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## **DEVELOPMENT AND EVALUATION OF MATERIALS FOR CHILDREN TO REDUCE THE TABLET DEVICE OPERATIONAL PROBLEMS**

**Hodaka Kachi**

*Graduate School of Education, Shizuoka University, Shizuoka, Japan*  
*[hodaka09231997@gmail.com](mailto:hodaka09231997@gmail.com)*

**Taichi Yasunaga**

*Graduate School of Education, Shizuoka University, Shizuoka, Japan*  
*[yasunaga.taichi@gmail.com](mailto:yasunaga.taichi@gmail.com)*

**Kyohei Sakai**

*Faculty of International Sociology, Toyo Eiwa University, Kanagawa, Japan*  
*[sakai.kyohei@toyoeiwa.ac.jp](mailto:sakai.kyohei@toyoeiwa.ac.jp)*

**Ryosuke Hyuga**

*Kensetsu System Co., Ltd, a software company, Shizuoka, Japan*  
*[ry-hyuga@kentem.co.jp](mailto:ry-hyuga@kentem.co.jp)*

**Shingo Shiota**

*Faculty of Education, Shizuoka University, Shizuoka, Japan*  
*[shiota.shingo@shizuoka.ac.jp](mailto:shiota.shingo@shizuoka.ac.jp)*

## **Abstract**

*In Japanese schools, there is a problem that teachers are overburdened. Therefore to reduce teachers' workloads, this study developed online video teaching materials to assist students to troubleshoot their tablet device operational issues. To develop the teaching materials, we first conducted a questionnaire survey among teachers to understand what kind of operational problems were occurring with tablets in the classroom. We then developed the teaching materials based on the results. The evaluation of the teaching materials was conducted through questionnaires and interviews with teachers. The results suggested that the video teaching materials were able to resolve many of the students' problems and reduce the need for the teachers to deal with all tablet device technical problems.*

### **Keywords**

ICT, Burden on Teachers, Operating Problems, GIGA School Initiative

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## **1. Introduction and Theory/Concept**

The Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan, has been promoting the GIGA School Initiative, which involves the provision of one computer terminal per student, the purposes of which are to “realize an educational ICT environment where diverse children, including those with special needs, can be fairly and individually optimized and their qualities and abilities can be further developed without leaving any behind, through the integrated development of one-per-person terminals and high-speed, high-capacity communication networks...[and] to maximize the power of teachers and students through the best mix of Japan's educational practices and state-of-the-art ICT”. MEXT's aims were that 96.5% of all municipalities would complete the delivery of the GIGA School Initiative by the end of March 2021. However, the GIGA School Initiative has meant that teachers' workloads' have increased because as well as teaching, they also have to deal with computer operational problems. Furthermore, as Murakami et al. (2021) describe, the use of ICT terminals is required to be more complex than in the past, such as the new requirement for the use of cloud computing.

But Khalid's research (2009) reveals that teachers have a strong desire to incorporate ICT into their teaching, but encounter a variety of barriers. In an awareness survey of 161 elementary and junior high school teachers, Okido et al. (2017) found that the reason teachers did not want to use tablet PCs in the classroom was that when there were problems with the devices, the class was

interrupted, and they did not want to be forced to use them. When the students were asked about the use of the tablet PCs, many gave negative responses about the operational issues, claiming that the operations were difficult, the preparation was difficult, and the use caused trouble in the class. Similarly, in an ICT survey of 92 elementary and junior high school teachers, Shinohara (2018) found that teachers felt that the more frequently ICT was used, the more likely it was to cause trouble. Terashima et al. (2017) surveyed 195 elementary and junior high school teachers to determine their attitudes toward the use of ICT and found that they were worried that if the student tablet devices stopped working, the class would not be able to continue, which was a disincentive for using the tablet devices.

Therefore, while the GIGA school concept has led to the installation of one-per-student terminal environments, there is a growing sense of crisis because of the increased burden on teachers to deal with the associated tablet terminal operational problems. To achieve the aims of the GIGA School Initiative, it has become necessary to find ways to reduce this extra burden on teachers.

