〈**CONFERENCE PAPER**〉

Improving Interactivity in Instructional Design
by Developing an ICT-based Social Studies Plan: Case Study of
Smart Agriculture in the National Strategic Special Zone of
Hyogo Prefecture's Yabu City

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Abstract

This research aimed at designing a lesson plan in elementary social studies that enhances interactivity by utilizing information and communications technology (ICT). Taking into consideration that lessons created along with students and ICT-based elementary social studies classes enhance students' learning, and based on the features of iPad, applications, and Zoom, a lesson for the fifth grade—called "Agriculture in Japan-Smart Agriculture in Yabu City, National Strategic Special Zone"—was designed. To clarify the actual situation pertaining to ICT utilization in the classroom, the lesson plan was examined from the perspectives of "information gathering," "information examination/thinking," and "reflection." Information gathering enabled searching the Web for supplementary/additional materials using learning content-related keywords, and also helped share information and enhance teaching materials. Information examination/thinking enabled the use of map-based applications to improve reading skills. Zoom also enabled interaction with persons mentioned in the learning and teaching materials. This way, students could apply their learning beyond the classroom to the real world. LoiLoNote, a class-support application, helped organize thoughts on cards. Like a portfolio, students were able to build a learning history on their own. All these made instant sharing of classmates' learning possible. Thus, utilizing ICT contributed to upgrading teaching and learning style and designing elementary school social-studies lessons to enhance interactivity.

Keywords: Information gathering, Information and Communications Technology (ICT), Instructional design, LoiLoNote, Zoom

Introduction

At present, the number of educational classes conducted using information and communications technology (ICT) has increased all over the world. The reasons for this development are as follows. The primary reason is the coronavirus disease 2019 (COVID-19) pandemic. Indubitably, in Japan, COVID-19 is a significant stimulant for ICT-based lessons. Moreover, the Japanese government's model society—"Society 5.0" [1]— encourages school education to use big data, artificial intelligence (AI), and so on. In response to Society 5.0, the Ministry of Education, Culture, Sports, Science, and Technology (2019) announced the "*Measures to Promote the Utilization of Advanced Technologies that Support Learning in the New Era* (*Final Summary*)," which entails using advanced technologies, such as educational big data, AI, Internet of Things (IoT), virtual reality (VR), and augmented reality (AR) to develop human resources for Society 5.0. The guidelines emphasize the active utilization of the above-mentioned technologies in the field of education. For instance, the Global and Innovation Gateway for All school program, which began in 2020, has been promoted to realize an educational ICT-based environment. However, due to the COVID-19 pandemic, individual tablets [2] were rapidly introduced in elementary schools nationwide. Although some issues remain, such as the development of Wi-Fi that guarantees stable communication speed, the hardware environment is likely to be in place nationwide. In the elementary school attached to the Hyogo University of Teacher Education, every student has been provided with an iPad since April 2021. Shortly, there will be a need for practical and research efforts toward teachers'/ student's ICT skills and teaching/learning methods to utilize them in class.

What kind of learning is intended at Japanese schools? The Ministry of Education, Culture, Sports, Science, and Technology (2021) aims at the integrated enhancement of "individual optimal learning" and "collaborative learning" by introducing individual tablets. In other words, while promoting individual learning, we intend to demonstrate collaboration through ICT. However, the specific utilization in elementary school social studies is still being researched. Evidently, some are versatile, and some are effective based on the characteristics of each subject.

Therefore, this research intends to develop a lesson plan that utilizes ICT in elementary school social studies lessons. Subsequently, this research also examined the impact of introducing ICT on the interactivity between teachers and students.

Significance of Utilizing ICT to Enhance Interactivity

Interactivity in Social Studies Classes

Introducing ICT into the classroom promotes greater "interactivity (interactive communication)" among students—and between students and teachers—than before. In this practical research, "interactivity" in social studies classes was defined as "building knowledge through solving problems in cooperation with both students and teachers."

ICT Equipment and Applications That Can Be Used for Elementary School Social Studies Classes
ICT Equipment and Assistant Application

Tablet terminals (hereinafter referred to as "tablet") comprise functions, such as "take (photo function)," "watch (video, etc.)," "edit," "input / write," "share," "save (record)," etc. In the third grade of the city hall tour, it effectively collected a large amount of information by varied means, including taking a picture of something

of interest, taking notes of what was noticed with a touch pen, and recording the story of a person in the city hall. After all, the big advantage of such devices is their compactness and portability in addition to collecting and storing information.

Tablets also offer display and sharing functions. Students' thoughts can be instantly displayed on tablet screens. Something specific that interests someone can be maximized on the screen by zooming in. Our school has an "Apple TV" connected to the display, making it easy to mirror. The tablet screen can be mirrored on it whereby writing on it and sharing it with everyone becomes easy. Additionally, there is an application called "Classroom" on the iPad, which enables teachers to check the status of every student's tablet (e.g., running applications, home screen). It also shows student's active screen on the classroom display instantly. In other words, ICT equipment is dependent on tablets and displays.

