

Teachers' Communities of Practice in Response to the COVID-19 Pandemic: Will Innovation in Teaching Practices Persist and Prosper?

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Abstract

This study explores how teachers' communities of practice facilitated the transition to emergency remote teaching after school closures in South Korea during the coronavirus disease 2019 (COVID-19) pandemic. We also investigate whether and how teachers' online education experiences in times of crisis continue to influence face-to-face teaching practices. We first conducted a literature review on teachers building communities of practice to cope with the pandemic and their execution of emergency remote teaching with collective professionalism. Five experienced teachers from elementary and middle schools participated in a semi-structured interview to share their experiences since the outbreak of COVID-19 until Spring 2022. We found that in response to significant pandemic-related challenges, teachers rapidly adapted to the digital educational environment, with assistance from their peers, through online and offline learning communities. Moreover, teachers' online education experiences have contributed to innovative teaching practices with technological integration. We present the implications for teacher education research and practice in the post-COVID-19 era.

Keywords: community of practice, professional learning community, emergency remote teaching, COVID-19, online education, collaboration

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic abruptly impacted schools and disrupted education in South Korea, causing school closures and delayed openings (Ministry of Education, 2021). With the help of digital technology, school-based education underwent a radical transition during the pandemic, shifting from traditional classroom instruction to a digital environment. Teachers were faced with the unanticipated and urgent transformation of teaching methods from conducting face-to-face classes to emergency remote teaching (ERT)—an alternative approach to instruction due to crisis (Hodges, Moore, Lockee, Trust, & Bond, 2020). Without previous experience in ERT, most teachers were hindered by several factors during the pandemic, such as inadequate digital skills, a lack of technology integration in a remote context, insufficient digital infrastructure in schools and homes, insufficient online learning resources, and government restrictions, including social distancing or school closures. Despite the pandemic, teachers were obligated to continue teaching their students, even with a lack of readiness or a systematic teaching and learning approach.

To ensure learning continuity for the country's 5.34 million students, the Korean government decided to conduct online education in elementary, middle, and high schools beginning April 9th, 2020 after the resumption of classes was repeatedly delayed (Ministry of Education, 2021). With upgraded infrastructure and a critical national education system to enable online education, the government also encouraged teachers to share educational resources and information with their peers. The official provision of online education was conducted through pilot schools, teacher support websites (e.g., School-On and Teacher-On), and the "Community of 10,000 Representative Teachers" (Ministry of Education, 2021), which are communication platforms for sharing teaching information, programs, and

best practices. While the government was quick to respond to the impact of COVID-19 on education by providing a sustainable solution, there was confusion among teachers in charge of classes and curriculum management. The confusion was due to media announcements of changes in scheduling and teaching methods before official notices were even sent to schools. There was also a lack of learning content and teachers did not have sufficient experience in conducting online education with the appropriate software and hardware for each subject (Cho, Kwon, & Yang, 2020; Jeong, 2020; Kim, 2020; Yang, Cho, & Yoo, 2020).

To overcome these difficulties and challenges in online education, teachers autonomously organized communities of practice or professional learning communities. In this study, we use the terms “community of practice” and “professional learning community” interchangeably, although they have similarities and differences in definition and focus (Blankenship & Ruona, 2007). Professional learning communities in Korea have been promoted since the 2010s, with the advent of the progressive school change movement, referred to as *Hyukshin* schools (Sung & Lee, 2018). Although teachers’ learning communities have been widely studied in Korea for about a decade, their usefulness or effectiveness in practice are not supported by enough large-scale evidence.

The COVID-19 pandemic has provided an opportunity for teachers’ learning communities to work effectively in practice. Communities of practice have mostly operated within or outside teachers’ own schools, promoting the exchange of information regarding the implementation of online education (Che & Lee, 2020; Cho et al., 2020; Lee, 2020; Son & Lee, 2020; Yang et al., 2020). Teachers’ learning communities were organized both online and offline according to subject, grade-level, or school. Teachers could use them to share information with colleagues, learn digital skills and the tools available to operate online education platforms, and effectively interact with students online throughout the pandemic.

