Chapter 2
How the COVID-19 Pandemic Is Reshaping the Education Service

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Abstract History teaches us that crises reshape society. While it is still uncertain how COVID-19 will reshape our society, the global pandemic is encouraging and accelerating innovation and advancement, especially in the digital sphere. This chapter focuses on the impact of the COVID-19 pandemic on the education service, which is typically classified as a service industry in industrial classifications. Digital transformation in the education sector has attracted significant attention recently. The current education system in Japan is based on a structure that was institutionalized in the industrial age. Although education has seen innovation since then, it is one of the sectors wherein innovation occurs at a slow pace, and therefore, it does not meet the sector's expectations and demands. The COVID-19 pandemic is, however, accelerating digital transformation in education: Not only in Japan, but globally too, educators, students, policymakers, and other role players are now actively undertaking efforts to bring about digital transformation in this sector. This chapter reviews the rapid expansion of digital transformation in the education service and explores, in detail, the two main trends in digital transformation in the education service in Japan. These trends are the expanding of distance education and increasing innovation in educational technologies. The discussion further reflects on prior studies questioning the impact of digital transformation on education; it also anticipates and explores the effects of and concerns about the digital transformation in the education

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[1]The education service is classified as a service industry (e.g. Standard Industrial Classification (SIC) code: 8200 "Services-Educational Services" and North American Industry Classification System (NAICS) code: 61 "Educational Services").

In the Japan Standard Industrial Classification (JSIC), the education service was originally classified under "Division L –Services." Since the scale of the education service was expanding along with the increase in learning opportunities, lifelong learning and leisure time, a new division of "Division O – EDUCATION, LEARNING SUPPORT" was established by separating these fields from "Division L – SERVICES" in 2002. For more information, please see "Summary of Development of the Japan Standard Industrial Classification (JSIC) and Its Thirteenth Revision" by the Ministry of Internal Affairs and Communications (available at https://www.soumu.go.jp/main_content/000316295.pdf).

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service. Finally, the chapter includes a discussion on how to address these concerns and maximize the digital impact. It indicates three concerns of the digital transformation in the education service: (1) poor motivation management, (2) negative effect of IT devices usage in education, (3) educational inequality by digital divide. They can be overcome by changing roles of instructors and further investment in ICT infrastructure in the education service. The discussions in this chapter give insight into how the education service might evolve after the COVID-19 pandemic. The distance education is becoming a new normal in the education service. However, the education community in general is not ready to maximize the merits of distance learning. We need to change the role of instructors from a knowledge teacher to a learning motivator and progress manager. In addition, we need more investment in ICT infrastructure in the education service to enhance educational effects.

Keywords Covid-19 · Digital transformation · Distance learning · Education service · Education technologies

2.1 Introduction

Although crises tend to reshape society, it is still uncertain how the global COVID-19 pandemic will transform our lives. Currently, numerous discussions are taking place across the globe about whether we should prioritize the treatment of the COVID-19 pandemic over the economy. In a short period, many actions and policies have materialized and been implemented across industries in reaction to the pandemic, despite these demanding social adjustments.

This chapter focuses on the impact of the COVID-19 pandemic on the education service in Japan. The education industry is a typical example of a service industry.[1] In Japan, many actions have been set in motion to address the impact of the COVID-19 pandemic.

In an attempt to contain the spread of COVID-19, most governments across the globe decided to temporarily close educational institutions.[2] When Japan closed all its schools in March 2020, many discussions about how the education service should be managed (during and after the pandemic) have taken place. Traditionally, Japan's academic year starts in April (many other countries' academic year starts in September). It has been suggested that Japan's academic year should now start in September too as a measure to manage education. In addition, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) implemented a financial support system for higher education in April 2020, which includes a reduction in tuition fees, waivers, and scholarship provision.[3] Furthermore, students are requesting their schools—in particular private institutions—to lower their tuition fees, because they are not using any school facilities (such as dorms, classrooms,

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[2]Visit UNESCO at https://en.unesco.org/covid19/educationresponse.

[3]MEXT website on the new financial support system (Japanese), available at https://www.mext.go.jp/a_menu/koutou/hutankeigen/index.htm.

and libraries) while they are in isolation at home. Moreover, many students are now facing financial hardship because they lost their part-time jobs or their families' income has decreased.[4] Many students are considering terminating their studies. None of the universities in Japan lowered its tuition fees to accommodate students; instead, some institutions have decided to offer scholarships or grants to give students financial support.

However, these measures and actions will not fundamentally change the education industry in Japan. Ultimately, the acceleration of digital transformation, prompted by the COVID-19 pandemic, will reshape the education service in Japan. In fact, some measures and actions taken during the pandemic might become everyday practice once the spread of the virus has decreased.

The rest of this chapter reviews the digital transformation in the education service, and against the background of prior studies, it includes discussions on the impact and concerns that pertain to these technological changes. Then, this chapter introduces the situation in Japan and anticipates how the education service will be after the COVID-19. Lastly, this chapter concludes with the future of the education service and the author's insight.

2.2 Recent Trends in Education Services: Digital Transformation

The two recent trends in digital transformation in the education industry during the COVID-19 pandemic are the expansion of distance education and the increasing innovations in educational technologies. These trends, accelerated by the educational demands during the pandemic, are discussed below.

