

Preliminary Study of Teachers' Opinions on the Effective Use of Digital Textbooks

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Abstract

In this study, we conducted preliminary interviews with a teacher with experience in the use of digital textbooks to examine the perspectives necessary for their effective use in the classroom based on the actual use and characteristics of digital textbooks observed by the teacher. We qualitatively analyzed the responses and organized the results as a case study. The results suggest the following four influencing factors in the effective use of digital textbooks: content and duration of initial instructions to familiarize students with digital textbooks, amount of experience with learning activities using digital textbooks, student attitudes toward learning, and characteristics of the subject matter.

Keywords: Case study, Digital textbook, Effect of utilization, Teachers

1 Introduction

1.1 What Are Textbooks in Japan?

The textbook system in Japanese school education has the following characteristics. In Japan, textbooks are considered the “primary teaching/learning materials for students to study in elementary, junior high, and high schools, which are organized according to the learning content at school” and are distinct from general teaching/learning materials [1]. Therefore, the Ministry of Education, Culture, Sports, Science and Technology (hereafter “MEXT”) reviews textbooks, and only those that pass this review are used as textbooks. This system ensures textbook quality. Elementary and junior high-level education in Japan is compulsory and free of charge. Therefore, textbooks used in schools are distributed free of charge to all students. The establishment of these systems has guaranteed people’s rights to education. It is also stipulated by law that all elementary, junior high, and high school students must learn by using textbooks [1].

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1.2 What Are Digital Textbooks in Japan?

As education has become computerized, digital textbooks are being used alongside paper textbooks in schools (Fig. 1). Digital textbooks are teaching/learning materials used on digital devices and information terminals that have basic functions, such as editing, moving, adding, and deleting, in addition to the contents of paper textbooks and software to view that content [2]. They can also be used by individual students on their own information terminals. Furthermore, they provide functions for sharing writing over the network, simulation, audio playback, and video, depending on the subject. Digital textbooks are used in conjunction with paper textbooks [3][4].



Figure 1: Learning using digital textbooks

1.3 Digital Textbooks to Support the Learning Process

The GIGA School Initiative was launched in Japan in 2020 to equip each elementary and junior high school student in the country with an information terminal and cloud environment. In the relevant classes, students are expected to learn independently while operating information terminals. In particular, it is a learning process for students to collect high-quality information, organize and analyze it, summarize it, and communicate the content to others [5]. Expectations for digital textbooks to become tools for smoothly advancing the learning process using information terminals are increasing.

1.4 Previous Studies on Digital Textbooks

Research on the functions and effects of using digital textbooks is currently underway. Yamada and Hasegawa [6] asked students using digital textbooks for their opinions of the textbooks and their awareness of the textbooks' useful functions. Moriyama et al. [7] clarified teachers' expectations of the functions of digital textbooks. Nakahashi et al. [8] studied instructional strategies in classes using specific functions of digital textbooks in Japanese language departments. These studies investigated students' and teachers' awareness of functions, functions in specific subjects, and so on in classes using digital textbooks. MEXT also verified the effectiveness of using digital textbooks [9]. The results suggested that digital textbooks have a certain effect on the development of qualities, abilities, and teaching methods, but they did not clarify teachers' awareness of the use of digital textbooks or the effect of use as perceived by them.

Digital textbooks do not in themselves complete teaching, but presuppose coordination with teachers [10] [11]. We thus believe that conducting a survey of teachers' attitudes toward the use of digital textbooks is necessary, such as how teachers coordinate their students' use of digital textbooks and how they perceive the effects of their use.

Previous researchers have examined teachers' attitudes regarding digital textbooks, such as Moriyama et al. [7], who examined the functions mentioned above, and Yamada and Sato [12], who investigated how teachers use digital textbooks. However, no research so far has asked teachers who have employed digital textbooks in class about the actual use of digital textbooks and how they can be used effectively.