Web Search and Map-based Applications

Functions can be expanded by introducing applications to the basic functions of tablets. In social studies classes, the basic applications would include web search and map-based applications. Search engines like Google or Yahoo! make instant searches according to a student's individual interests. Map-based applications, such as Google Maps or Google Earth help focus on the landform and location. For example, in the third grade, students can observe the city where they live from a birds-eye perspective by using the "street view" function and thereby collect realistic information that cannot be obtained through a flat map.

Class Support Application "LoiLoNote" [3]

LoiLoNote is a cloud-based lesson support application. Students as well as teachers can associate their thoughts with not only text but also videos and photos. Information can be collected through Web search and stored in cards that can be arranged and classified. Learning can be enhanced by easily sharing the card with the class. Since it is a cloud-based application, it can be stored without restrictions, and it turns into a portfolio. In other words, all information—including materials distributed by teachers, materials found by oneself, one's thoughts, and thoughts of one's friends—can be collected in one LoiLoNote, which can be retrieved any time. Additionally, LoiLoNote has varied "thinking tools" functions that visualize students' thoughts. For instance, since students' thoughts are expressed on the card, they can exercise their thoughts, such as comparison and classification, by simply arranging these cards on the diagram of the prepared thinking tool. LoiLoNote can also be used as a platform to support students' learning because it has icons, such as cameras, memos, web searches, and maps, which are also functions of a tablet.

Web Conferencing System: "Zoom"

Zoom is an application that allows holding seminars and online meetings using a personal computer (PC), smartphone, or tablet. By preparing an online room, it is possible to hold meetings regardless of location or time, and it is often used in business and educational settings. This made it possible for multiple people to interact over video calls online. This system is likely to be useful in social studies classes as well. For example, it will be possible to interact with guest teachers and broadcast from the field. Until now, there were serious temporal and spatial barriers, making classes difficult. However, Zoom has made it possible to overcome some of these barriers.

Characteristics of Elementary School Social Studies Classes by Utilizing ICT to Enhance Interactivity

The features of elementary school social studies classes that utilize ICT to enhance interactivity are summarized in the following three points.

First, students' way of learning will be updated. In social studies classes thus far, students have been encouraged to learn by utilizing materials distributed by teachers, textbooks, and collections of self-owned materials. However, with the introduction of ICT, their learning is no longer limited to textbooks and reference materials. Students begin searching from the start of the lesson, learning keywords related to the content. In other words, students begin individual learning while expanding ideas from the keywords related to the learning content created by the teacher. Moreover, until now, it was not possible for students to immediately clarify simple questions or concerns. The effect of ICT, which made it possible for students to search any facts/ information in social studies classes instantly and automatically, is thus beneficial.

Second, it is possible to organize lessons/learning processes that can be created with students. Until now, lessons basically consisted of materials prepared by teachers, with a focus on textbooks and collections of materials. However, by utilizing ICT, it will be possible to utilize materials prepared by students, who are already beginning to learn individually while expanding their ideas from keywords related to the learning content. Consequently, the student discovers a lot of materials. While sharing the same, the student can deepen the learning by connecting it with the materials prepared by the teacher. In other words, teachers and students can bring materials together to create lessons to solve learning problems. This increases interactivity in social studies classes.

For example, during the lesson practice described later, when sharing the image of agriculture at the introductory stage, an agricultural machine, a tractor, became a controversial issue. At that time, the student who had an image was sharing their experiences ("I'm at home and I've been riding" and "I've seen it in a rice field"). Simultaneously, another student searched, found a picture of a tractor, and shared it. This student subsequently said, "That's it. It's not what I expected." When asked, the student mistook the tractor for something else. When the teacher examined the entire class, there were some students who misunderstood the meaning of "tractor." This would not have been possible in the previous lessons. It would have been dismissed if the teacher used his/ her own discretion. However, the students' behavior provided a common understanding. Perhaps, in the limited class time, many parts were unilaterally considered "good." It is possible that some of the students' understanding was incomplete. In other words, by utilizing ICT, there is a possibility that the lesson structure would evolve to capture the context of students' learning.

Third, it is possible to expand learning in social studies classes. Until now, there were few opportunities to learn how students themselves enhanced their learning in social studies. A student with a personal tablet connects the learning of social studies to reality, and a student is molded into becoming an individual who tells the teacher what they found in their life and what they noticed. For example, a student sent a picture of a bag of rice that he was eating at home; he drew an illustration focusing on the clothes of the person working in the rice field, and he found a connection between real-life scenes and learning. Such learnings in the past could not be shared in the same manner without attending school in-person. However, the tablet made instant sharing possible, regardless of the temporal and spatial limitations.

Actual Elementary School Social Studies Class Utilizing ICT to Enhance Interactivity

Here we introduce examples of ICT utilization in the fifth-grade social studies class on "Japanese Agriculture." [4]

Elementary Social Studies Learning Themes in Japan

In elementary school in Japan, social studies are taught from grades 3–6. Its themes are shown in Table 1. The class we designed focused on "Food production in our nation's agriculture and fisheries industry."