2.2.1 Expansion of Distance Education

The COVID-19 pandemic compels educators to explore and implement methods of distance learning on a larger scale than ever before. Although distance education practices were in place before the COVID-19 pandemic, it was uncommon, and most learning activities happened in the classroom. Initially, when Japanese schools were closed in March 2020, most schools postponed their classes for a certain period.

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[4]Free (https://www.free20180913.com/), a student group advocating tuition-free higher education, conducted an online survey (between April 9 and April 27, 2020) on the impact of the COVID-19 pandemic on university students. A total of 1200 university students from 319 universities and colleges responded. Approximately 70% of the respondents indicated that they lost their part-time income, and more than 40% of the respondents' financial supporters had lost their income. Approximately 20% of the respondents are considering terminating their studies due to the COVID-19 pandemic.

When this period was prolonged, these schools initiated distance learning practices that, at that point, were quickly becoming the new standard.

Distance education has a long history (Sumnar 2000); the first attempts at distance learning were made during the nineteenth century[5] when print-based course materials were sent to learners through the postal service. More recently, the second generation of distance education involved a combination of multimedia (such as radio, television, cassette tapes, and CD-ROMs) and print materials. The third generation of distance learning is Internet-based.

The emergence of Internet-based distance learning is attributed to the information revolution. In addition to print materials, course materials are now available in digital format. Today, students can even conduct virtual experiments and simulations with educational software applications. Aside from these differences, third generation distance learning is unlike the first two generations in a fundamental way. The main objective of the first and second generations was to produce and distribute teaching and learning materials to learners. The learning activities were predominantly one-way, and interactivity was supported marginally. Internet-based learning, on the other hand, enables interaction between instructors and students.

Internet-based distance learning can be categorized into two models: recorded online courses and online interactive sessions. The following section reviews these models and their merits in detail.

2.2.1.1 Recorded Online Courses

The use of recorded online courses is primarily made possible by the expansion of the Massive Open Online Course (MOOC). The MOOC is an online educational platform that offers most of its content for free. The MOOC, which is a result of the Kahn Academy on YouTube, offers various courses for, among others, universities, skills and job training institutions, and preschools. Students can select their own courses.

MOOC has many advantages. First, the platform improves learning efficiency by enabling people to learn at their own pace and anywhere. The MOOC even allows learners to customize their learning speed. The traditional education services design curricula to be completed within a certain timeframe (i.e., per semester) and in a classroom. For example, a semester at a Japanese university consists of 15 weeks of classwork. For a standard course, learners and teachers meet once a week for 90 min. In other words, a student must spend 15 weeks to complete a subject and receive the due credits or certificates. MOOC, on the other hand, allows students some flexibility: Students can attend lectures when it suits them and learn at their own pace. A capable student can therefore study intensively and complete a course within a few days.

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[5]According to (Verduin and Clark 1991), Isaac Pitman offered the first recognised correspondence courses in shorthand in 1840 in England.

In addition, the MOOC provides global access, enabling students to choose their course levels and instructors. Traditionally, students must enroll at a specific institution, follow its curricula, and receive instruction from employed teachers; their options are, in other words, limited. At primary and secondary level education, students have almost no alternative options in terms of curricula and instructors. In higher education, the options in terms of curricula and instructors increase: students can enroll at one institution and learn from other institutions too, or use exchange programs and credit transfer systems. Nonetheless, these options are limited to partnered institutions. Aside from this, the preparations and relocation to other regions or countries are costly. The MOOC, however, enables a student to select a course at a suitable level and an instructor who teaches in a way that the student wants to be taught. In short, the MOOC makes customized learning possible for individuals.

Aside from these benefits, the MOOC provides open access and pursues an equal educational opportunity for everyone. However, based on the living conditions of some students, this ideal is not always achieved in the traditional education system. Students whose living conditions are poor find it difficult to commit to learning. Less-educated students are disadvantaged in terms of job seeking and promotion. In addition, unequal learning opportunities in one generation increase the next generation's disadvantage. In this regard, the MOOC content is mostly free and accessible from anywhere if one has access to the Internet. Currently, parents tend to relocate to other regions so that their children can attend renowned schools. But MOOC, which is free and accessible from anywhere, might decrease such movement between areas. Unlike traditional education, MOOC may provide students with an equal opportunity for learning.

Fourth, the MOOC has the potential overcome the language barrier in the education industry. While most of the courses on the MOOC platform are taught in English—which might be problematic for Japanese students—some recent courses provide Japanese subtitles. Such learning support and aid expand students' opportunities by enabling them to find suitable online courses taught by excellent instructors across the globe.

Finally, the MOOC meets social demands and addresses needs. Innovations in the high-tech industries occur at such a rapid pace that it is difficult to predict what new technologies will become available and how they will change society. What is clear, however, is that we need to be adaptable to our ever-changing environments. For example, Frey (2017) predicts that it will be common for us to change occupations several times throughout our lives. Enrolling at higher education institutions and committing to several years of study requires effort and sacrifices. In the future, people would need to learn new skills while they continue to work, and the MOOC would offer them the opportunity to do so. For this reason, online learning in the form offered by the MOOC will become standard.

2.2.1.2   Live, Interactive Online Courses

Interactive online learning has also become a trend in the education sector. Despite the many merits of the MOOC platform, most lectures are pre-recorded, making it similar to earlier generations of distance learning.

