International Journal of Learning Technologies and Learning Environments
International Institute of Applied Informatics
2025, Vol. 8, No. 1, IJLTLE763

Case Studies of DRR Delivery Lessons Using ICT in Elementary School Classrooms in Japan – Lessons from COVID-19 to Future Practices

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Abstract

The COVID-19 pandemic has made it difficult to conduct the face-to-face contact-based DRR (disaster risk reduction) delivery lessons that we had been providing in elementary schools. To overcome this challenge, we developed a video tool and practiced delivery lessons by using ICT in schools. This paper reports on three cases. In study 1, we conducted a delivery lesson by connecting the school broadcasting room to the classroom in a unidirectional manner. In study 2, we connected the laboratory in the university to the individual student's computers. In study 3, we visited the school and carried out the lesson by connecting the school computer room with the teacher's computer in the classroom. We summarized the differences among these three practices, as well as their various characteristics, and discussed the future directions of ICT-based DRR delivery lessons. The ICT-based DRR delivery lesson could bring new educational effects that have never been generated by the traditional delivery lessons.

Keywords: Case Study, Elementary School, ICT-based DRR delivery lesson, Video

1 Introduction

1.1 DRR Delivery Lessons after the Great East Japan Earthquake

Many people were lost in the Great East Japan Earthquake on March 11th, 2011, which resulted in 15,899 dead and 2,526 missing in the past 10 years [1]. The disaster triggered a movement to enhance disaster risk reduction (DRR) and its education. In Japan, structural measures have been undertaken for tsunami disaster prevention over the years. Iwate prefecture, for example, had a seawall known as the Great Wall of China ("*Banri no Chojou*" in Japanese) even before the Great East Japan Earthquake. However, the breakwaters were not enough to block the tsunami generated by the disaster. Those things that have happened in the Great East Japan Earthquake clearly proved the limits of structural measures. Today, it is considered to be important not only to develop structural measures, but also to promote non-structural measures, such as

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improving people's DRR awareness and knowledges. One of the most representative measures is DRR education in elementary and junior high schools.

We have conducted DRR delivery lessons (composed of a lecture, a group activity, and a summary) at elementary schools in Japan [2], mainly in Miyagi Prefecture, other prefectures in Japan, and all over the world (e.g., Thailand, Indonesia, and the United States of America) since 2014 (called YUI project). When held in small schools, the lesson is usually conducted in a classroom, and when held in large schools, it is conducted in a large place such as a gymnasium or assembly hall (though generally in a gymnasium). The lesson takes about 90 minutes. We have visited about 300 schools and have given DRR delivery lessons to about 17,000 children. One of the challenges is to continually provide the DRR delivery lessons to the children into the future.

However, due to the COVID-19 pandemic, we could hardly visit schools from April 2020 to March 2021. As opposed to regular school classes, delivery lessons by an external lecturer were seriously limited in order to avoid unnecessary physical contact. The number of DRR delivery lessons given 2020 school year (April 2020 – March 2021) was only five schools (As a reference, we provide delivery lessons for about 30 to 40 schools in a typical year).

In order to resolve this matter, we have designed a video that can be used in classes and trainings for DRR. From April 2021 to October 2021, we carried out the delivery lessons by utilizing ICT in schools. These practices help decrease the amount of unintentional contact.

1.2 COVID-19 Pandemic and Education in Japan

Because of the pandemic, schools have been forced to adapt. Japan is no exception [3]. For the past two years (SY 2020-2021 and SY2021-2022), schools have been taking various approaches to prevent the spread of the disease, depending on the number of infected people. When the number of infected people increases, the schools took appropriate countermeasures, such as dispersed school attendance and online classes. When the number of infected people decreases, students can go to school, but group work in classes has been refrained from, they must eat in silence at lunch time, and visitors have been restricted from coming into the school.