1.5 Teachers in the Implementation Phase of New ICTs

Teachers accustomed to analog teaching aids such as paper, blackboards, and chalk are hesitant about introducing ICTs such as digital devices, software, and the Internet into the classroom, and the older they are, the more anxious they are about the use of ICTs [13]; however, some veteran teachers have taught using ICTs with the learning and teaching methods they had developed in their careers [14]. Horita et al. [15] showed that teachers teaching in classrooms where visualizers were permanently installed identified various uses, and that visualizers eventually became indispensable to their teaching. Thus, teachers working in a new learning environment where ICTs have been introduced have gained experience in their use through trial and error and are aware of their effects. Similarly, an investigation of how teachers see the characteristics of digital textbooks, which types they use, and what kind of trial and error they carry out to ensure the effective use of recently introduced paper and digital textbooks is important to facilitate the process of spreading digital textbooks in the future.

2 Purpose

In this study, we conducted a preliminary survey to examine the perspectives necessary for the effective use of digital textbooks in class, based on teachers' views of the actual use of digital textbooks and their characteristics.

3 Methods

3.1 Survey Target

In this study, we investigated one teacher (hereinafter, "Teacher A") who works at Y Elementary School. Teacher A's former school, X Elementary School, was designated by MEXT to participate in the "Empirical Research Project on Efficacy and Impact of Digital Textbooks for Learners" [9] in 2020, and Teacher A participated in this project from September to December 2020. Even after the project ended, Teacher A used digital textbooks for two years at X Elementary School. During this time, Teacher A actively used digital textbooks, as by publishing math class practice on the textbook company's website.

In Japan, teachers are transferred from one school to another every few years regardless of

whether they want to, and Teacher A had worked at X Elementary School for eight years before being transferred to Y Elementary School in 2023. Y Elementary School provides digital textbooks for Japanese, mathematics, and English. The school had implemented one information terminal per person and a cloud environment, and while the school uses paper textbooks, it was creating cloud-based classes in which digitized materials and collaborative editing, where one file would be edited by multiple students, were implemented.

The survey target and the first author belonged to a voluntary study group hosted by the third author. Both studied classroom development using ICT and formed a rapport between them.

Studying Teacher A in this study has the following advantages: First, she has experience working in two schools in different environments. As X Elementary School was working on a national project, we consider the environment to have been such that the teachers were led to assess the effectiveness and impact of the digital textbooks. On the other hand, Y Elementary School was not involved in any special projects and therefore had no special initiatives for the use of digital textbooks. Metacognition by Teacher A was also believed to potentially lead to the manifestation of tacit intellectual aspects, such as the use of digital textbooks in specific classroom situations, the characteristics of digital textbooks as seen by the teachers, and the effects of their use, as well as the formalization of the content of this knowledge. Second, we believe that it is possible to gain a more detailed understanding of teachers' feelings through interviews with a person with whom one has preexisting rapport. Third, only a short period has passed since the introduction of digital textbooks, and few teachers use them daily. In addition, there are even fewer teachers who have implemented digital textbooks in more than one school, and no research has been conducted on such teachers. Accordingly, we considered Teacher A a suitable participant for our survey.

3.2 Survey Period

The study was conducted in March 2024.

3.3 Survey Methods

We conducted one-hour semi-structured online interviews that were recorded. The interviews were as follows:

- ① We asked questions about the use of digital textbooks at X Elementary School (the designated school; frequency, contents, situations of use, background, etc.).
- ② We asked questions about the use of digital textbooks at Y Elementary School (the current school; contents, situations of use, background, etc.).
- ③ We compared the contents asked in ① and ② and asked questions about the differences and possible reasons behind them.

We organized and analyzed the answers from the interviews in accordance with the following process:

- ④ We transcribed the audio recordings of the interviews.

- ⑤ We grouped the text to ensure one content per unit.
- ⑥ Of the grouped contents, we extracted answers that fell under any of the following four categories: [Use of digital textbooks at the former school (designated school)], [Reasons for use of digital textbooks at the former school (designated school)], [Use of digital textbooks at the current school], and [Reasons for use of digital textbooks at the current school].
- ⑦ From the answers extracted, we considered the perspectives necessary for teachers to use digital textbooks effectively.

4 Results

The relevant responses for each of these four categories as provided by the teacher are given below. The teacher's actual answers are in double quotation marks and the author's notes are in parentheses.

[Use of digital textbooks at the former school (designated school)]

Teacher A taught the upper grades for three years using digital textbooks and conducted classes using digital textbooks in three subjects: Japanese language, mathematics, and social studies. The use of digital textbooks varied depending on the subject.