While there should be ICT support personnel available, as Sumimura et al. (2021) found, because many schools had not yet deployed this personnel, there was a limit to the teachers' abilities to respond to every operational problem.

Under these circumstances, in order to solve this problem, it is necessary to develop the ability of children, who are most likely to cause operational problems, to deal with such problems.

## **2. Literature Review**

In an overview of previous studies, we can find existing teaching materials that provide teachers with information knowledge, such as "Cloud for Better Education - Education ICT Guidebook Ver.1" (Ministry of Internal Affairs and Communications, 2017). This guidebook introduces effective ways to use tablet devices in educational activities, contributing to the development of teachers' information utilization skills, but it does not address how to deal with tablet operation problems.

As a learning material for children, there is a learning material called "Let's develop ICT media literacy" (Ministry of Internal Affairs and Communications, 2007). This introduces the functions and specific uses of ICT terminals and shows children how to use ICT terminals appropriately. However, it treats cell phones as the main device, and the content is not consistent

with the times when tablets and other devices are used today.

In addition, the Ministry of Education, Culture, Sports, Science and Technology (2017) has a website on how to use smartphones properly with the theme of "For you in the age of smartphones". There are also videos on how not to use tablets (the Ministry of Education, Culture, Sports, Science and Technology, 2021). However, both of them do not show how to deal with operational problems after they have occurred.

A study by Olga et al (2017) developed an online course on ICT problem-solving skills for high school teachers, which successfully improved teachers' ICT problem-solving skills and reduced teachers' anxiety about ICT. However, improving teachers' ICT-related skills limit their ability to deal with many ICT operational problems at the same time.

Thus, there are no teaching materials to improve children's ability to deal with operation problems on tablets, and there is no research on teaching materials for children to reduce the burden on teachers.

### **3. Research Issues**

Therefore, this study developed teaching materials to assist students to deal with their own operational problems and to reduce the burden on teachers. The term "tablet" in this study is a generic term that refers to both "tablets" and "tablet PCs" as most of the computer "terminals" provided by the GIGA School Initiative are "tablets" or "tablet PCs."

### **4. Methodology**

To develop the student teaching materials, a preliminary survey was conducted on elementary and junior high school teachers to clarify the current issues at school sites and the additional burdens being placed on teachers.

#### **4.1. Implementation and Results of The Preliminary Survey**

Two separate surveys were conducted. The first survey was conducted on 58 elementary and junior high school teachers who claimed that they had not experienced any difficulties in using ICT in their schools. The purpose of this survey was to determine whether these teachers had any concerns about the future use of ICT and to identify teachers who had already experienced operational problems. The questions and results are shown in Table 1. A second survey was conducted on 44 elementary and junior high school teachers who had experienced operational issues in their classes. The survey was focused on the teachers' burdens when these operating

problems occurred, the types of operating problems experienced, the methods and the people who dealt with the operating problems, and the possible future problems with the use of tablet terminals. To identify the possible specific troubles, cases from the official websites of Apple, Lenovo, and NEC were referred to as these are the leading manufacturers of the tablet terminals installed in the schools. The answers to the questions about how the teachers dealt with the problems and who dealt with them were extracted and classified and are shown in Table 2.

**Table 1:** *Survey items and results for teachers who had not experienced any ICT issues*

1. What kind of problems, if any, are you worried about in the future? ( Multiple answers are possible )	
Trouble in operation (e.g., the tablet stops working)	75%
Problems with photos and videos (e.g., someone took a picture of you that you didn't want taken)	73%
Physical problems (e.g., breaking the tablet screen)	56%
Communication problems (e.g., swearing in the comment section)	54%
Awareness trouble (e.g., looking at videos or unrelated websites during class)	48%
Authentication problems (e.g., forgetting your ID or password)	46%
No worries	0%

(Source: *Elementary and junior high school teachers n=58*)