At the same time, the GIGA (Global and Innovation Gateway for All) school project, i.e., the establishment of one computer per student and a high-speed network environment, progressed in Japan [4]. During the COVID-19 pandemic, as the project was carried out ahead of schedule in order to ensure continuous student learning [5]. With the implementation by the government and its new educational methodologies under the COVID-19 pandemic, new educational strategies were explored, and superior practices were developed that should be continued even the after the pandemic has ended. It would be meaningful to share these practices with society at large, to use them as a reference for other teacher's practices, and to share the challenges of these practices with many teachers in order to pursue better education in the future. The practice of applying ICT during the COVID-19 pandemic, which should be shared with society, is not limited to teachers in elementary and junior high schools but should also include teachers from third-party organizations (e.g., delivery lessons by researchers). Our practices of DRR delivery lessons would be one of them.

Figure 1: Screenshots from video [6]

Note. A video of an experiment comparing a wave and tsunami (upper), a simulation of a tsunami coming to Japan (middle), and quiz time (lower).

1.3 Purpose

This paper reports our DRR delivery lessons in elementary schools using ICT during the COVID-19 pandemic and provides applicable insights for future DRR delivery lessons after the pandemic has ended. In the following section, we will give an overview of the video, report on our practice of using the video (three cases), and finally, discuss the future directions

2 Materials

2.1 Video

The video [6] is based on the lecture of the delivery lesson we conducted [7] [8]. Real movies and animations are mixed in the video (Figure 1). It includes clips of experiments and simulations of natural disasters [9] [10] [11], as well as quizzes given by a lecturer, and three animated characters (Mari-sensei as a science communicator, Yui-hime [Princess], and Saizo [Ninja]) appear to interact with each other. The detailed contents of the video are shown in Table 1. The length of the video is about 22 minutes.

Table 1: Overview of the video

Start time	Chapter name	Details
02:30	Introduction	Introduction of the anime characters and explanation of the concept of disaster risk reduction (DRR)
03:40	Geographical characteristics of Japan	Explanation of the nature of the earth, the geographic features of Japan, and earthquake hazards
06:17	The mechanism of tsunamis	Explanation of past tsunamis in Japan and the Great East Japan Earthquake
11:03	The mechanism of earthquakes	Description of the features of damage caused by inland earthquakes
12:15	Earthquake preparedness	Highlighting examples of earthquake preparedness
13:23	The mechanism of torrential rains	Describing the mechanism and examples of heavy rainstorm damage
18:51	Preparedness on a regular basis	Summarizing preparedness actions for future natural disasters
19:18	Evacuation behavior	Summarizing the details of evacuation actions
20:21	Summary	Summarizing the story and important points

2.2 Worksheet

The worksheet that is used after watching the movie, contains three questions: "*What have you learned from the video?*", "*What will you talk about and teach to your parents?*", and "*What will you teach to little children?*" These questions help students to reflect on what they learned and to develop disaster knowledge and attitudes

3 Case Studies

In this section, we present the practice of using the video in three schools since April 2021. A questionnaire on DRR knowledge and attitudes was conducted before and after these practices, but we will not report on them because the questionnaire study is not directly related to the goal of this study (which is to ethnographically analyze and report on the practice of DRR delivery lessons).

3.1 Study 1

3.1.1 Students and Teachers

There were eighty-one 4th grade students, one hundred and ten 5th grade students, and one hundred and twelve 6th grade students (3 classes per grade). Each class had one teacher.

3.1.2 Practice

This practice took place in April 2021. This practice was 45 minutes long. Two practices were conducted, one with 4th and 5th graders and the other with 6th graders. The school did not have sufficient Internet infrastructure, and we therefore used the existing system in the school, which connects the TV set (or screen) in each classroom with the broadcasting room. This system also had a switch function. With this function, we could, for example, send the images being taken by the video camera in the broadcasting room and the images played on the DVD player to the TV set (or screen) in each classroom, and we could switch freely between them. This system is sometimes used for greetings by the school principal.