Teaching Material Settings: Current Situation in Japanese Agriculture

This learning unit focused on agriculture that supports Japan's food production, and aimed to clarify the systems and issues of agriculture by considering the future possibility of agriculture devoid of these issues. Agriculture, considered "the primary industry," is the foundation of Japanese industry, closely related to the topography and climate of the country. One can learn about social systems, such as production, distribution, and sales, while considering the characteristics of climate and topography learned previously. Therefore, in this unit, "rice," which is representative of Japanese agricultural products, was used as teaching material. This was because the production, distribution, and sales systems have been established, the mechanism is easy to understand, and it is familiar to students. In production, systems, such as mechanization of work, field maintenance to improve the efficiency of mechanization, and breeding to improve production volume and quality have been constructed. In distribution and sales, a supply chain system is constructed in which producers reach consumers via Japan Agricultural Cooperatives and wholesalers, and a direct sales system to consumers is possible through the promulgation of the Internet. Subsequently, there are also major issues in Japanese agriculture. The problem of harsh work called 3K (*kitsui* : hard work, *kitanai* : messy, *kiken* : dangerous) overlaps with the problem of labor shortage, aging workers, and a decrease in small-scale farmers due to a shortage of successors. In some areas, there is concern that Japan's landscape will be damaged by the increase in abandoned cultivated land created by the decrease in farmers.

Therefore, this unit took up the case of Yabu City, Hyogo Prefecture, which overcomes the problems of agriculture and promotes community development centered on agriculture. There were two reasons for this; first, Yabu City is located in a mountainous area. In Japan, mountainous areas such as Yabu City occupy about 70% of the total land area in mountainous regions, and about 40% of the population farm in the mountainous areas. In other words, it is not a vast flat land; instead, the specifics of agriculture are unique to mountainous areas. Second, their objective was to overcome the challenges of Japanese agriculture. Despite being the foundation of the industry, agriculture in Japan still faces challenges; such as the increase in abandoned cultivated land, labor shortage, and aging. Furthermore, while many regulations have been set up in Japan to protect farmers, these regulations have sometimes been detrimental. Therefore, Yabu City is declared as a "National Strategic Special Zone" where the mayor has the authority to relax or change the regulations. Thus, this can promote agriculture aimed at pursuing profits through the entry of companies, promote smart agriculture utilizing ICT and AI, create employment, and secure migrants for the purpose of agriculture. For students, the case of Yabu City would be a glimpse of the new agriculture of the future.

Unit Plan

The unit consisted of 10 hours in total and three steps:
- · First step: "What is the first rice?" (three hours)
- · Second step: "Rice production system" (four hours)
- · Third step: "Secrets of smart agriculture" (three hours)

Unit Goals

The unit goals were shown as follows:

- For agriculture in the Shonai Plain,[5] students understand the rice production, distribution, and sales systems, and then understand the issues of Japanese agriculture, such as labor shortages and aging.
- Based on the understanding of the social systems on rice, students consider Yabu City as a concrete example of trying to overcome those problems.
- By learning about deregulation and smart agriculture promoted by the National Strategic Special Zones, students think and express about Japanese agriculture in the future.

Unit Overview

Based on the above, the following unit plan was designed (table 2).

Significance of Elementary School Social Studies Classes Utilizing ICT to Enhance Interactivity

To clarify the actual situation of ICT utilization that enhances interactivity, we approach the lesson from the three perspectives of "information gathering," "information scrutiny/thinking," and "reflection."

Information Gathering

"Information gathering" in classes implies collecting information related to learning content by searching the Web. At the stage of introduction, restrictions on how to use the tablet could not be laid down. Hence, it was possible to search the Web throughout. At the same time, at the beginning of all lessons, students collected information in relation to the content of the lessons, including the process of searching. In other words, the students applied multiple perspectives. Here, we take up a remarkable lesson scene and explain how students used multiple thoughts in it.

In the sixth lesson in the 2nd step "Why are there rice with various names?" the following two scenes were taken up. First, with the introduction of this class, students read the materials for "List of varieties of rice
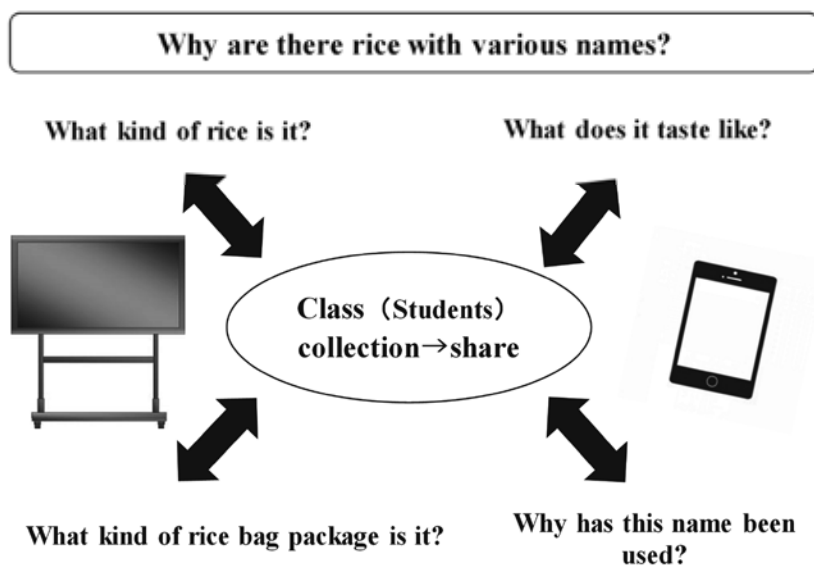
Figure 1. Information gathering and sharing
Source: Created by authors.