The MOOC relies on asynchronous education as opposed to synchronous education. Asynchronous models allow students to complete courses at their own pace; in other words, students can complete pre-recorded courses when it suits them. While that is one of the main advantages of asynchronous teaching, such a model has its disadvantages too. In asynchronous courses, students cannot ask questions or receive immediate feedback. Moreover, asynchronous teaching does not allow instructors to take immediate and flexible action based on the students' motivation and attitudes. Additionally, students cannot actively participate in class activities. Because the MOOC is a one-way method of instruction, the platform does not maximize the merits of the third generation of distance learning.

Live and interactive online courses can overcome such challenges by encouraging two-way communication and allowing students to attend a lecture in real-time, ask questions, and discuss work with instructors and classmates from anywhere in the world.

2.2.2   Development and Expansion of Educational Technologies

Most governments around the world have temporarily closed schools in an attempt to contain the spread of COVID-19. Homeschooling is now the obvious option for parents because learning content is accessible remotely and educational technologies (or EdTechs) are developed and shared to assist learning. The COVID-19 pandemic presents the education system with a renewed opportunity to embrace new EdTechs.

In recent years, there has been rapid innovation in EdTechs. Current EdTechs are mainly a utilization of new IT devices and the digitization of textbooks and teaching materials. Although such EdTechs improve the efficiency of education, they do not increase the effect of education and, therefore, do not fundamentally transform the education service.

2.2.2.1   Learning Management System

Some EdTechs, such as the learning management systems (LMS), will change the traditional education industry dramatically. An LMS is a software application that assists with the administration, documentation, tracking, reporting, and delivery of educational courses and training, learning, and development programs. Companies often use LMS for online training courses for employees. Now, the LMS is used in

the education service more widely. Despite its merits, an LMS used to be costly, but lately, the development of cloud-based LMSs has reduced the initial and operational cost of these systems.

There are several reasons to introduce an LMS in the education service. First, it improves the efficiency of teaching preparation and communication between instructors and students. For example, students can submit their assignments online. Accordingly, instructors do not need to print out documents and assignments, thus saving costs and acquiring additional time to prepare for teaching. In addition, some LMSs have a social networking service (SNS) function with which instructors, students, and parents can communicate.

Importantly, an LMS informs instructors of education performances immediately because it allows students and instructors to confirm attendance, submit assignments, and complete tests and simple surveys online. An instructor can gain insight into a subject or a student's performance and provide relevant feedback by analyzing the data on the system. Such efforts will eventually improve teaching materials and methodologies in the education service. (Smartphone applications offer similar services.) As Nakane (2005) points out, Japanese students tend to be silent in classrooms—even when an instructor encourages them to talk. It has been reported, however, that the use of educational applications, such as the above, improves interactions between instructors and students in the class.

2.2.2.2 Artificial Intelligence-Based Education Tools

Artificial intelligence-based education tools are regarded as the most innovative among newly developed education tools. Artificial intelligence (AI) tools collect data on a student's level of understanding, analyze it, and then determine how to improve comprehension.

The two leading EdTech companies in Japan, ATAMA and COMPASS, develop their own AI-assisted education tools, namely, Atama Plus and Qubena. These tools allow students to answer questions and solve problems using a tablet. The AI tool then collects and analyzes the log and other data (such as response times and answers) to determine a student's level of comprehension, strengths and weaknesses. The AI tool then challenges students with supplementary problems to help them improve their level of understanding. It is widely understood that an ideal education is a customized education, and AI offers the opportunity to offer tailor-made instruction to students. Ultimately, this should increase the effects of education, and for this reason, several cram schools in Japan are introducing similar educational tools. Despite these advantages, customized instruction remains expensive.

The impact of AI tools on education effects was unforeseen, as the case of COMPASS's Qubena illustrates (Jinno and Sato 2019). In July 2018, the Ministry of Economy, Trade and Industry (METI), selected Qubena as one of its demonstration projects in math classes for 1st, 2nd, and 3rd graders in a middle school in Tokyo between September 2018 and February 2019. While the course's standard learning time is 62 hours, students who used Qubena completed the course in

34 hours. Moreover, these students demonstrated a better understanding and higher scores compared to a comparison group. In addition, not only did the students who used Qubena expressed positive attitudes toward relevant subjects; they also had increased interaction with their instructors and classmates, asked more questions, and exchanged feedback with classmates.

2.2.2.3 Creating an OODA Loop

One aim of digital transformation in the education service is to generate and utilize relevant data to improve learning by applying the OODA loop (Boyd 1987). The OODA loop consists of four steps (observe, orient, decide, and action) and a feedback loop (see Fig. 2.1). The first step in the OODA loop is to collect and observe relevant data. This step is followed by analyses and a decision. A comparable concept with the OODA loop is the PDCA cycle (plan, do, check, and action). The PDCA cycle is a method used in business for the control and continuous improvement of processes and products (Moen and Norman 2009). The PDCA cycle (plan, do, check, and action) starts at the planning stage, where stakeholders formulate assumptions and develop hypotheses. Sometimes the PDCA cycle reveals disparity between assumptions and the reality/practice and does not cover the reality beyond its hypothesis. On the other hand, the OODA loop does not reveal such weaknesses.