In this study, we explore how teachers’ communities of practice facilitated the exchange of knowledge and skills in using digital technologies for online education during the transition to ERT. We then investigate whether and how teachers’ online education experiences during the pandemic continue to influence face-to-face teaching practices. After reviewing prior literature and conducting a qualitative analysis of interviews with five teachers, we present the findings and suggest implications for teacher education research and practice in the post-COVID-19 era.

2. Literature Review

During the early days of COVID-19, teachers were expected to shift to online education according to the government’s mandate. However, as they were expected to adapt quickly, they could not thoroughly prepare and develop the professional skills necessary to adopt a new form of teaching when classes resumed online. Importantly, they needed to be familiar with new teaching methods, learn how to use digital technologies more effectively for teaching and learning, and adapt their teaching techniques to a changing educational environment (Lawless & Pellegrino, 2007). However, the inadequate integration of digital technologies in online education may lead to underperformance by teachers. Therefore, for successful technology integration and practical teaching and learning, it was necessary to attain technological pedagogical content knowledge (TPACK). TPACK is a form of theorized knowledge that emerged as teachers combined their technological, pedagogical, and content knowledge in teaching using digital technologies (Mishra & Koehler, 2006).

Engagement in a community of practice helps teachers rapidly enhance their knowledge and skills for online education. A community of practice is a group of people who share a concern for something they do and interact with others to learn how to do it better (Lave & Wenger, 1991; Wenger, 1998). As a practice-centered approach, a community of practice assumes that learning is distributed among community members who have diverse expertise and can influence each other with their actions (Buysse, Sparkman, & Wesley, 2003). Members frequently interact with each other (e.g., novices and experts), share information, foster learning, and solve problems. They also mentor apprentices and form collaborations to enhance their skills in formal and informal settings (Buysse et al., 2003; Li et al., 2009). Communities of practice can be an effective method for overcoming the difficulties of integrating technologies in instruction (Hanson-Smith, 2006).

For the past decade, the progressive school reform movement of *Hyukshin* schools in Korea has laid the foundation for teachers’ learning communities to take root (Sung & Lee, 2018). *Hyukshin* schoolteachers have developed a professional learning community, on which they formed a democratic and collaborative school culture (Park & Fang, 2019). Thus, *Hyukshin* schoolteachers are more collaborative as they engage in professional learning communities when confronted with sudden challenges like COVID-19.

Previous studies reported that many teachers organized communities of practice to enhance their knowledge and

skills in conducting online education during the pandemic. It was found that teachers' collective professionalism and capacity-building was facilitated by engaging in such communities during the pandemic (Alsaleh, 2021; Kim et al., 2021; Zaalouk et al., 2021). To understand teachers' experiences in communities of practice during the pandemic in Korea, we reviewed articles reporting the results of elementary and middle school teachers' community activities during school closures and online education in 2020 and 2021. Prior studies described how schools and teachers reacted to the crisis, including external demand for immediate and adaptable responses and implementation, teachers' responsibilities and enthusiasm, working with colleagues to overcome emotional obstacles, sharing teaching practices and information in a remote context, connecting with colleagues and teachers from other schools, and building online and offline communities of practice (Che & Lee, 2020; Cho et al., 2020; Jeong & Youn, 2020; Jeong, 2020; Kim, 2020; Lee, 2020; Lee et al., 2021; Lim & Kwon, 2020; Yang et al., 2020; Yoo, Cho, Yang, & Kwon, 2020; Yun, Choi, & Kim, 2021).

First, teachers were demanded to act immediately and adapt to the changing curriculum to guarantee students' right to learn. The education legislation mandates that primary and secondary schools in Korea must have 190 school days. As public officials, teachers try to ensure the curriculum meets the mandatory number of school days and abides by all the requirements. However, the COVID-19 pandemic raised concerns about the postponement of the curriculum due to a lack of online education preparedness amid school closures. In February 2020, the government allowed schools to shorten the mandatory number of days up to 10% of what was mandated. Further, teachers felt that they had been the driving force behind emergency teaching through their sense of duty and responsibility in guaranteeing students' right to learn. With their lack of online education capabilities during school closures, they agreed to adopt ERT and use online education resources, since traditional in-person instruction was largely impossible. Furthermore, students' right to learn in education law should be guaranteed by schools (Che & Lee, 2020).