cultivated and brown rice produced in *Reiwa* 3rd year (2021)." This material was centered around the name of the variety of rice, and it was difficult for students to imagine what kind of rice it was. The students who noticed this began to search the Web using the name of the variety as a keyword and began to share pictures of rice bags. There was a variety name that the students were particularly interested in, and there was a tweet asking, "What kind of taste does it have?" So, the students were researching various varieties while looking at the photos of rice bags' packaging. Since this scene was an introduction, it was intended to raise awareness about the variety name. However, in reality, it was a scene where the students investigated not only the name of the variety but also the packaging of rice bags and the characteristics of the variety. In this way, the interactivity of collecting and sharing information that is insufficient with the presented materials increased (see Figure 1). The purpose of the scene, where the material the "family tree of rice" is presented, was to make people aware that the breeding centered around *Koshihikari*, a famous rice cultivar, was being carried out. In actuality, the students discussed their thoughts, gathered information in class, and deepened their learning, such as the year when the ancestors of *Koshihikari* and the characteristics of the newest varieties were integrated into the study design. The appearance of such students might indicate a new style of learning born from the introduction of personal tablets.

Information Scrutiny/Thinking

Information scrutiny/thinking means deep-thinking about problem solving while analyzing and scrutinizing the collected information using ICT.

The fourth lesson in the 2nd step "Why is so much rice produced in the Shonai Plain?" was a remarkable lesson for student's information scrutiny/thinking using ICT. First, the teacher transferred the bird's-eye view of the Shonai Plain to the students' iPad, and when he presented it, he incorporated an activity to find the place using Google Maps. Since the name of the material was hidden, the students were looking for the places from the name of the mountain or the river as a clue. The students who found the Shonai Plain on the map intuitively tried to zoom in and out of the map and began to investigate the characteristics of the land. When all the students were able to present the map of the Shonai Plain on the tablet, they presented the land use map of the Shonai Plain. From that moment on, the students began to scrutinize the land use map against Google Maps. Specifically,
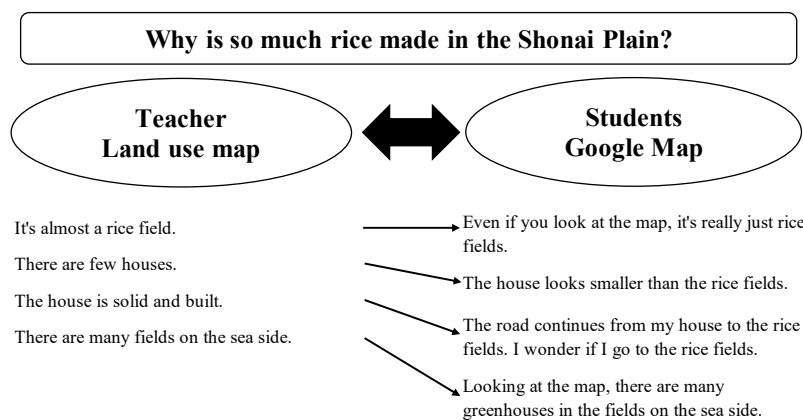

Figure 2. Information examination scene to improve reading comprehension of materials by utilizing map application

Source: Created by authors.

the students examined the information, such as comparing the tablet screens on two screens and checking the land use map information on the aerial photograph of Google Maps. For example, from the reading of the land use map, there was a student's remark that "there are many fields near the sea." So, when the teacher actually projected Google Maps on the display and checked it, the students noticed that there were many greenhouses in the Shonai Plain. The students could not notice a large number of greenhouses just by reading the land use map. In other words, by utilizing ICT, it was possible to improve the level of reading comprehension of materials, leading to deeper awareness among students. (See Figure 2).

The eighth lesson in the 3rd step "Why did Mr. Fujita, who works in a tile sales company, start farming in Yabu City?" was also a remarkable lesson. This class entailed learning about Mr. Fujita, who is engaged in agriculture. When a student learned that Mr. Fujita's work and headquarters are in Miki City, Hyogo, she opened Google Earth and started searching. The teacher took that into account, and at the stage the student discovered, the teacher instructed her to project her tablet screen onto the display. Consequently, the students noticed the many rice fields around Mr. Fujita's head office. A student said, "I understand that Mr. Fujita is farming because there are many rice fields around him." This was a scene where students who had insufficient understanding initially, understood that he was farming as part of a business company. This was also a scene that was not intended by the teacher, but it was created by adjusting to the students' flow of thought. Thus, by utilizing ICT, it was possible to deepen and help the awareness of the entire class by collecting and sharing information born from the flow of students' thoughts.