In Japanese classes, the use of digital textbooks was limited to underlining and separating paragraphs: "It was only really possible to draw lines or add paragraphs. Being able to extract only the necessary parts and compare them is sometimes a useful feature of the (textbook company's) Japanese (digital textbook), but we did not have that function. Hence, the students used them basically like a normal paper textbook, underlining and highlighting the text." Contrariwise, the frequency of use would differ based on the unit: "(The use of digital textbooks) depends on the time and the teaching module; I used them relatively often in units like stories and explanations, but I do not think I ever used the unit on short linguistic terms."

For mathematics, the ease of use varied by unit: "In mathematics, it depended on the unit the most. There were times when the students said that this (given unit) is no good." Specifically, the students themselves used paper or digital textbooks depending on the unit, as seen in "In a unit with graphics, if you tried to zoom in and out, the screen would move. If you touched the screen a little, you might pinch out or something, move it arbitrarily, then it would not fit (the size) and you could no longer measure how many centimeters it is, and there were units where (the students) did not like them." "In others, they would say if they were only doing exercises, then do we really need (digital textbooks)?" "Basically, I (normally) had the tablet on the table, so we used digital textbooks, but for mathematics, the students had (paper) textbooks, so they used either, depending on the time and situation."

Digital textbooks were used more for social studies than for the other subjects. "In my final year, every hour was social studies. It became necessary to use it every hour in social studies." "I had been using (digital textbooks in class) for Japanese in the first year, social studies in the second year, and mathematics in the third year, and I think that the (digital) textbook for social studies is

the easiest to use and most usable in class.” They were mainly used to write down their ideas and write what they had read from the text and materials: “In social studies, the advantage of digital textbooks is that you can pinch out photos and magnify them, and then you can notice more things. The (size of) pictures in the textbooks are probably around 5 cm, and the only way to look at them (in paper textbooks) is to look with your eyes, but the best thing about (digital textbooks for) social studies is that you can make them larger, pay more attention, notice the details. I also think the best thing about digital textbooks is that you can notice the relationship between the text and the materials.”

The ease of writing was another factor mentioned in the context of social studies. Specifically, the ease of writing also led to learning activities that utilized the writing functions: “It is also very easy to write down things you notice. Both erasing and writing. That is the best thing about (them for) social studies.” “I think these students become excited about writing in digital textbooks after they discover how easy it is.” Furthermore, writing has also led to the sharing of information with the whole class: “It is so easy to use what you write down as the basis. Share it with your friends, or share it with everyone. I think doing that digitally is very easy.”

[Reasons for the use of digital textbooks at the former school (designated school)]

Teacher A gave two reasons for this state of use. First was the opportunity to explain the functions and uses of digital textbooks. “In contrast, it was the introduction period for the former students, so I was teaching them how to use the digital textbooks. It was the first basic step to show them which functions were available and the ways in which they could use them,” so when the digital textbooks were introduced, Teacher A taught them about their functions. “I had taught them that, so (the students) realized how easy it was to write (in them), to change colors and draw lines, and also how easy it was to erase, so students in the former school were writing a lot in their Japanese textbooks.” Because of this experience, the students themselves became aware of the advantages of digital textbooks and actively engaged in learning activities using their functions.

Second was the setting of the required use of digital textbooks. “The more they are used, the more I think it would be great if it had this effect or if there were videos for instructors in the students’ (digital textbooks for learning),” so by first using digital textbooks, they were able to learn the advantages of the textbooks that they had been unaware of. Furthermore, the students as well as the teachers became accustomed to using digital textbooks, which might have enhanced their confidence in learning with digital textbooks and the expansion of the ways in which they can be used. “I thought it would be difficult (to effectively use them) without that (a time where they were required to be used).” In the beginning, even I started by thinking, “Why should I use digital textbooks? The paper ones are fine, how (am I) to even use the digital ones, why not stick with paper?” “The advantages of using digital technology can only be understood by trying, so we (the teachers) teach at first; the students are good at doing various things and they realize the advantages, and their learning expands, or rather, their usage expands after the initial introduction period. I feel that (the students) have grown a lot in two years because we were together during the introduction period.”