Current EdTechs provide infrastructure that will enable the creation of an OODA loop for learning. For example, IT devices that provide educational content generate data that can be used as a new input for the development and improvement of the content. By repeating the loop, innovations in the education service will accelerate. In this sense, the dissemination of EdTechs establishes a crucial infrastructure for learning in the education industry.

Since the outbreak of COVID-19, private sector companies in Japan have been offering temporary and free online educational content to children.[6] As a result, a large number of students and their parents are testing online courses and newly
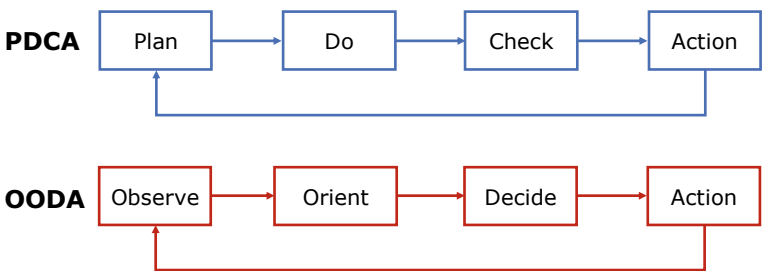

Fig. 2.1 The PDCA cycle and OODA loop

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[6]The METI published on the Ministry's website the private sector companies that provide online teaching materials for free: https://www.learning-innovation.go.jp/covid_19/.

developed EdTechs. The author conjectures that these developments will further enable the dissemination of EdTechs and the construction of OODA loops.

2.3 Concerns and Limitations in Digital Transformation in the Education Services

The COVID-19 pandemic caused some concerns in the education services including class postponement. Students are concerned that their education would be left behind. However, such concerns are temporary. Schools can arrange supplementary classes. However, there are more fundamental concerns and limitations caused by the digital transformation in the education services. This section aims to introduce them.

As discussed above, the major trends in the education industry give the impression that the sudden and rapid changes in educational technologies will result in an ideal system, which is not necessarily the case. Based on findings from earlier studies, the next section considers the concerns and limitations of these trends: (1) poor motivation management, (2) negative effect of IT devices usage in education, (3) educational inequality by digital divide.

The concerns and limitations in this section is not necessarily caused by the COVID-19 pandemic.

2.3.1 Poor Motivation Management

Distance learning's popularity is increasing, and some experts believe that this form of learning will replace traditional education eventually. However, it is still uncertain whether distance learning improves the effect of education or even guarantees successful learning. Live, interactive online sessions are reasonably new, and, yet, there is no research available on their educational effects. There are, however, many insightful studies on the educational effects of the MOOC.

In this regard, Chuang and Ho (2016) describe the case of edX, an MOOC created by the Massachusetts Institute of Technology and Harvard University. With edX, students receive a certificate when they complete a course. Chuang and Ho researched edX's initial four-year progress—from its establishment in 2012 to 2016. The researchers also analyzed the enrollment patterns and the issuing of certificates and found that enrollments on edX increased steadily since its establishment. The system had 2.4 million unique enrollments during these four years, or 1523 days (an average of 1554 enrollments per day). However, only 159,000 of these enrollments resulted in a certificate being issued. About 250 thousand certificates were issued for 4.45 million course registrations. These numbers indicate that the course completion rate is about 5.5%.

Reich and Ruipérez-Valiente (2019) conducted a follow-up study in 2018, and their findings were the same as Chuang and Ho's (2016). In total, 52% of all enrollments had never started the courses. They found that although the number of new enrollments had increased since the establishment of the MOOC, the number of new enrollments started decreasing in 2016. Other studies also indicate that the MOOC has low completion rates. For example, one study analyzed 39 MOOC courses and found that the completion rates were between 2.3 and 19.5%, with a median average of 6.5% (Jordan 2014).

The findings of Chuang and Ho (2016) and Reich and Ruipérez-Valiente (2019) suggest that distance learning models and tools do not guarantee the proper use of online educational content. Furthermore, EdTechs do not increase learning motivation. Ito et al. (2019), for example, examined the causal effect of computer-aided instruction (CAI) on children's cognitive and non-cognitive skills. The researchers used a CAI application, called Think!Think!, to support learning among approximately 1,500 students from G1 to G4 in Cambodia. Although their findings show that the use of the application raised students' expectations in terms of future studies, the use of CAI had no significant effect on their motivation and self-esteem. Their findings suggest that even when students are provided with good educational content in proper education environments, few of them sustain their original motivation.

2.3.2 Negative Effects of IT Devices in Education

IT devices are social infrastructures essential in our daily lives. However, there is a concern over the usage of IT devices among children. Pioneers and leaders of the information revolution are strict about their children's technology use. Furthermore, even though students admit that IT devices are a distraction, they continue using them, thinking that the benefits outweigh the costs (Kay and Lauricella 2011).

Several studies and reports have investigated the effect of the use of IT devices among children. The Programme for International Student Assessment (PISA) of the Organization for Economic Cooperation and Development (OECD), for example, regularly evaluate educational systems by measuring 15-year-old school pupils' scholastic performance on reading, mathematics, and science. In 2015, PISA conducted a comparative analysis of the digital skills that students have acquired and the learning environments designed to develop these skills (OECD 2015). A finding from the report indicates that there is no difference in reading, mathematics, or science skills between students in the countries that had invested heavily in information and communications technology (ICT) for education and those in other countries. The report suggests that building deep, conceptual understanding and higher-order thinking requires intensive teacher-student interactions, and technology distracts from this valuable human engagement, although the report presumes other reasons for the result.