The nineth lesson in the 3rd step "Why is Mr. Fujita challenging agriculture using AI and ICT?" was a remarkable lesson too. This was a class focusing on "smart agriculture" that Mr. Fujita is working on with the support of Yabu City as a National Strategic Special Zone. After confirming the characteristics of the tractors, rice transplanters, drones, mowing machines, and combine harvesters used in smart agriculture that Mr. Fujita uses, the teacher asked the students, "Why does Mr. Fujita use agricultural machinery that utilizes AI and ICT?"
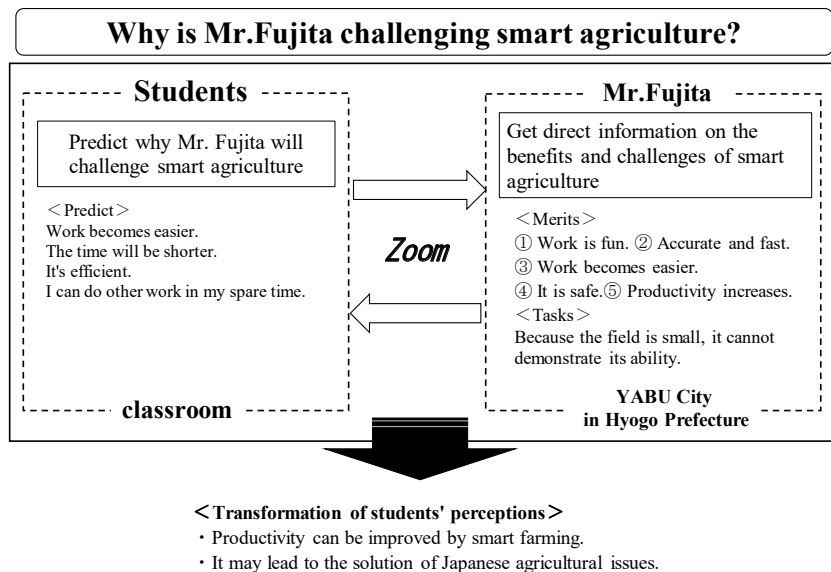

Figure 3. Information thinking scene with enhanced interactivity by Zoom

Source: Created by authors.

Figure4. Dialogue using Zoom
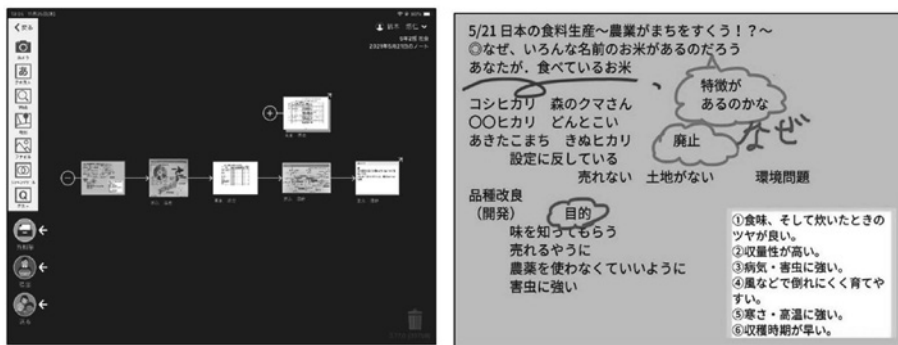Source: Taken by authors.

Figure 5. Dialogue using Zoom Student's LoiLoNote screen (left) and student's card (right)
Source: Taken by authors.

and then shared student's expectations with other students. Here, the teacher connected to Mr. Fujita in Yabu City via Zoom. Therefore, the teacher incorporated an activity to have Mr. Fujita himself teach the merits of smart agriculture. Mr. Fujita taught the students five merits: (1) fun to work, (2) accurate and fast, (3) easy to work, (4) safety, and (5) increased productivity (lowering the cost of making things). At this time, the display shared a picture of the field, which had been taken when the teacher interviewed him earlier. Furthermore, when asked about the disadvantages and issues from the teacher, Mr. Fujita answered, "I have not fully used the functions because my field is small." In this way, by utilizing Zoom, it was possible to break away from learning only by teachers and students and deepen learning while connecting with the persons involved in the teaching materials (see Figure 3 and 4). Until now, there were time and distance barriers, and it would have been difficult to have guest teachers come directly to the classroom. Zoom made it possible to teach students directly online and overcome the learning barrier due to classroom-only learning for teachers and students, thus leading to the latter's deeper learning. In other words, lessons with enhanced interactivity with teachers, students, and related parties were constructed through teaching materials, and students' thinking toward problem solving deepened.

Finally, in this unit, "LoiLoNote" was used. All teaching materials prepared by the teacher were distributed using LoiLoNote. Here, we consider a student's cards pertaining in the sixth lesson in the 2nd step "Why is there rice with various names?" as an example of using LoiLoNote (see Figure 5). On the screen of the

student's LoiLoNote, we can see that the materials transferred by the teacher and the cards made were connected and organized. Looking at the screen of the student's LoiLoNote, the materials with high priority were selected for solving the learning task. We could also find that a student organized his cards while positioning the materials on the card or while connecting the materials to the card and organizing them. Looking at the notebook (Figure 5) created by the student, while positioning the materials prepared by the teacher on the card, it summarized simple questions about the task, the contents read from the materials, and the contents read by classmates, etc. In the past notebooks, it was not possible to make notes while positioning the materials. LoiLoNote made it possible to relate personal materials and relationships between materials using lines and arrows. As a result, the students were able to move their own card to exercise their thinking and deepen their learning.