[Use of digital textbooks at the current school]

At the current school, digital textbooks for Japanese language and mathematics were introduced in 2022 (R4). English textbooks were also introduced in 2023, but Teacher A did not have the opportunity to use digital textbooks because they were taught by specialized departments.

For Japanese, Teacher A said that the students were unable to make the most of the advantages of digital technology, saying, "For Japanese, if these students learn how to use (digital textbooks) properly in class, they could make more effective use of them. When I see how students use the digital textbooks, they really use them just like paper textbooks." "I told them that it would be easy if they cut out part of the text on MyBlackboard (one of the functions of the digital textbook). In that unit, they might use (the features I spoke about)." "Even if it is digital, (they use it in) the same way (as paper), but the students did not write much in the digital (textbooks) even when told directly to do it." "When I tell them to add a paragraph, I tell them to press the button (to add the paragraph) (using the function of the digital textbooks), so they use it (functions) only when they are told (how to use) that." "But, for example, if you asked me whether they would write down their own thoughts (on the digital textbook screen) while reading a unit, I do not think they would do that." The students used writing and extracting functions when instructed but not on their own.

Conversely, the digital textbooks in mathematics are difficult to use: "The mathematics (book) is really hard to use. I cannot make a big deal of this, but I think that is an issue with the textbook company. I did not say anything about it and I did not tell them to use it," so the students were not encouraged to use it.

Digital textbooks were not introduced for social studies.

On the question of the frequency of use of the digital textbooks for the two subjects, "The frequency of use, especially for this year, was up to the students, so in the same class there are some students using paper textbooks and others who bring tablets and use digital textbooks, so there are no regulations or requirements." The frequency of use of paper and digital textbooks varied depending on the student.

[Reason for the use of digital textbooks at the current school]

Teacher A said the following regarding the reasons for the use of digital textbooks at the current school:

For students not using the functions of digital textbooks, "It might be because I did not have time to spend (to teach them how to use the functions). (At the former school) because they were the first students to use it, we had to teach them how to use it initially, but the students at Y Elementary School had already completed that stage, so they had learned to use it to a certain degree, or at least were in a position to use it, in the 6th grade, so we did not have to go to the trouble of teaching them." Thus, as digital textbooks had already been introduced, the teachers did not provide instructions on the functions of the textbooks. Furthermore, "Maybe (they were not taught how to use the functions) because not everyone used them. If everyone used digital textbooks, I

think if we introduced them to this way of using them, they would be used more.” Thus, the mixture of paper and digital technology makes it difficult to introduce students to the functions.

Teacher A mentioned another reason for students not using the functions of digital textbooks—learning rules. Teacher A spoke of the students’ restlessness: “It may be the class difference or something; this year’s sixth graders found it really difficult. The principal and I were talking about how the basis (of learning) was quite different (from my former school).” “I understood. I did not speak much (about the use of digital textbooks). It was quite difficult with the sixth graders. It was a daily occurrence (for the students) to play games in class with their tablets open in April. Therefore, there were many difficulties with life guidance, such as doing unrelated things with the tablet in hand.” “That’s what I think (that teachers themselves did not actively use information terminals because of the difficulty of teaching students). The realities of the classroom play a major role.” “Things have changed (over the last year). However, before the change, we instructed the students to close the tablets when they were not in use at a fairly early stage, and we have been doing that again this year.” Thus, there was a period when using the information terminals did not lead to learning, and instructions were given to restrict their use.

Consequently, there was a difficulty in not building up the contents of instructions regarding learning methods: “It is a year of cultivation. It is like doing it (teaching methods of using digital textbooks) all over again if it is true. Maybe if I had fourth- or fifth-grade students, things would be different.” “It is not that this year’s students did not retain anything (about how to use digital textbooks). However, the retention could have been wider.”

Furthermore, there were no opportunities to discuss the lack of digital textbooks for social studies with other teachers. The lack of experience in using digital textbooks for social studies also contributed to the difficulty in communicating the effectiveness of digital textbooks: “Ultimately, the teachers in the current school have not experienced (the effectiveness of digital textbooks for) social studies. Hence, they are not aware of (the effectiveness of digital textbooks). I was the only one speaking out about (the need for digital textbooks for) social studies.” Thus, Teacher A stated the necessity of having a set duration for using them to feel the effectiveness of digital textbooks: “They should first be used even where their use is not obvious. Once you use the device, you notice different things. When you notice things, it gradually expands and spreads like these three stages, but you need a couple of years (to feel the effectiveness) to reach that stage.”