Others have studied the use of IT devices among lower-performing students. For example, Mueller and Oppenheimer (2014) investigated whether taking notes on

a laptop versus writing longhand affected academic performance. They conducted comparative experiments among students at Princeton University and the University of California in the United States and found that students with laptops took more notes than those who used longhand. Furthermore, the laptop notes had more verbatim overlap with the lecture than the longhand note. Despite this, students who took notes longhand performed better on tests, especially on conceptual questions. The authors argue that longhand note-taking requires students to select important information and engage with the content, which, in turn, enables them to study more efficiently. In short, although laptops allow students to take notes easily and speedily, the students do so indiscriminately and mindlessly, which has a negative impact on their learning.

2.3.3 Educational Inequality by Digital Divide

Finally, the impact of the digital divide on the education industry should be addressed. The digital divide is a new concept, and it refers to the inequalities in society in terms of knowledge, that is, the gap between people who have access to ICT and those who do not. The digital divide exists not only between more advanced and less advanced countries but also between regions within the same country (Wong 2002; Nishida et al. 2014).

As mentioned earlier, usage and familiarity of ICT devices in the education industry do not necessarily result in academic performance. The ICT infrastructure is necessary to build an OODA loop in the education service. Schools with good ICT infrastructure will improve their education services faster than those with poor ICT infrastructure. The wider the digital divide, the wider the educational opportunity gaps.

2.4 Japanese Education Services During the COVID-19 Pandemic

This section introduces how Japanese education services corresponded during the first few weeks of the COVID-19 pandemic. To achieve this objective, a few systematic surveys by MEXT are reviewed. Additional literature was unavailable because this chapter was drafted soon after the start of the COVID-19 pandemic in Japan.

2.4.1 On the Introduction of the Distance Education

MEXT conducted surveys on how universities and colleges in Japan corresponded during the COVID-19 pandemic. The first survey was performed three times: twice

in April and May 2020, and once on May 12, 2020 (Tables 2.1 and 2.2). Japan's academic year starts in April; thus, the data were from the first two months of the academic year. Of the 1070 schools that received a survey, 1046 schools responded; thus, the response rate was 97.8%.

Table 2.1 indicates that nearly 90% of all schools in higher education in Japan postponed their classes. Schools that did not postpone their classes started distance education.

Table 2.2 indicates that 96.6% of universities and technical colleges had started or were discussing starting distance education. Variations between types of schools were observed.

A follow-up survey was conducted on May 20 to assess the types of correspondence used by the surveyed schools to communicate the start dates of their classes. Of the 1075 schools that received a survey, 890 schools responded; the response rate was 82.8%. As of May 20, 185 schools had not replied.

Table 2.3 indicates that 80% of the universities and colleges had started their classes as of May 20. Most schools could start their classes one month later than usual.

Table 2.1 Whether the class started as usual (On April 1st) or was postponed

	Class postponement	No class postponement	
		Distance education	Other infection prevention
National university	78 (90.7%)	8 (9.3%)	0
Prefectural and other public university	87 (82.9%)	14 (13.3%)	0
Private university	715 (87.0%)	86 (10.5%)	1 (0.1%)
Technical college	50 (87.7%)	7 (12.3%)	0
Total	930 (86.9%)	115 (10.7%)	1 (0.1%)

Source MEXT report "On Correspondence of universities and colleges to the COVID-19 pandemic." Available at https://www.mext.go.jp/content/202000513-mxt_kouhou01-000004520_3.pdf

Table 2.2 Implementation of distance education

	Distance education started	Distance education under discussion	No distance education
National university	71 (82.6%)	15 (17.4%)	0
Prefectural and other public university	58 (55.2%)	43 (41.0%)	0
Private university	536 (65.2%)	254 (30.9%)	12 (1.5%)
Technical college	43 (75.4%)	14 (24.6%)	0
Total	708 (66.2%)	326 (30.5%)	12 (1.1%)

Source MEXT report "On Correspondence of universities and colleges to the COVID-19 pandemic." Available at https://www.mext.go.jp/content/202000513-mxt_kouhou01-000004520_3.pdf

Table 2.3 Whether the class started or was postponed further as of May 20

	Class started	Class postponed
National university	86 (100%)	0
Prefectural and other public university	83 (79.8%)	2 (1.9%)
Private university	638 (77.1%)	24 (2.9%)
Technical college	57 (100%)	0
Total	864 (80.4%)	26 (2.4%)

Source MEXT report "Implementation status of university and college class during to the COVID-19 pandemic." Available at https://www.mext.go.jp/content/20200527-mxt_kouhou01-000 004520_3.pdf

Table 2.4 indicates that 90% of universities and colleges started distance education only. A few universities and colleges started distance education and face to face lectures. Some private universities started face to face classes only and started distance education after one to two months of preparation.

Table 2.5 presents the data on the start date of classes for the 26 schools that postponed their classes in Table 2.3. Most schools started classes before June 15.