Reflection

LoiLoNote was also used for reflection wherein students wrote down what they learned and thought about the learning task on the card and submitted it to the submission box. LoiLoNote has a submission box function, so teachers can collect and stock students' cards in retrospection. Additionally, if the submission box is shared, it can be seen by classmates (see Figure 6). In other words, after class, teachers can share what the classmates have learned. In the past, it was common for teachers to collect notes and worksheets and share them as mediators. By sharing this for a certain period of time after class, it is possible not only to know the thoughts of colleagues but also to refer to the perspectives of others' reflections. Furthermore, in this unit, the retrospective
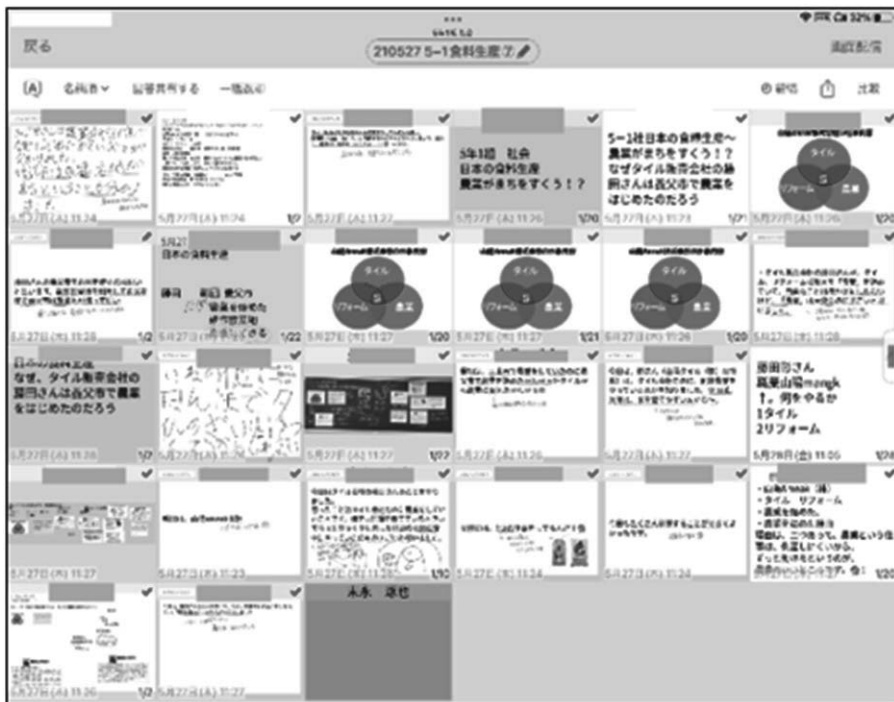

Figure 6. Screen sharing students' answers using LoiLoNote
Source: Taken by authors.

account of each student's notebook were connected to the materials that they found. This enabled viewing the students' thoughts. Additionally, since it is gathered like a portfolio, not only teachers but also students were able to look back and see the changes in each student's thoughts.

Conclusion

Significance and Future Tasks Pertaining to This Study

The significance of the research lies in the following two points.

First, we designed an elementary school social studies class that utilizes ICT to enhance interactivity. By using LoiLoNote and Zoom, we were able to show the concreteness of the lessons that enhance the interactivity through the interactive material examination and thinking activities of students and teachers.

Second, it was clarified that interactivity in elementary social studies class can be enhanced by using a map, a search application, a class support application "Roilo Note," and a web conferencing system "Zoom." LoiLoNote and Zoom have made it possible to overcome temporal and spatial barriers and renew the teaching style of the past.

Subsequently, it is necessary to develop the ability to utilize information. Students are now able to obtain and share a large flow of information, partly because it has become easier to search the Web. However, there are many cases where the credibility and accuracy of the information are not taken into consideration. It is important to cultivate the ability to identify the procedure and method of collecting information and the viewpoint and method of examining materials. Since it has become easier to collect digital information, it is also necessary to design a new elementary school social studies class that combines lessons that allow the experience of more realistic material and information and classes that enhance interactivity using ICT.

Prospects in ICT Use in Social Studies Education

The only way to assess a student's growth in his/her competencies behind the behavior is to observe the changes in the behavior in a concrete context. Since the interpretation always includes the evaluator's interpretation, it is necessary to develop the teacher's competence. By accurately grasping the results of the student's growth and learning and improving the daily instruction by the teacher, a student can move on to the next stage of learning. The teacher must positively evaluate the goodness and progress of the student while letting them realize the significance and value of learning, rather than ending with the evaluation for the sake of it. The practice of the fifth-grade unit "Japanese Agriculture" focuses on agriculture that supports Japanese food production, clarified the current situation and issues of Japanese agriculture, and then took up the case of Yabu City that overcomes the issues.