**Table 2:** *Survey items and results for teachers who had experienced operational problems*

1. When you experienced operational problems, how much of a burden did you feel?			
I felt a strong burden.	I felt it was a little burden.	I didn't feel much.	I didn't feel it at all.
55%	45%	0%	0%

2. Please tell us about any trouble you experienced. (Multiple answers are acceptable)

Unable to connect to the Internet	68%
Slow and unresponsive	66%
Applications do not open or crash frequently	32%
No sound	25%
No power	20%
Cannot charge the battery	5%
Other	11%

**3. The person who handled the operation problem.**

Leaders themselves	64%
Other teachers (colleagues, assistant teachers, nearby teachers)	27%
ICT support staff, information staff	18%
Children, students	5%
Others (manufacturer, vendor, city board of education)	9%

*(Source: Elementary and junior high school teachers n=44)*

**4.2. Discussion for The Preliminary Surveys**

First, the survey results for the teachers who had not experienced operational problems revealed that 75% were worried about future operational problems. The survey results for the teachers who had experienced operational problems revealed that all respondents felt "burdened" when these operational problems occurred, with more than half feeling "very burdened." The specific problems experienced were as follows: 68% could not connect to the internet; 66% had slow or unresponsive PC problems; 32% had problems with applications that did not open or frequently crashed; 25% had problems with the sound; and 20% had problems with PCs that did not turn on. Of the people who had to deal with the operational problems, the majority (64%) were the instructors themselves, followed by other teachers (27%) and ICT support staff and information staff (18%), which suggested that the students found it difficult to deal with the operational problems on their own. These results indicated that reducing the need for the teachers to deal with the tablet operational problems could reduce the mental burden on the teachers and the disturbances to the classes. When asked how the teachers dealt with these problems, they said that asked students to use another terminal or to share with neighbouring students; however, others said they gave up or changed the class content. These results indicated that the increased burden on the

teachers was because they had to deal with all operational problems that occurred, regardless of the cause.

### **4.3. Development of the Teaching Materials**

Based on these preliminary results, video teaching materials were developed to reduce the burden on teachers when there were tablet operational problems. The teaching materials were aimed at students to assist them in first trying to solve the problems by themselves before consulting the teachers, which was hoped to reduce the teachers' workloads by only needing to deal with the operational problems they could handle.

Rather than simply teaching the students how to deal with the tablet device operational problems, the video teaching materials were specifically focused on troubleshooting along conditional branches, learning specific methods, becoming familiar with new troubleshooting words and phrases, such as "SSID" and "cache," and learning how to delete applications running in the background.

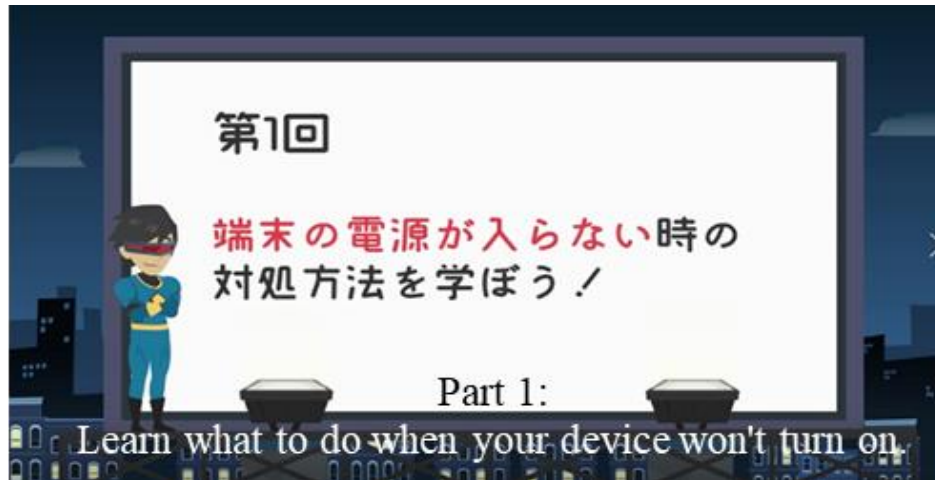
The video material dealing with how to respond to operational problems was designated the "application" part, and the video material dealing with basic ICT skills was the "basic" part. The developed video materials were designed to be used by students interested in ICT and were posted on a website so students could voluntarily and easily access them at home.