Second, teachers accustomed to teaching in the classroom overcame their fear and anxiety of conducting classes fully online with their colleagues (Cho et al., 2020; Yun et al., 2021). Most teachers faced a sudden change in teaching methods and class management without previous experience, instructional plans, content, or platforms. To cope with these constraints, teachers had to act as frontline practitioners in four representative ways: (1) by following guidelines from the local education office, (2) by having discussions with teachers in each subject or those in the same grade-level at school, (3) by communicating with personal networks in other schools, and (4) by engaging in official teacher communities supported by the Ministry of Education or Regional Offices of Education.

Teachers reported experiencing the following emotional states while preparing for and accepting the need to conduct online education during the pandemic: (1) nervousness about their unfamiliarity with online education platforms or content being revealed to their colleagues, students, or parents, and (2) dissatisfaction with being notified of sudden changes by local governments or the Ministry of Education about the status of the pandemic. Notably, in demonstrating their best practices for coping with the situation, senior teachers who were less familiar with online education first shared their knowledge and skills, then made efforts to learn from others, creating a collaborative atmosphere. All teachers promoted online education together during school closures.

Third, teachers promptly organized communities with other teachers unfamiliar with online education, sharing how to plan the curriculum for each subject, apply instructional methods, interact with and receive feedback from students, and evaluate student performance (Lee, 2020). They also actively communicated with other teachers from distant schools to learn and share effective teaching practices (Che & Lee, 2020). Many reports on teacher behavior during the pandemic asserted that most of them had built communities of practice. Predominantly, they aimed to learn how to use or where to find resources for online education due to the urgent need to plan the curriculum and continue teaching.

Fourth, after familiarizing themselves with emergency online education, teachers attempted to innovate their teaching practices and develop professionally (Jeong, 2020; Kim et al., 2021). They applied the newly learned strategies from colleagues and utilized online resources. Teachers' online education experiences seem to have forced them to develop professionally at a faster pace. For in-service teachers, curriculum-based training was replaced by hands-on practice-based learning in communities of practice. Teachers' technology acceptance and integration cannot be quickly enhanced because they need sufficient TPACK for teaching using digital technologies. However, the pandemic shortened the time needed for them to accept and integrate technology in their teaching methods, and their experience appeared to be successful.

3. Methods

3.1 Participants

Five experienced teachers were interviewed for this study—four from elementary schools and one from middle school—who taught at schools located in five different regions in South Korea. They were the main source of information for exploring how teachers coped with the pandemic, and more importantly, the role of teachers' learning communities. Purposive sampling was employed in the interview planning stage. Four participants had more than 20 years of teaching experience. Three worked at Hyukshin schools during the 2020 and 2021 academic years. Table 1 presents the detailed background information of the participants.

Table 1. Participants' Background Information

Participants	School Level	School type	Region	Years of Teaching	Roles
Teacher 1	Elementary	Hyukshin	Gyungsoangnam-do	24	Leader of PLC
Teacher 2	Elementary	General	Incheon	28	Leader of out-of-school PLC
Teacher 3	Elementary	Hyukshin	Chungcheongbuk-do	24	Leader and participants of multiple PLCs
Teacher 4*	Elementary	Hyukshin/General	Seoul	35	Leader of PLC in Hyukshin school/ vice-principal in general school
Teacher 5	Middle	General	Sejong	19	Leader teacher

* Teacher 4 had worked at a Hyukshin school during 2020 and 2021 and moved to a general school in 2022 as vice-principal.

3.2 Data Collection

A literature review on teachers' responses to government decisions and their experiences in implementing online education helped us develop the interview questions. One-on-one semi-structured interviews were conducted online in May of 2022 to fully capture participants' individual experiences during the pandemic. Each interview lasted about one hour. During the interview, follow-up questions and clarifications were raised to the participants to obtain additional information. The interview questions were as follows:

