (2020). Marketing innovations during a global crisis: A study of China firms' response to COVID-19. *Journal of Business Research*, 116, 214-220.
- Witell, L., Gebauer, H., Jaakkola, E., Hammedi, W., Patricio, L., & Perks, H. (2017). A bricolage perspective on service innovation. *Journal of Business Research*, 79(10), 290-298.
- Yu, X. Y., Li, Y. J., Chen, D. Q., Meng, X. T., & Tao, X. M. (2019). Entrepreneurial bricolage and online store performance in emerging economies. *Electronic Markets*, 29(2), 167-185.

Appendix: List of interviewee information

School SY				
Position/department	Number	Main roles	Duration of the interview	Interview questions
Vice principal	1	Management of the school's teaching, curriculum teaching and research, educational affairs, and teacher training.	50-60 min	◆ Interview questions for vice principal and directors: <ul style="list-style-type: none"> • Could you please introduce your daily work? • How did you do at the beginning of COVID-19? • What online teaching resources did you utilize during the pandemic? • Did relevant requirements or standards (such as the syllabus), differ from the previous offline teaching during online teaching? • What challenges did you encounter in carrying out online teaching? How did you cope with it?
Guidance director	1	Teaching administration of primary grade and teaching management of mathematics teaching group.	60-90 min	
Director of the information department	1	Technical support in online teaching.	60-90 min	
Group leader of teaching and research	2	<ul style="list-style-type: none"> ◆ Group leader of Mathematics: Mathematics teaching and research in the primary grades (grades of 1-3) and math teaching for two classes. ◆ Group leader of Chinese: Chinese teaching management of the fifth grade, class teacher work, and recording online Chinese courses in JA District Education Bureau. 	60 min	
Course teacher	5	<ul style="list-style-type: none"> ◆ IT course teacher ◆ Chinese teacher of grade two ◆ Chinese teacher of grade five ◆ Math teacher of grade two ◆ English teacher of grade six 	60 min 60 min 60 min 60 min	◆ Interview questions for group leaders and teachers: <ul style="list-style-type: none"> • Could you please introduce your daily work? • What online teaching tools did you use in online teaching? • What did online teaching differ from on-site teaching? How did you conduct online teaching? • What resources did you use in online teaching? • How did you use existing teaching resources? On this basis, do you arrange the teaching order according to the original knowledge layout? Are teaching resources adjusted, and how? • How did you interact with students? • How did you communicate with student parents? What difficulties did you meet in the process of communication? How did you do to deal with difficulties?

Online education platform personnel	1	Operations and maintenances of the platform, technical training for teachers, demand docking between the school and the platform.	60 min	<ul style="list-style-type: none"> • What difficulties did you encounter in online teaching? How did you solve these difficulties? ◆ Interview questions for online education platform personnel: <ul style="list-style-type: none"> • Could you please introduce your daily work? • Could you please introduce your platforms, such as functions, modules, and contents? • What services did you provide to online education during the pandemic? ◆ Interview questions for students: <ul style="list-style-type: none"> • Could you please introduce yourself? • What did online classes differ from offline classes? • How did you interact with your teachers? • What difficulties did you meet in online learning? And how did you do to solve problems? • What did you obtain through online learning? ◆ Interview questions for student parents: <ul style="list-style-type: none"> • How did you do to support your child in learning online? • What did online classes differ from offline classes? • What challenges did you meet during online learning? How did you do? • Are you satisfied with online education? What are the advantages and disadvantages of online learning for children?
Students	3	◆ A student in grade two	30 min	
		◆ A student in grade two	30 min	
		◆ A student in grade five	30 min	
Parents	3	Three parents of the above students	30-60 min (per person)	