In this practice, personal tablet was prepared for each student, and LoiLoNote was used to summarize the students' thoughts and develop mutual learning. At the begin of the lesson, the students collected information about learning content by using the Web search application. Additionally, using Google Maps, the students could intuitively and repeatedly zoom in and out on the map to get an overview of rice cultivation in Japan, focusing on the names of mountains and rivers and the state of the land in the Shonai Plain where rice cultivation is carried out. For the lesson focusing on "Why are there rice with various names?" each student wrote down what he/she came up with on a tablet in the form of a classification of facts, divided into breeding, purpose, and environmental problems. Each student connected the above events with arrows to depict the relationships and write their own words. LoiLoNote is a tool for students to learn where students can freely write down their thoughts on a card,

arrange them in an order that is easy to convey, and classify them. By easily sharing the card with the class, new learning was initiated. Most importantly, it is a portfolio that accumulates as it is created. All lessons are portfolios, including teacher and presentation materials, such as cards and charts created by students. By reflecting on these, students were able to perceive their own growth. LoiLoNote has various thinking tools for developing thinking ability. To create thoughts, such as "comparing, classifying, and associating," LoiLoNote supported visualization with various pattern diagrams, such as Venn diagrams and chart diagrams. Furthermore, it was noteworthy that students' choices and thoughts can be expanded through means, such as cameras, texts, maps, and Web searches. Monitor evaluation was performed in appropriate situations in the learning process while looking at the unit contents and the unity of time. There were three stages of evaluation using ICT, namely "information gathering," "information scrutiny/thinking," and "reflection." This meant that the teacher not only shows the context up to problem solving and performs monitor evaluation at each stage, but also formative evaluation of the students themselves, and metacognitive activities that can be utilized for subsequent learning are possible. Further, by utilizing Zoom, the teacher set up opportunities to interact with the persons involved in the learning content in real time, and by utilizing ICT, which has the potential to expand learning by jumping over the classroom at any time, interactivity has been increasing.

Since this practice can be evaluated, students can assess their learning process and growth by utilizing ICT. "Learning" is the process by which a student learns to discover and develop their inherent potential. To properly evaluate their activities, teachers must study, including further improvement of their skills as professionals involved in education.

At the end of this paper, we would like to provide some suggestions using ICT, especially, collaboration with outside personnel utilizing with ICT. By being able to build collaborative relationships with others, it is possible to create a new space in the school. This contributed to our lesson in the following points:

1) For students, improving the level of students' thinking through the process of forming social cognition, which is a common foundation for problem solving,

2) interactive learning activities inevitably created opportunities for students to give feedback, and created a sense of competence among students and a sense of motivation and accomplishment to express their intentions, and

3) for outside personnel, responding to simple questions from students has led to the creation of their own awareness of issues as issues in the real world.

In addition, although collaboration with the local community is being attempted on various occasions, it is becoming more and more necessary for social studies teachers to conduct research with a view to subjects and students' academic achievement. It can be pointed out that has been seen as a new future task.

Notes

1. According to Cabinet Office (n.d.), "Society 5.0" means "A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space."

2. In this program, "individual tablets," which we call one device for one student, is receiving attention and now we can see lessons using tablets or other ICT devices in Japanese schools.

3. If you want to learn more about "Loilo Note," visit the following website: https://loilonote.app/login?hl=en-US

4. In the study of teaching materials, we mainly referred to the following: Kai (2019), Andnian et al. (2020), Kubota and Yamaguchi (2020), Miwa (2020), Ohizumi (2020), and Yagi (2021).

5. Shonai Plain in Yamagata Prefecture is a famous place for rice production in Japan. In many elementary social studies textbooks in Japan, the case of Shonai plain is used to teach and learn about the production, distribution, and retail systems of rice.

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Table 1. Elementary social studies learning themes in Japan

Grade	Spatial scale	Geographical strand	Civics strand	Historical strand
3. Community learning	Mainly local area	(1) Characteristics of local areas	(2) Production and selling business in local area(3) Works to protect the safety of local area	(4) Transition of characteristics of our city
4. Community learning	Mainly the prefecture where students live	(1) The characteristics of the prefecture (5) The characteristics of areas with local character within prefecture	(2) Works to support people's health and living environment (3) Works to protect people from natural disasters	(4) Tradition, culture, and achievements of predecessors within prefecture
5. Learning about natural environment, various industries	Mainly Japan	(1) Characteristics of our nation and people's living (5) Natural environment in our nation and its relationships with people's lifestyle	(2) Food production in our nation's agriculture and fisheries industry (3) Industrial production in our nation (4) Relationships between information and industry in our nation	
6. Learning about politics, history, and international understanding	Mainly Japan, partly global		(1) Politics in Japan (3) Globalizing world and Japan's roles	(2) Historical phenomena in Japan

Source: Created based on Ministry of Education, Culture, Sports, Science and Technology (2018).