Before the class started, the school principal introduced the lecturer to the children via video camera. The lecturer then explained the purpose of this lesson to the children, also via video camera. Students sat at their own desks in each classroom and watched the video streamed from a TV set (or screen) at the front of the classroom. The video was played from beginning to end without being stopped. The class teacher wrote down keywords and expressions in the video on the blackboard.

After watching the video, the lecturer instructed the students on how to reflect on what they had learned. The teacher gave each student a worksheet to write a reflection on. During this process, the lecturer left the broadcasting room and went to each classroom to observe the students reflecting on their own learning. After this observation walk, the lecturer returned to the broadcasting room and introduced, orally, the student's written notes that had been picked up during the classroom observation, in order to share them with all of the

students. At the end of the lesson, the instructor gave a final greeting, and the teacher also gave a closing speech in the classroom.

Figure 2: The scene of practice in Study 1
Note. The lecturer is sitting in the broadcasting room and speaking to the camera (upper), and a teacher in the classroom is writing on the blackboard (lower).

3.2 Study 2

3.2.1 Students and Teachers

There were twenty-eight 4th grade students (one class). The class had two teachers (i.e., a classroom teacher and the vice principal). Twenty-seven students participated from the classroom and one student from the nurse's room, because this student had difficulty

participating in the classroom. In Japan, this approach is allowed for children with some challenges [12].

3.2.2 Practice

This practice took place in September 2021. The lesson time was 45 minutes. The school had sufficient Internet infrastructure, and each student could use his or her own tablet in regular classes. Given this situation, following a meeting with the teachers, we decided to practice using Google Meet [13], which is frequently used in online lessons. The camera was turned on and the microphone was turned off on the tablets used by the students. In Google Meet, the teachers informed the students in advance not to touch and operate the screen without permission in order to prohibit the learners from behaving in a selfish manner.

The lecturer accessed Google Meet from the laboratory of the university as a co-host (the other host was the homeroom teacher). At the same time, the teacher set up a laptop computer in front of the blackboard in the classroom and accessed Google Meet on the laptop to communicate with the lecturer. Each student individually accessed Google Meet on his or her own tablet device and watched the video via a shared browser (a private YouTube link). There were three "Thinking Time (time to think about a specific question)" and "Concluding Summary" sections in the video. The instructor paused the video in order to ask the students a question according to what they had just seen. The students who wanted to answer the questions were required to raise their hands on their own, instead of using the hand-raising button on Google Meet. One or two of the children were selected for each question by the lecturer. The selected students then stood near the teacher's laptop in front of the blackboard and answered the questions to the lecturer. After watching the video, the classroom teachers distributed the worksheets to the students to summarize what they learned from watching the video. The students worked on the worksheet one at a time. Afterwards, students who wanted to answer questions on the worksheet had to give their answer as a speech in the same manner as the questions and answers in the previous section. The lesson was concluded with a thank you and closing remarks.

Figure 3: The scene of practice in Study 2
Note. Students are raising their hands to answer questions (upper), and a student is taking a note while watching the video (lower).

3.3 Study 3

3.3.1 Students and Teachers

There were one hundred forty-eight 4th grade students (4 classes) and 10 students who were treated specially (2 classes). Each class had one teacher.

Figure 4: The scene of practice in Study 3
Note. Students are watching the video (upper), and one student is standing and presenting what he learned from the lesson at the front of the classroom (lower).

3.3.2 Practice

This practice took place in October 2021. The practice lasted 45 minutes in total. The lecturer launched Google Meet on a computer in the computer room, which is separate from the classroom, and became the host. The screen of the host was then shared on the laptops of the teachers in each classroom, and the computer screen was projected on the screen at the front of the classroom. The students watched the video projected on the screen together (we used a private YouTube link, just like in Study 2). The instructor's screen was tiled with the names of the teachers in each classroom and the situation in each classroom. Like in Study 2, the lecturer stopped the video at each of the three places in the video for "Thinking Time" and "Concluding Summary". For each of the pauses, the lecturer asked for any student wishing to share his or her answer to the question, and those who wished to do so raised their

hands to respond. At this moment, the lecturer appointed a student in each classroom and asked the student to present their answer (e.g., the student with the red hoodie in the class A). The student presenters stood near the teacher's laptop computer in front of the blackboard and presented to the lecturer on the screen. After watching the video, the teacher distributed the worksheet to each student to summarize what he or she had learned from the video.