Table 2.4 Class method

	Distance education	Distance education and face to face	Face to face
National university	78 (90.7%)	8 (9.3%)	0
Prefectural and other public university	76 (91.6%)	7 (8.4%)	0
Private university	568 (89.0%)	44 (6.9%)	26 (4.1%)
Technical college	56 (98.2%)	0	1 (1.7%)
Total	778 (90.0%)	59 (6.8%)	27 (3.1%)

Source MEXT report "Implementation status of university and college class during the COVID-19 pandemic." Available at https://www.mext.go.jp/content/20200527-mxt_kouhou01-000004520_3.pdf

Table 2.5 Start of class

	In May	June 1–15	June 16–30	In July or later
National university	–			
Prefectural and other public university	0	2 (100%)	0	0
Private university	13 (54.1%)	8 (33.3%)	1 (4.2%)	0
Technical college	–			
Total	13 (50.0%)	10 (38.5%)	1 (3.8%)	0

Source MEXT report "Implementation status of university and college class during to the COVID-19 pandemic." Available at https://www.mext.go.jp/content/20200527-mxt_kouhou01-000004520_3.pdf

Table 2.6 Homeschooling policy during the temporal closure of schools (multiple answers)

	Responses	Share (%)
Homeschooling using textbooks and paper teaching materials	1,213	100
Homeschooling using television	288	24
Homeschooling using class movies taken by Board of Education	118	10
Homeschooling using digital textbooks and digital materials	353	29
Homeschooling using live, interactive online courses	60	5
Others	145	12

Source MEXT report "Status of teaching in public schools relevant to school disclosure to prevent the COVID-19." Available at https://www.mext.go.jp/content/20200421-mxt_kouhou01-000006590_1.pdf

The elementary, middle, and high schools had not started distance education. On April 16, 2020, MEXT published a survey of public school superintendents[7] who provided information on their schools' status of teaching; 1,213 establishers responded, and they temporarily closed 25,223 schools.

Table 2.6 presents the homeschooling policy during the temporary closure of schools: all the establishers started homeschooling using textbooks and paper teaching materials, 5% started homeschooling using live, interactive online courses; 29% started homeschooling using digital textbooks and digital materials.

In summary, higher education in Japan quickly started to provide online classes. By contrast, the elementary, middle, and high schools continued to rely on traditional paper-based teaching during the COVID-19 pandemic but gradually introduced online classes and utilization of digital teaching materials. Thus, in Japan, in higher education and in elementary, middle, and high schools, distance education expanded, and educational technologies are under development to complement the distance learning.

2.4.2 Reactions to the Distance Learning

No systematic surveys or reports were available; therefore, reactions to distance learning remain unknown. The available surveys and reports were based on voluntary self-reports done by schools on their employed teachers, or students, and were conducted by using mass media and tens to up to two hundreds of samples. The surveys and reports differed in their questions and other survey elements; thus, a review would neither represent the whole situation in Japan nor allow for comparisons of schools. Accordingly, instead of relying on the data of those surveys and

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[7]The central government, local governments, and corporations, as specified by law, can establish schools in Japan. National schools, prefectural and other municipal public schools, and private schools are founded by the central government, local governments, and corporations, respectively.

reports, this subsection is based on the author's knowledge and perceptions after reviewing as many of the available surveys and reports as possible.

In Japan, during the pandemic, distance learning became a new normal in higher education. Notably, the few private universities that were delayed or did not start distance learning had the lowest budgets and were located in suburbs where there are fewer students (Tables 2.1–2.5). Except for those few exceptions, most higher education institutes managed distance learning well. A few concerns from students were observed, for example, unstable internet connections at home increased the difficulty of accessing distance education. However, such concerns are solvable by providing improved internet accesses. Additionally, before the COVID-19 pandemic, professors taught students remotely to some extent; thus, best practices and sample teaching models of distance education were available from experience in the past. Accordingly, the introduction of distance education in universities and colleges was smoother than expected.

Additionally, distance learning in elementary, middle, and high schools has expanded slower than that in higher education, and most of the schools, save a few exceptions, relied on textbooks and paper teaching materials. Regarding the perceptions of distance learning of students and their parents, many concerns were observed. The most major concerns were as follows: whether students could manage self-education well; whether parents could teach their children, elementary school students, at home while working; whether insufficient homeschooling would result in low educational development; whether (and how) the children should socialize with classmates while homeschooling; and whether students had sufficient internet environments to support distance learning. Additionally, although most teachers were unfamiliar with distance education, there were a few exceptions, for example, all Kumamoto city public schools started the academic year (April 15, 2020) with live, online, interactive classes.[8]

Recognizing such difficulties of homeschooling children, many EdTechs have been developed in Japan. Those EdTechs are provided for free for a certain period of time. Students use laptops and tablets to access digital educational materials and EdTechs. This situation is a good opportunity for young students, their parents, and teachers to try EdTechs, and for teachers to apply them their curriculums. EdTech providers have successfully constructed OODA loops and collect data logs from free trials to improve these EdTechs, for example, enhance the educational effects. This phenomenon will promote EdTechs' further development and use beyond the COVID-19 pandemic.

Notably, the concerns and limitations indicated in Sect. 2.3 remain and will be revealed as more schools employ the distance learning and EdTechs. Accordingly, follow-up studies are necessary to investigate the weaknesses and externalities of distance education.