Table 2. Lesson plan "Agriculture in Japan—Smart Agriculture in Yabu City, National Strategic Special Zone"

	○ **Main question** ・**Learning activities**	**Materials**	**Knowledge that students will acquire**
	What is rice?		
1st step	1 What is rice? ・ Form questions about rice while sharing what you know about rice.		
	2 Let's find out about rice. ・ Search the Web for rice based on the questions that were formed the previous time and put them together on a LoiLoNote cards.		
	3 What kinds of rice are there? ・ Compare the photographs of *Uruchi* rice, Indica rice, and seedlings to clarify their characteristics.	①②	・ There are various types of rice, such as glutinous rice, indica rice, sake rice, and glutinous rice. ・ Rice contains two types of starch, amylopectin, and amylose. About 80% of glutinous rice is amylopectin and 20% is amylose. ・ Indica rice accounts for 80% of the world's production.
	What kind of system is there to produce rice?		
2nd step	4 Why is so much rice produced in the Shonai Plain? ・ Clarify the characteristics of land use map, sunshine duration, and average temperature, and consider the reason why the Shonai Plain is suitable for rice cultivation.	③④⑤ ⑥⑦	・ Most of the Shonai Plain is used as rice fields. ・ Factors, such as large land, abundant water, sunshine hours, temperature difference, and monsoon have an effect on rice cultivation in the Shonai Plain. ・ Japanese rice cultivation is popular in the Tohoku region and Hokkaido.
	5 How do rice farmers produce a lot of rice? ・ Consider the reason why a rice farmer organizes the work process for one year and promotes mechanization and field maintenance.	⑧⑨⑩	・ Rice is produced in the order of raising rice, scraping rice, planting rice, and harvesting rice. In addition, there are various work processes, such as seedling production and water management. ・ The rice produced is processed by a country elevator and stored properly. ・ Mechanization can reduce work labor and time. ・ Mechanization is promoted by field maintenance to improve efficiency.
	6 Why is there rice with various names? ・ Consider the reason for increasing the variety of rice brands produced in Japan.	⑪⑫⑬	・ There are about 800 varieties of rice cultivated in Japan, and many *Koshihikari* rice are cultivated. ・ Rice farmers are improving varieties centered on *Koshihikari*. ・ The purposes of breeding are: (1) good taste and gloss when cooked, (2) high yield, (3) resistant to diseases and pests, (4) easy to grow due to colds, (5) resistant to cold and high temperatures, and (6) early harvest time.
	7 Why are the number of people and farmers who work in agriculture decreasing? ・ Understand the challenges of Japanese agriculture by using materials such as changes in the number of farmers, the age ratio of agricultural workers, and changes in abandoned cultivated land.	⑭⑮ ⑯⑰	・ The agricultural population is declining. ・ The agricultural population is aging. ・ The increase in abandoned cultivated land causes four problems: (1) weeds and pests are generated, (2) floods cannot be prevented, (3) illegal dumping of waste occurs, and (4) wild animals can act.

		Why is Mr. Fujita challenging smart agriculture?	
3rd step	8 Why has Mr. Fujita, who works in a tile sales company, started farming in Yabu City? · Think about the reason why Mr. Fujita, employee of a tile sales company, started farming when he moved to Yabu City. 9 Why is Mr. Fujita challenging agriculture using AI and ICT? · Consider the merits of smart agriculture by clarifying the characteristics of the smart agricultural machinery that Mr. Fujita is working on. 10 What will happen to Japanese agriculture in the future? · Based on the rural landscape of Yabu City, Hyogo Prefecture, forecast images will be created to enable students to concretely imagine future agriculture by processing copyright-free illustrations on the Internet and photographs of agricultural machinery taken by the teachers.	⑱⑲ ⑳㉑ ㉒㉓㉔	· Mr. Fujita thought that the tile sales and remodeling business would reduce profits in a society with a declining population in the future and started agriculture as a promising industry in the future. · Yabu City has obtained the approval of the National Strategic Special Zone and made it possible for companies to enter. · By smart agriculture utilizing AI and ICT, productivity has been improved by improving work efficiency and labor saving. · There are possibilities to solve the problems of aging workers and labor shortage, which are the problems of Japanese agriculture.

〈Main materials〉
①*Uruchi* rice and indica rice; ②Photo of *Uruchi* rice and Indica rice seedlings; ③Land use map of Shonai Plain; ④Monthly sunshine hours of Tsuruoka City in Yamagata Prefecture and Kesennuma City in Sendai Prefecture; ⑤Monthly average temperature of Tsuruoka City and Kesennuma City; ⑥Mechanism of seasonal wind; ⑦Rice production amount; ⑧Igarashi's agricultural work; ⑨Annual per decade changes in cultivation time in Yamagata Prefecture; ⑩Comparison between before and after field maintenance; ⑪List of production area varieties of paddy rice *Uruchi* rice and paddy rice *Uruchi* brown rice; ⑫Variety of *Uruchi* rice that is the largest planted area in each prefecture; ⑬Family tree of rice; ⑭Transition of the farmer population; ⑮Number of Farmers; ⑯Average income per farmer and ratio depending on agricultural income; ⑰Problems that occur when abandoned cultivated land increases; ⑱Mr. Fujita's photo; ⑲Mr. Fujita's business contents; ⑳Mr. Fujita's story; ㉑Facts about Yabu City as a National Strategic Special Zone; ㉒Mower (Spider); ㉓Photo of smart agricultural machine used by Mr. Fujita; ㉔Demonstration verification video of a mower (an employee).

Source: Created by authors.