Learners individually wrote about what they learned on the worksheets. After that, students gave a presentation of what they had summarized on their worksheets, and the instructors nominated students to present while the video was playing. That is, students who wished to present to the whole class raised their hands and were invited to do so by the instructor. At this moment, the external lecturer appointed a student in each classroom and asked him or her to present to the audience. The student standing near the teacher's laptop in front of the blackboard presented to the lecturer, who was projected on the screen. This interaction (video and audio) was also projected onto the screens of the other classes. One student was selected as a presenter for each class, and children from the special needs classes also listened to the presentations. Finally, the lecturer gave a closing remark, and the classroom teachers and children thanked the lecturer.

4 Discussion and Future Directions

In this paper, we reported on three different practices using ICT in schools, during the COVID-19 pandemic. In Study 1, the lecturer went to the school, stayed in the school broadcasting room, and then linked the room to the TV set in every classroom. In Study 2, the lecturer conducted the practice by linking the laboratory to the school instead of going to the school. In Study 3, the lecturer visited the school and practiced from the computer room, which was connected to individual classrooms.

In Study 1, although we were not able to practice using one computer per person or a network, we practiced by using the existing system in the school in order to prevent infection. In Study 2, we conducted the practice by using one computer per person and a network. One of the features of this practice is that it allowed for bidirectional communication. Another feature of this practice is that students who are not usually able to study in the classroom were able to do so from the nurse's room. This kind of possibility for students who have difficulty being in a classroom to be able to study together with other students might be regarded as a new approach to studying in the digital age. A similar idea is currently in discussion on educational practices in networked classrooms. Specifically, it had been assumed that this type of practice would be used for students who needed support for the treatment of illnesses [14]. In Study 3, multiple classes did not have to gather in a gymnasium, as they did in the past, but were able to take the delivery lessons in their own classrooms. In the case of the gymnasium assembly approach used in the past, there were problems with maintaining the focus of students seated in the very back. In contrast, the decline in the level of attention and focus was reduced by the practice of connecting each class to the network, as shown in Study 3. In addition, the teachers of each class were only passively listening to the lecturer's talk in the practice in the gymnasium until now, but in this practice, teachers played the role of writing keywords and important content on the blackboard in order to ensure and deepen

the students' understanding. This approach of providing delivery lessons to each class using a network has the potential to greatly advance existing delivery lesson methods.

Table 2 summarizes the characteristics of the three studies in terms of the learning environment, the lesson process, and the interaction with the lecturer. The learning environment shows the ways in which students and the lecturer connected. The lesson process shows how each was implemented in terms of lecture methods, student reflections, and the final summary. The interaction with the lecturer assessed the strength of the interaction "between the lecturer and students (L & S)" and "between the lecturer and teachers (L & T)" in terms of communication[2].

In Study 1, the interactions between the lecturer and students, as well as between the lecturer and teachers were considered weak because the school used its own unidirectional system to connect the lecturer and classroom. In Study 2, the interaction between the lecturer and students was determined to be strong because of the use of Google Meet to connect to individual students, since each had one computer. For the interaction between the lecturer and the teachers, we judged it to be medium because it was a bidirectional system, rather than the unidirectional system of Study 1. In Study 3, the interaction between the lecturer and the students was judged to be medium, because although Google Meet was used, the video was projected on the screen at the front of the classroom. The interaction between the lecturer and the teachers was also judged to be medium, just as it was for Study 2.