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[8]Kumamoto city prepared the distance education before the COVID-19 pandemic. When a series of earthquakes including a magnitude 7.0, known as the 2016 Kumamoto earthquakes, struck beneath Kumamoto city in 2016, schools in Kumamoto prefecture closed for a while. As a lesson, Kumamoto City Board of Education had been preparing the distance education such as distributing iPads to schools and training teachers for the distance education.

2.5   The Education Service After COVID-19

This section reflects on the future of the education industry when the COVID-19 pandemic has subsided. Furthermore, the section considers ways to overcome the concerns and limitations that pertain to the two main trends in the education service by introducing practices in Japan.

2.5.1   Further Acceleration of Digital Transformation in the Education Service

Although the trends discussed above have been taking place since the information revolution, COVID-19 has accelerated digital transformation in the education sector. Prior to the pandemic, digital transformation in the education service happened at a modest pace, and, although the MOOC was increasing its footprint, many educational institutions had not adopted these systems or the array of new EdTechs. Moreover, institutions and students used live, interactive online courses on a voluntary basis. Overall, only a few higher educational institutions adopted these trends.

The MOOC launched in Japan in 2013 when the University of Tokyo and Kyoto University joined Coursera and edX. The Japan Massive Open Online Courses Promotion Council (JMOOC) also launched in 2013. The MOOC, however, has a higher number of available online courses than the JMOOC. As of May 2020, 36 universities in Japan offer approximately 340 courses, and in response to the COVID-19 pandemic, most universities now offer live and interactive online courses.

Although the distance learning in Japan is currently merely duplicating the classroom content and offering it online, distance learning models will evolve to overcome such concerns and limitations as our experience and knowledge accrue and new EdTechs become available.

2.5.2   Changing Roles of Instructors

Section 2.3.1 indicated that only few of students sustain their original motivation over the distance learning and most of them do not finish online courses. New models of distance learning may change the role of instructors too. Aside from teaching, instructors, in the future, might be required to manage students' learning motivations and progress. The following case study in Japan illustrates this scenario.

The N High School,[9] a Japanese school financed by the Kadokawa Dwango Corporation, was founded in April 2016. Since then, the number of students has increased

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[9]Visit the N High School's webpage at https://nnn.ed.jp/.

rapidly from 1,482 to 12,414 in January 2020. All the school's students begin their distance learning experience with a virtual reality ceremony.

The school's curriculum includes the regular subjects taught at high schools across Japan. In addition, it offers an advanced program, which includes subjects such as programming, web designing, and novel writing. Each student has an assigned homeroom teacher advising them about their learning progress and future education. The school's program is designed to overcome the concerns and limitations of digital transformation in the education service to some extent.

Despite its short history,[10] the N High School has a good reputation and outperforms other high schools in several areas. First, the N High School has fewer students who terminate their studies. Furthermore, the school reports that 81.8% of its graduates started entered into careers,[11] as opposed to 61.5% from other distance learning high schools in Japan who started careers or studies at higher education institutions in 2018.[12] Surprisingly, 77.1% of the students who dropped out of other high schools and finished their studies at the N High School started careers after graduation. Moreover, graduates from the N High School are accepted to top universities. In the class of 2019, one graduate enrolled at the University of Tokyo and three at Kyoto University. In the Japanese educational context, this is an impressive achievement for a school with such a short history.

The N High School's achievements mean that the school's educational model can be referenced when we consider distance learning in other contexts. Admittedly, its model and approach might not be transferable to distance learning at the university level, but it provides insight into how we can improve distance learning.

To sum up, when the distance learning becomes a new normal, teachers might be required to manage students' learning motivations and progress.

2.5.3 Further Investment in ICT Infrastructure in the Education Service

Section 2.3.3 indicates that the digital divide in the education service leads to educational inequality. The availability of 5G and AI technologies will further stimulate the transformation and development of distance education and EdTechs. These technologies will support teachers in terms of preparation, innovation, and lesson design to improve online courses.

In addition to these technologies, infrastructures that will allow educators to collect data are also being built. In Japan, for example, the MEXT announced in December 2019 the Global and Innovation Gateway for All (GIGA) school program

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[10]The first group of the N High School's students graduated in 2018.

[11]The N High School's presentation on March 27, 2019.

[12]MEXT: School Basic Survey 2018. Available at https://www.mext.go.jp/b_menu/toukei/chousa01/kihon/1267995.htm.

to prepare children for life in Society 5.0.[13] The GIGA program aims to supply an educational IT device to every student and to establish high-speed, high-capacity communication networks in schools across the nation. With an IT device, a student can search for information on the Internet, complete their homework digitally, or even learn to program (a critical skill in the current era). GIGA is similar to the One Laptop Per Child (OLPC) project.[14]

Although the educational effects of GIGA and OLPC are still uncertain,[15] these programs would require an OODA loop in the education service, which will improve the educational effects. Determining the effects of educational policy is a costly process as it involves the collection and analyses of data on educational behaviors and performances. For example, to evaluate a new educational policy, researchers might experiment with a small sample size (e.g., a few classes). All the information they receive, however, is recorded in handwritten documents that need to be manually inputted to produce digital data. Since the data have not been standardized, it is difficult to combine or compare sets of data from different experiments.