Some of the developed video materials for "Application" are shown in Figures 1, 2, 3. Table 3 shows the structure of the website on which the developed video materials were posted.



**Figure 1:** *Some of the video materials*

*(Source: <https://ensupp.jp/>)*



**Figure 2:** Some of the video materials

(Source: <https://ensupp.jp/>)



**Figure 3:** Some of the video materials

(Source: <https://ensupp.jp/>)

The four problems selected for the application of teaching material themes were based on the results of the survey regarding the problems the teachers had experienced: unable to connect to the internet; a slow or unresponsive terminal; when there is no sound; and when the terminal does not turn on. The third most common problem, which was when an application did not open or frequently crashed, was excluded from the training materials because this problem could arise because of internet access or application problems.

When the terminal would not turn on, the students were first advised to try charging the terminal for an hour with a special charger. If the problem persisted, they were advised to check if



the terminal was hot and then hold down the power button for 5 to 7 seconds to restart the device, with the final choice being to consult the teacher.

To check whether it was a Wi-Fi problem, the students were advised to see if the other tablets were connected. If they were connected, the students were asked to turn the Wi-Fi settings “off” and then “on” again. If the problem persisted, they were advised to move the tablet closer to the router device, check if they were connected to the correct network SSID, press and hold the power button for 5~7 seconds to reboot, and finally, if all else failed, talk to the teacher.

For when the device was slow, students were advised to try deleting the apps running in the background, deleting the search function and search apps cache, deleting the images and videos they did not need, rebooting the device by pressing and holding the power button for 5 to 7 seconds, and finally, if all else failed, consulting the teacher.

Each video content section was from 2<sup>1/2</sup> to 4 minutes and focused on dealing with the operational problems that were relatively independent of the school's settings, such as “let's charge the battery with a special charger for one hour” and “Let’s check that the volume is not set to zero.”

By registering as a user, the students could check the status of their certification examination and when they passed the final test, could receive their certificate.

**Table 3:** *Composition of the website*

Home	-What is Ensup?
	-SE Certification TOP
	<b>-SE Certification: Basic Editor</b>
	-Part 1: Computer Components
	-Part 2: Hardware
	-Part 3: Software
	-Part 4: Networks I
	-Part 5: Networks II
	-Part 6: Information Security
	-Part 7: Information Morality
	<b>-SE Certification: Application</b>
	-Part 1: When the device does not turn on
	-Part 2: When there is no sound from the terminal
	-Part 3: When there is no Internet connection
	-Part 4: When the terminal becomes sluggish
	-Login
	-My Page

(Source: <https://ensupp.jp/>)

## 5. Analysis

To evaluate the effectiveness of the video teaching materials in reducing the burden on teachers, a survey was conducted with 47 elementary and junior high school teachers and interviews were held with four elementary school teachers in their 20s and 30s who were actively using ICT devices in their classes. The contents and results of the survey are shown in Tables 4, and Table 5 shows the questions asked in the interviews.

All teachers believed that the video materials were of value to the children/students who might be interested, with some of the reasons being that some children were attending ICT-related lessons, such as programming classes, that it was free, and that some children were learning about Wi-Fi and USB standards by themselves. Another response was that children were working on their own themes related to Wi-Fi and USB standards for home study. When asked about the

number of students interested in this material, the four interviewed teachers answered 3 out 5 and at most around 10.

Finally, three teachers agreed that because the animation videos were easy for the children to understand and were effective in enhancing their abilities to deal with problems, the materials could improve the students' abilities to handle problems. However, some teachers commented that they were unable to deal with the problems not covered in this material and that if the children no longer needed to consult the teacher, the teachers would not improve their own abilities to deal with the problems.