- (1) Recall the start of the 2020 academic year when the COVID-19 pandemic abruptly struck the country. What did you do at the school- and individual teacher-level when the shift to emergency remote teaching was announced by the government?
- (2) In 2021, most schools in Korea provided in-person instruction parallel to online instruction. How did you deal with the in-person and online instruction? How did you carry out blended instruction?
- (3) When you had to switch to online classes, how did you acquire the technological skills, learning content, etc.?
- (4) Do you agree that a professional learning community was an effective strategy for teachers to overcome the pandemic and its challenges? Were there any other strategies?
- (5) How was the professional learning community operated during the COVID-19 crisis? In addition to your own experience, please let us know of other teachers' experiences if you are aware of any.
- (6) As of now in 2022, all schools in Korea fully provide in-person instruction. How is your online teaching experience utilized in the current face-to-face instruction?
- (7) How do you expect your online education experience, knowledge, and skills that were upgraded in the past two years to contribute to the innovation of teaching practices?
- (8) Do you still engage in professional learning communities until now?

3.3 Data Analysis

Our analysis focused on participants' experience of teacher engagement in professional learning communities in response to the COVID-19 crisis. Specifically, we attempted to find answers to the following questions: What did teachers do during the transition to ERT? How did they respond to the urgent demands of online education collectively? What kind of innovative teaching practices did they implement? How did their online education experiences influence in-person instruction? What are the future prospects of teachers' learning communities in the post-COVID-19 era? For data analysis, we read the transcripts repeatedly and used multiple coding cycles (Saldaña, 2015). After conducting open coding, we labeled the information, perceptions, and meanings and grouped similar ones to generate the following key themes: connectivity, collaboration, innovation, and transformation. These themes guided us in answering the research questions.

4. Findings

4.1 Seeking Connectivity in a Remote Context

When teachers were informed that the 2020 academic year would start online due to the pandemic, they began to search for alternative ways to reach students whom they ordinarily met in person. Some made phone calls to students and parents just to make certain of their presence. In this section, participants' names are abbreviated as T1 for Teacher 1, T2 for Teacher 2, and so on.

We wondered how students and parents would feel about not being able to go to school and thought we had to listen to them. So, we made phone calls to each student and parent to let them know of our (teachers') presence (T3).

All schools had to first decide on a communication platform, which they quickly adopted to communicate with students. The government provided three types of online classes: real-time interactive, content-oriented, and task-oriented. In Spring 2020, most public schools opted for content- or task-oriented classes and the participants' experience was no different. In the fall semester of 2020, some public schools, particularly Hyukshin schools, started to employ real-time interactive classes (T1, T3, T4) for reasons ranging from the influence of private schools' advanced provision to teachers' enthusiasm in ensuring student learning.

After a few months of adapting to the digital education environment, teachers in general schools gradually felt comfortable with non-interactive online education because a lecture video and homework sheet were enough to form a class. However, our schoolteachers wanted to make sure that students learn what they should learn. So, we started real-time classes ahead of other public schools (T4).

Faced with an unprecedented transformation to online education in all schools across the country, teachers sought assistance beyond their own school. Teachers who were well-experienced in integrating technology into methods of instruction started to share their know-how and online learning resources. T2 is a representative teacher who uploaded lecture videos using a digital textbook.

I started to think of what teachers would need in this urgent situation. So, I made instructional video clips and uploaded them on my Youtube channel. I had about 1,000 followers in 2020 and 800 were added in 2021. The COVID-19 pandemic gave me a chance to be a content creator (T2).

4.2 Sense of Unity and Collaboration Within a Same-grade Learning Community

The elementary school participants, T1–T4, unanimously agreed on the effectiveness of engaging in a same-grade teacher learning community in school. The teachers' experiences in their community of practice based on grade-level reminded them of the saying "In unity, there is strength."

Hyukshin schools continued to run professional learning communities before the COVID-19 crisis. That is, we were accustomed to meeting regularly with colleagues to revise and reconstruct the curriculum. The COVID-19 pandemic provided a much greater challenge for us to consider online education. We first selected learning content suitable for online education and in-person instruction. Each teacher took charge of specific subjects and created learning content in advance. In our community of practice, we reviewed the content together and enhanced its quality. Thanks to COVID-19, we could create collective intelligence by engaging in the same-grade learning community (T1).

Professional learning communities based on grade-level were very active, not only in Hyukshin schools, but also in general elementary schools where such learning communities were perfunctory before the pandemic. T2, who was a lead teacher for fourth graders at a general elementary school, said that activities in the same-grade community of practice had upgraded the quality of online instruction.