An IT device can simplify this process. If every child has a device, it will be easy to produce and collect relevant data. Furthermore, it will allow researchers to easily analyze data, observe educational behaviors and effects, and compare data sets to gain detailed insight into a specific group of students. New findings and insights from one analysis can be applied and tested effortlessly. This process results in an OODA loop. It is not yet clear whether GIGA aims to create an OODA loop, but other private educational institutions are making haste to build their own OODA loops to improve their services. Infrastructure such as an OODA loop will facilitate faster and more dynamic innovations in the education service.

To sum up, investment in ICT infrastructure in the education service is necessary to minimize the digital divide in the education service.

2.6 Conclusions

This chapter reflected on the impact of the COVID-19 pandemic on the education service, in particular in Japan. Despite its severe impact on the traditional education system, it offers the education industry the opportunity to transform its service. To

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[13]See https://www.mext.go.jp/a_menu/other/index_00001.htm.

[14]The OLPC was initially proposed by Professor Nicholas Negroponte, the founder of the Massachusetts Institute of Technology's Media Lab, at the World Economic Forum in Davos in 2005. His vision was to provide a $100 laptop to give all children access to education. Visit http://one.laptop.org/ for more information.

[15]Some studies analyzed the educational effects of the OLPC in several countries (Kraemer et al. 2009; Warschauer et al. 2012; Beuermann et al. 2015). These studies compared, for example, learning prior to and after receiving a laptop and learning with and without a laptop. The majority of these studies reported that there was no observable improvement in learning with a laptop. In fact, some researchers have noticed that those students with laptops performed worse in mathematics and linguistics than those who did not receive a laptop.

address the challenges of the isolation policies during COVID-19, many institutions have now started to utilize distance learning supported by newly developed EdTechs. This suggests that the pandemic is accelerating digital transformation in the education industry.

However, digitalization is not a simple process, and the education community is not ready to maximize the merits of distance learning. Currently, distance education entails the duplication of the classroom content on an online platform. Moreover, many teachers and parents are uncomfortable or unfamiliar with technology. Parents also struggle to supervise the distance learning or homeschooling of young children. A full transition to distance learning, therefore, requires not only solid ICT infrastructure, but also support for teachers, students, and parents. Throughout trials and errors in the transition, we can expect improvements such as enhanced online-teaching tools, digital fluency, and attractive and engaging lessons.

It is still uncertain how long COVID-19 will impact our lives, and there might be a second and even third surge of the virus. This uncertainty will only further fuel rapid digital transformation in the education service. The creation of OODA loops will also facilitate innovations in the education industry; Various kinds of educational data will be collected through IT devices adopted in the classroom. Analysis on such data will be used to enhance individual and overall educational performance. This process will be repeated.

Currently, a large number of universities experience challenges with distance learning and EdTechs, particularly because it had to be introduced within a short timeframe. For example, some online lectures have been interrupted by uninvited guests, resulting in offensive and harassing situations. Universities' servers also went down due to the sudden surge in online access. These issues, however, are minor and should be solved in the future. Meanwhile, they will not hinder digital transformation in the industry.

Digital education and traditional education have their strengths and weaknesses. In the future, distance learning will offer students more opportunities and options than traditional education. Educational technologies will enable students to take ownership of their learning. Students' taking ownership of their learning is the new normal of the education service that is shaping gradually.

Author's Insight

This chapter might trigger questions such as the probability of the digital education services replacing the traditional education services after the COVID-19 pandemic. Harvard University, the wealthiest university in the world, offered its staff early retirement[16] and instituted a salary freeze on all exempt employees[17] to reduce expenses.

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[16]https://www.bloomberg.com/news/articles/2020-06-09/harvard-offers-staff-early-retirement-in-move-to-cut-expenses.

[17]https://www.harvard.edu/president/news/2020/economic-impact-covid-19.

Furthermore, schools have started providing online tuition, and various EdTechs have been released by education startups and tech firms. These incidents can be regarded as initial signals of disruption in the traditional education service.

If education is the sole focus, finding a post-pandemic replacement is, to a great extent, possible. Educational institutions that cannot offer distance learning and competitive educational contents may not survive during and after the COVID-19 pandemic. They will be replaced by attractive MOOC content that allows self-motivated students to continue their education without enrollment into formal educational institutions.

However, education is not the only thing that students get from traditional education service providers. They acquire other assets such as lifelong friends (some of which may become business partners in the future), access to a scholarly network, skills, opportunities, (Galloway 2017), and, in case of students in top schools, brands. Although these assets do not always bring rewards, they are still valuable tools for success in future endeavors. Although digital innovators such as Bill Gates, Steve Jobs, and Mark Zuckerberg did not complete formal higher education, it was on the campus that they found their passion, business partners, and business opportunities. There is no certainty as to how much of these assets a digital education system can provide.

According to the knowledge management theory, interactions in the same space, which Nonaka and Takeuchi called "Ba" (Nonaka and Takeuchi 1998), between people with different knowledge and perspectives encourage knowledge flow between them (Nonaka and Takeuchi 1995). "Ba" is a shared space that serves a foundation for knowledge creation. Schools play a similar role as students from different backgrounds interact with each other during curricular and co-curricular activities. Although one may argue that virtual spaces such as social media and online communities can play the same role, users are less likely to be exposed to users with different perspectives (Himelboim et al. 2013). As the popular saying goes, "birds of the same feather flock together."

Therefore, it is unlikely that the digital education services will replace the traditional education services completely. Additionally, education startups and tech firms may not be able to replace traditional education institutions.

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