Finally, let us discuss the limitations and future directions of this study. Only three cases were reported in this paper, which may be not sufficient to provide a generalized model of ICT-based DRR delivery lesson. As of November 2021 (when we were writing this paper), schools tended to mainly request face-to-face, that is, conventional delivery lessons. However, as previously mentioned, there are several good reasons for using ICT in delivery lessons that may provide a better effect than the face-to-face approach. For example, it may be possible to motivate younger students by presenting attractive videos using ICT, or to lead them to deeper understanding by presenting more visual materials. In addition, classes via the internet will make it possible for students to take classes at the same time from anywhere, whether at home or in the hospital. Therefore, we encourage network-based delivery lessons and will provide more instances in the future.

Second, we reported and summarized three practices from specific viewpoints (i.e., interactions). It would be helpful to further summarize these cases and future cases from another viewpoint when further practices become available. This sort of classification will be useful for identifying more the advantages and drawbacks of ICT-based delivery lessons.

Table2: Summary of the characteristics of the studies

	Grade and Number of Class (Number of Students)	Environment				
		Students	**Lecturer**	**Student's interface**	**Lecturer's interfac**	**Connection**
Study 1	4th: 3 Classes (81) 5th: 3 Classes (110) 6th: 3 Classes (112)	Classroom	Braodcasting room in the school	Screen or TV at the front of classroom	Video camera or DVD plyer	Lecturer → Classroom
Study 2	4th: 1 Class (28)	Classroom	Lecturers' office in the laboratory	Individual student computers and a screen at the front of the classroom	Computer	Lecturer ↔ Classroom
Study 3	4th: 4 Classes (148)	Classroom	Computer room in the school	Screen at the front of classroom	Computer	Lecturer ↔ Classroom

	Environment (continuous)	Lesson process			Interaction with the lecturor	
	System	**Lectuer**	**Student's reflection**	**Ending (Q&A, feedback, and comments)**	**L and S**	**L and T**
Study 1	Traditional sysytem (Swiching video camera and DVD player)	DVD player to the TV (or screen) in each classroom, and not stopped	with group member in classroom	One way	Weak	Weak
Study 2	Google Meet	YouTube, and stopped in some sections	Individually	Both way	Strong	Medium
Study 3	Google Meet	YouTube, and stopped in some sections	Individually	Both way	Medium	Medium

Note. One student joined the lesson from the nurse's room in study 2. S, L, and T mean students, lectuer, and teachers.

Third, in this study, as described note, the evaluation is based on the subjective judgment of the authors. While it is considered to be reasonably convincing, there remains room for improvement in terms of objectivity. Moving forward, the
validity of this evaluation will be examined through discussions among researchers and surveys targeting experts and practitioners.

In regard to past delivery lessons, we were only able to digitize the instructor's lecture in this study. However, the delivery lesson includes not only a lecture, but also group work (for more detail [6][7][8]). A digitized version of the group work has not been developed yet. In the future, we will study how to implement group work using ICT. For example, one method could be to prepare one collaboratively editable sheet for each group online, utilizing googles spreadsheets, etc., and have each group fill in their own disaster prevention actions and discuss them in groups. By having students in groups consider their actions in the event of a disaster; while looking at the opinions of others as well as their own, it would be possible to raise students' awareness of disaster preparedness.

Note

1) This paper is a more detailed discussion of the proceedings (Yasuda et al.2021) submitted and orally presented at AAI-winter 2021.
2) The evaluation was conducted based on discussions among two educational psychologists—one a professor and the other an assistant professor—who have been engaged in research on lesson design and assessment incorporating ICT, and one disaster education scholar who has been practicing disaster education since the Great East Japan Earthquake.

Acknowledgement

This research was supported by the Disaster Mitigation Education Fund of Tohoku University. The authors would like to express our gratitude. We are thankful to the students and teachers at the elementary schools who participated. We also are especially grateful to Sugiura, K. (International Research Institute of Disaster Science, Tohoku University), Suppasri, A. (International Research Institute of Disaster Science, Tohoku University), the Earthquake and Tsunami Risk Assessment (Tokio Marine & Nichido), and Endowed Research Division of the International Research Institute of Disaster Science, Tohoku University, for their support of this research.

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