The COVID-19 crisis made us meet more often and discuss learning content and materials. Every teacher had a specialty subject to deal with and there was division of labor. We shared instructional materials and learned technological skills in the same-grade teacher learning community (T2).

I heard teachers, even those in general schools, gathered around the same-grade group, although they did not specifically call it a “learning community.” Moreover, teachers in small-sized schools located in remote areas convened outside their own schools to exchange instructional ideas and know-how (T1).

Schools provided on-site professional development opportunities for teachers who were not prepared for online education (T2, T4, T5). However, the teachers seemed to acquire the knowledge and skills for actualizing online instruction from their peers through hands-on experience in same-grade learning communities. The frequency and intensity of working together there was high enough to make those who engaged in the community feel fulfilled.

We (teachers in the same-grade learning community) met daily, wearing face masks in school. We also met and chatted online to revise learning materials and even reconstructed the curriculum after school. We were extremely busy in preparing for online classes together. It was very, very hard, but we enjoyed learning and growing together (T3).

The crisis necessitated and facilitated distributed leadership in schools. For the same-grade learning community to operate effectively, lead teachers in schools of the same grade must demonstrate leadership.

As an experienced teacher, equipped with technological pedagogical content knowledge, I taught my colleagues in the same grade online education know-how and shared relevant resources. They responded to them quickly and were able to conduct a certain level of online instruction. Before long, most teachers could make lecture videos and got to know how to use online platforms (T2).

We placed the most competent and enthusiastic lead teachers in each grade, and they were the centerpiece of the same-grade learning communities (T4).

4.3 Blended and Individualized Instruction with Technology Integration

Depending on the COVID-19 situation, schools provided online instruction simultaneously with in-person instruction. For example, teachers met students in person two or three days a week and taught online classes for the remaining days. It was natural for teachers to think of which part of the curriculum was better suited for online and offline classes. Teachers made good use of the situation to devise a blended form of instruction.

We selected parts of the curriculum for online instruction and taught them using remote teaching methods. After making students study the content online, we touched upon it in other ways to increase the study effects when they came to school (T1).

Teachers with advanced TPACK implemented individualized teaching and learning in online education. According to T2, it was easy to perform a process-oriented assessment of student performance in online classes.

As for blended instruction, I applied diversified teaching methods even in a real-time interactive online class. It was possible for me to carry out individualized teaching and learning in online classes. For example, instead of conducting lectures for the entire duration of the class, I provided students with tasks after a short lecture. After students finished their work, I gave them individual feedback while other students were still doing their tasks. (T2).

4.4 The Promise and Reality of Future Education

Two years of online education experiences driven by the COVID-19 pandemic have enhanced most teachers' TPACK to a remarkable degree. All participants agreed that they were able to develop their capabilities in conducting online classes and that their peers' capacity to teach, in terms of technology integration, was also greatly enhanced. In this regard, the COVID-19 pandemic could be considered a blessing and opportunity for realizing the future of education within a short period of time.

We still use the platforms. For example, we conduct international exchanges online. This year, we are connected to a Colombian school. My students and Colombian students communicate with each other online using the same application tool. This is a great opportunity for students to develop global citizenship in a practical way (T2).

Another example was the application of the metaverse during class. Advanced teachers who are well-versed in TPACK applied the metaverse in their teaching practices.

My school is a practice school to which student-teachers from colleges of education are sent. With student-teachers, I observed a model class-teaching of a lead teacher who applied the metaverse in his instruction. It was amazing to see students learn using the metaverse with a tablet computer (T4).

As the pandemic gradually subsides, and schools become fully operational, some teachers are likely to revert back to the normal teaching methods used before the pandemic. However, they may not employ the same exact teaching practices they employed in the past.

I see many teachers reverting back to the teaching practices they used in the past as the pandemic comes to an end. However, teachers' online education experiences have remained, and they still make use of their digital know-how in a variety of ways. For example, teachers still use online communication platforms and utilize QR codes to let students know about learning materials (T5).

4.5 Professional Learning Communities in the Post-COVID-19 era

The pandemic certainly facilitated the establishment of teachers' learning communities, without which teachers would hardly be able to overcome the unprecedented challenges they encountered. Will they continue to engage in communities of practice in the absence of external demands? The study participants were very optimistic.