School DX				
Position/department	Number	Main roles	Duration of the interview	Interview questions
Vice principal	1	Management of the whole school's teaching, curriculum teaching and research, teacher training, and moral education management.	50-60 min	◆ Interview questions for vice principal and directors: <ul style="list-style-type: none"> • Could you please introduce your daily work? • How did you do at the beginning of COVID-19? • What online teaching resources did you utilize during the pandemic? • Did relevant requirements or standards (such as the syllabus), differ from the previous offline teaching during online teaching? • What challenges did you encounter in carrying out online teaching? How did you cope with it?
Guidance director	1	Implementation and supervision of teaching work.	60-90 min	
Director of the information department	1	Technical support and training in course recording and online teaching.	60-90 min	
Group leader of teaching and research	2	◆ Group leader of Mathematics: Math teaching research management of senior grade (grades of 4-6) in primary school, curriculum coordination, activity planning, and document-making.	60 min	◆ Interview questions for group leaders and teachers: <ul style="list-style-type: none"> • Could you please introduce your daily work? • What online teaching tools did you use in online teaching? • What did online teaching differ from on-site teaching? How did you conduct online teaching? • What resources did you use in online teaching? • How did you use existing teaching resources? On this basis, do you arrange the teaching order according to the original knowledge layout? Are teaching resources adjusted, and how? • How did you interact with students? • How did you communicate with student parents? What difficulties did you meet in the process of communication? How did you do to deal with difficulties? • What difficulties did you encounter in online teaching? How did you solve these difficulties?
		◆ Group leader of Chinese: Chinese teaching management of the sixth grade, class teacher work, and weekly Chinese teaching arrangement and summary.	60 min	
Course teacher	5	◆ IT course teacher	60 min	
		◆ Chinese teacher of grade two	60 min	
		◆ Chinese teacher of grade one	60 min	
		◆ English teacher of grade five	60 min	
		◆ Psychology teacher	60 min	

Online education platform personnel	1	Optimization and upgradation of platform functions according to requirements, and technical guidance and training for teachers.	60 min	<p>◆ Interview questions for online education platform personnel:</p> <ul style="list-style-type: none"> • Could you please introduce your daily work? • Could you please introduce your platforms, such as functions, modules, and contents? • What services did you provide to online education during the pandemic?
Students	3	◆ A student in grade one	30 min	<p>◆ Interview questions for students:</p> <ul style="list-style-type: none"> • Could you please introduce yourself? • What did online classes differ from offline classes? • How did you interact with your teachers? • What difficulties did you meet in online learning? And how did you do to solve problems? • What did you obtain through online learning? <p>◆ Interview questions for student parents:</p> <ul style="list-style-type: none"> • How did you do to support and assist your child in learning online? • What did online classes differ from offline classes? • What challenges did you meet during online learning? How did you do? • Are you satisfied with online education? What are the advantages and disadvantages of online learning for children?
		◆ A student in grade two	30 min	
		◆ A student in grade five	30 min	
Parents	3	Three parents of the above students	30-60 min (per person)	

Education Bureau				
Position/department	Number	Main roles	Duration of the interview	Interview questions
Officer of JH District Education City Bureau	1	Guidance and management of the teaching work, curriculum development of JH District school, supervision and management of curriculum quality, online curriculum resource development and management.	90 min	<p>◆ Interview questions for education bureau officer:</p> <ul style="list-style-type: none"> • Could you please introduce your daily work? • How did you do at the beginning of COVID-19? • What measures did you carry out to support online education? • Could you please exhibit your online education platform, i.e., Education Cloud?

About the Authors

Miao Cui is a professor in School of Economics and Management, Dalian University of Technology. Her research interests mainly include digital transformation and innovation management, digital community management and electronic commerce. Her research is based on qualitative case study. Her work has been published or is forthcoming in Information Systems Journal, International Journal of Information Management, Information & Management, the Journal of Strategic Information Systems, and International Journal of Electronic Commerce.

Jinfang Qian is a PhD student in School of Economics and Management, Dalian University of Technology. Her research interests mainly include digital transformation and electronic commerce, which are based on qualitative case study. Her work has been published in International Journal of Information Management.

Xin Dai is a professor in School of Management, Huazhong University of Science and Technology. He received his Ph.D. degree in management from the School of Management, Huazhong University of Science and Technology in 2005. His research interests include new media marketing, digital enabling and change management. He has published papers in Journal of Business Research.

Mengjun Liu is an associate professor at department of Educational Technology of Hubei University PRC. He received his Ph.D. degree in computer science (Information Security) from the school of computer, Wuhan University in 2016. His research interests include educational data mining, application of Artificial Intelligence in Education, educational data security and privacy.

Copyright © 2021 by the Association for Information Systems. Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and full citation on the first page. Copyright for components of this work owned by others than the Association for Information Systems must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists requires prior specific permission and/or fee. Request permission to publish from: AIS Administrative Office, P.O. Box 2712 Atlanta, GA, 30301-2712 Attn: Reprints, or via email from publications@aisnet.org.