**Table 4: Content and results of the survey**

<b>1. Do you think that these efforts are effective in solving problems?</b>			
I strongly feel so.	Somewhat.	Not much.	Not at all.
65%	33%	2%	0%
<b>2. Do you think that these efforts are effective in reducing the burden on teachers?</b>			
I strongly feel so.	Somewhat.	Not much.	Not at all.
48%	48%	4%	0%
<b>3. Do you think there are students who might be interested in these efforts?</b>			
I strongly feel so.	Somewhat.	Not much.	Not at all.
48%	50%	2%	0%
<b>4. If you were in charge of a class, would you recommend this kind of activity to your children?</b>			
I strongly feel so.	Somewhat.	Not much.	Not at all.
54%	41%	4%	0%

*(Source: Elementary and junior high school teachers n=47)*

**Table 5: Hearing survey questions**

<b>1. Do you think that these efforts are effective in solving problems?</b>
<b>2. Do you think that these efforts are effective in reducing the burden on teachers?</b>
<b>3. Do you think there are students who might be interested in these efforts?</b>
<b>4. How many students are likely to be interested in one class?</b>
<b>5. Do you think these materials will improve the students' abilities to handle problems?</b>

*(Source: Elementary school teachers n=4)*

The survey results found that over 90% of the respondents felt that the video materials were effective in solving the operational tablet problems and all felt it was an effective solution. One reason given was that the ICT literacy would be enhanced in children who had not been good at ICT, had taken the course, and become SEs. Another reason was that as it was difficult for teachers to solve all the problems, even if one child acquired the necessary knowledge to solve the problems, it would be a good thing as this knowledge could be passed on to other children, which would help the teachers.

The results revealed that 96% of the survey respondents and three of the interviewed teachers felt that the teaching materials were effective in reducing the teachers' workloads, and three interviewed teachers also said that it reduced their burden because they could ask the children who had passed the exam to help them with the terminal problems, which reduced their practical and mental burdens, especially as it was difficult to teach the subject matter at the same time as teaching the children how to operate and deal with the ICT problems. They commented that was good if the children learned how to operate the ICT devices by themselves without their having to spend time teaching them in class, which took the responsibility away from the school.

However, only 2% of the respondents said that there were students who would be interested in this material, which suggested that not many students were interested. In the interviews, the teachers claimed that only 3 to 5 students and at most around 10 students would be interested, which was only about one-third of the class. They agreed that this material could increase the ICT literacy in children who had taken the course and become SEs, encourage other children who were not good at solving problems, spread the ICT literacy to others, and improve the self-affirmation of the children and students who responded to the problems, all of which would reduce the teachers' workload.

However, the teachers commented that while the materials provide an opportunity to learn, excellent children would be left to their own devices and stop thinking. When asked whether they would be able to deal with the content not covered in the training material, they claimed that if the children do not feel the need to learn, they will depend on the other course participants, which would not improve their own response skills, that is, it would be difficult to improve the ability of the children who received such support. Therefore, because these teaching materials only dealt with a limited range of problems, to properly encourage the students to respond appropriately when faced with unknown situations, they felt that a different approach may be necessary.

## 6. Conclusion

The survey and interview results suggested that while these teaching materials could resolve some of the tablet operational problems and reduce the burden on teachers, further evaluation was necessary. This is because we have not yet conducted an actual evaluation of the children in this study. Therefore, future research will focus on the students who used the teaching materials and their teachers to more precisely evaluate the quality of the teaching materials and the effectiveness of the burden reduction.

One of the limitations of this study is that it is difficult to reduce the burden on teachers when problems occur that can never be solved by children. Based on these limitations, in order to fundamentally reduce the burden of problems with tablet devices, it is necessary to improve the quality of tablet devices themselves and for all teachers to acquire more specialized knowledge.

In the future, we will also consider how to efficiently develop teachers' ability to deal with operation problems on tablet devices in a more professional manner.

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