The professional learning community has been very effective in transforming school culture. Particularly in Hyukshin schools, we value and prioritize the professional learning community activities. We all promise to schedule regular meetings where we hold a professional learning community at least weekly (T1).

I run a Youtube channel where I upload online education know-how and broadcast a live stream once a month with my community members. As a leader of an out-of-school teachers' learning community, I will continue to share my own and other teachers' knowledge and skills via online platforms (T2).

I now participate in multiple professional learning communities. In my school, everyone cannot help but learn and grow by engaging in professional learning communities. Even if I leave this school and move to another general school in the future, I am sure I will continue to engage in professional learning communities because I learned how enlightening and inspiring the experiences in learning communities are (T3).

5. Discussion and Implications

Our findings suggest that Korean teachers collectively responded to the COVID-19 crisis by actively engaging in professional learning communities within or out of school, both online and offline. Collaboration was a necessity for teachers to continue teaching and guarantee students' right to learn during the pandemic. As mentioned by Hargreaves and Fullan (2020), the pandemic accelerated collaborative professionalism in places where it already existed, such as in Korea's Hyukshin schools. Even in general schools, teachers voluntarily organized communities of practice to conduct online education because it was impossible for them to face the enormous challenges posed by the pandemic. Thus, most teachers experienced the power of collaboration by engaging in various learning communities, and their knowledge and skills in online education were also enhanced.

With two years worth of online education experience, teachers are now more confident in utilizing technological skills in teaching. Some even attempt to innovate their current face-to-face teaching practices. Although some teachers have reverted to past teaching practices, their teaching methods will not be exactly the same as it was pre-pandemic. Teachers' ability to integrate technology into their teaching practice has already been enhanced. Within a short period of time, Wi-Fi has already been installed in almost all classrooms. Hence, students, parents, principals, and policymakers will have higher expectations about innovative teaching practices. That is, there seems to be sufficient conditions for innovation in teaching practices to persist and prosper. However, innovation cannot immediately happen under such conditions alone. The willingness and enthusiasm of teachers to support innovation through collaborative professionalism is also necessary.

Times of crisis seem to offer an opportunity for the culture of individualism among schoolteachers (Lortie, 1975) to change. Teachers who experienced the inevitability of collaboration in order to overcome the pandemic, recognized the value of community. Once teachers internalize the value of collaboration and collective professionalism in practice, they are likely to diffuse what they learned and consistently commit themselves to collaboration.

The importance of teachers' collaborative approach in overcoming crises and turning them into opportunities for innovative teaching practices offers the following implications. First, pre-service teachers should start engaging in communities of practice on technology integration, including online education, early during their enrollment in teacher preparation programs. Furthermore, pre-service teachers should more holistically and systematically improve their communication and collaboration skills based on courses and curricula. It is necessary that they know how to professionally communicate and work with other teachers to pursue the same goal in their communities.

Second, in-service teacher education curricula for enhancing self-efficacy in using digital technologies should be

reconsidered as an integrated course rather than separate courses. Teachers should enrich their knowledge on how to use e-learning platforms, motivate students when teaching in a remote and blended format, and integrate digital resources in their method of instruction (Almaiah, Al-Khasawneh, & Althunibat, 2020). We are certain that online education is not merely a temporary solution for coping with the COVID-19 pandemic. After COVID-19 ends, traditional teaching in the classroom will not be as useful or effective as before. The demands for online education have risen significantly due to the pandemic, and educators should thus redesign the in-service teacher education curriculum.

Third, the importance of teachers' communities of practice in teacher education cannot be overemphasized; however, they are not included in the curriculum. In schools or local districts, teachers should be able to autonomously build communities of practice and actively keep them operational to achieve their common goals. With the enhancement of curriculum-based knowledge, self-efficacy in implementing technology, and collaboration, teacher educators should promote a better understanding of how to create and manage communities of practice as a leader or member, as well as how to moderate and sustain them.

Fourth, conducting training for the principal as an administrator or a master teacher is essential. Teachers with many years of experience become principals and are likely to have underdeveloped digital competencies relative to the younger generation. Principals in the era of digital transformation should engage in courses that advance their knowledge and skills and help them handle changes in classroom instruction and learning. Some of these include, fostering a culture of innovation utilizing technology, cultivating digital teacher leadership for positive digital outcomes, and enhancing their professional growth by using high-quality digital resources. The principal is a manager who provides administrative, financial, and institutional support for teacher education that should benefit students. Their leadership courses should be reconstructed to focus more on understanding emerging technologies (e.g., artificial intelligence) in education, digital technology integration and its implementation in the curriculum, and blended education.

Amid school closures during the COVID-19 pandemic, online education was inevitable for teachers. Thus, they had to quickly adapt to unexpected changes. Very quickly, teachers had to prepare for remote teaching using digital technologies and change their teaching methods from in-person classes. This unprecedented crisis presents implications for possible future research directions regarding teacher education from a large-scale educational experiment.

First, researchers in teacher education should pay more attention to teachers' acceptance of the unexpected changes of the pandemic. Existing research on teacher professional development has mostly focused on the development of pedagogical content knowledge (Van Driel & Berry, 2012): what and how to teach subject-matter knowledge based on understanding how students learn and the subject matter itself. However, the rate of technological and digital change in our society is faster than ever before. This indicates that traditional education, focusing on knowledge transfer rather than problem-solving skills, creativity, and technological skills (including artificial intelligence), struggles to adapt to such changes. Further, the sudden emergence of the pandemic and school closures accelerated the digital transformation of schools. Consequently, teachers have struggled with limited, professionally-developed affective and behavioral capabilities to adapt to such changes. Teachers' acceptance and adaptation to change is observed in their commitment or passion rather than professionalism, which can be developed in systematic curricula for teacher education. Therefore, it is necessary to study the ways in which teachers' change management capabilities can be developed. It is also important for schools to prepare for upcoming changes and implement relevant plans.

Second, blended education, combining online and offline classroom instruction, will continue at schools, expanding students' learning experiences and providing them with personalized support. To keep up with future changes, students must learn how to collaborate better, innovate, be self-directed, solve problems, and use digital technologies (World Economic Forum, 2016). Thus, it is necessary to study the developmental stages of teachers' professionalism in digital technology integration.

From the literature review, teachers showed the following tentative developmental steps in their digital technology integration: use, familiarity, attempts at application, expansion of usage, and diffusion with colleagues. Furthermore, teachers' emotions at each stage (e.g., anxiety, reluctance, satisfaction, expectation, and commitment) can be studied to develop a consolidative model of their professional development in integrating digital technologies. We could observe the developmental stages and changes in emotional status from teachers' responses in their emergent communities of practice, which would have taken much longer if not for the pandemic. Future studies must elaborate on the tentative stages of teachers' professional development model of integrating digital technologies with empirical evidence in cognitive, affective, and behavioral aspects.

Third, one possible future topic is the effects of peer collaboration or pressure in the adaptation to change stage. Teachers tried new approaches after enduring anxiety and uncertainty from when they were unfamiliar with new education strategies. When teachers attempted to change their instructional approach from in-person to online, they encountered the same problems and tried to solve them. Feeling obligated to prevent deficits in student learning or external pressure forced them to adapt.

Fourth, the adaptation mechanisms of low-performing teachers during the pandemic should be studied in terms of the cases of high-performing teachers having autonomy and acceptance. The gap between low- and high-performing teachers in online education can significantly influence students' learning quality. This gap can be narrowed through better communication between teachers. As a loosely coupled system, the quality of communication between teachers with independent responsibilities in their respective classrooms is important for collaboration, encouragement, and problem-solving.

6. Conclusion

This study examined teachers' adaptation to implementing online education during the COVID-19 pandemic, focusing on the role of teachers' learning communities. The importance of collective professionalism was highlighted, using the case of South Korea. We found that teachers overcame the challenges brought by the pandemic by collaboratively engaging in communities of practice, in line with prior literature. This study contributes to prior research on the importance of teacher collaboration, adding that pandemic-based teaching practices are unlikely to disappear as teachers continue innovating them by participating in communities of practice. We expect future studies to report the long-term effects of the pandemic on teachers and teaching in schools.

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