Table 1 summarizes the results.

Table 1: Summary of interview results

Category	The former school (designated school)	The current school
Use of digital textbooks	<ul style="list-style-type: none"> • For the Japanese language, the frequency of use differed by unit. • For mathematics, the ease of use varied by unit. The students themselves used paper or digital textbooks depending on the unit. • Digital textbooks were used more for social studies than for the other subjects. The ease of writing led to the sharing of information with the whole class. 	<ul style="list-style-type: none"> • Students were unable to make the most of the advantages of digital technology. Students would use the writing and extracting functions when instructed but not on their own. • Digital textbooks are difficult to use, so the students were not encouraged to use them. • Digital textbooks were not introduced for social studies. • The frequency of use of paper and digital textbooks varied depending on the students.
Reasons for the use of digital textbooks	<ul style="list-style-type: none"> • The opportunity to explain the functions and uses of digital textbooks. • The setting of when digital textbooks were required to be used. 	<ul style="list-style-type: none"> • Digital textbooks had already been introduced, so Teacher A could not teaching instructions on the functions of the textbooks. • Because of the lack of established learning rules, there was difficulty in not building up the contents of instructions regarding learning methods. • The lack of experience in using digital textbooks for social studies also contributed to the difficulty in communicating the effectiveness of digital textbooks.

5 Discussion

Based on Teacher A's answers, we consider below perspectives on the effective use of digital textbooks.

5.1 Initial Instruction for Familiarization with Digital Textbooks

At the former school, Teacher A spent time giving initial instruction on the functions and use of digital textbooks. With careful teaching of the functions and ways of use, the students themselves became aware of the merits of digital textbooks and became active users. In contrast, the current school did not undergo such a period of introduction, and the students were not provided with initial guidance. The school also allowed both paper and digital textbooks to be used simultaneously, so initial instructions on digital textbooks were not provided throughout the school. We believe that this led to a lack of initiative among students in utilizing the functions of digital textbooks.

This suggests that reviewing the content and duration of the initial instructions may be necessary for familiarization with digital textbooks to facilitate their active use by students.

5.2 Experience the Value of Learning Activities Using Digital Textbooks

Teacher A noticed the merits of digital textbooks and the characteristics of their functions by experiencing learning activities using digital textbooks at the former school. Furthermore,

Teacher A found that the students were able to realize the merits of digital textbooks as they gained experience. This has led to the expansion of their learning activities and the possibility of independent utilization, such as the use of both paper and digital textbooks. By contrast, in the current school, Teacher A found that the lack of digital textbooks for social studies led students not to recognize their effectiveness.

This suggests that whether people realize the effectiveness of digital textbooks may be influenced by the experience value of the learning activities that use them.

5.3 Students' Attitude Toward Learning

Teacher A cited the lack of established learning rules in the current school as a reason why the students did not make use of the functions of digital textbooks. Teacher A believed that the lack of learning rules led to differences between classes in their actual use, as well as situations where students were unable to freely use information terminals. It was necessary to instruct students on attitudes toward learning in classes employing information terminals. Therefore, because they could not actively use digital textbooks, they found it difficult to build up the content of their instruction.

This suggests that the ability to use digital textbooks effectively may be influenced by the attitude toward learning that students develop, including the use of digital textbooks.

5.4 Differences by Subject

Among the digital textbooks that Teacher A had used, those for social studies were mentioned in particular as easy to use. Social studies is considered difficult to grasp, not only because of the textual information but also the graphs and the variety of expression formats [16]. If what is read from the materials can be easily written in a digital textbook and shared, it will be easier to work on learning tasks. In contrast, in mathematics, when measuring lengths accurately or comparing sizes, the sizes on the digital textbook screen change arbitrarily, which hinders the work.

This suggests that the characteristics of the subject matter may affect the ease of use of the respective digital textbooks.

6 Conclusion

In this study, we conducted a preliminary interview with a teacher experienced in using digital textbooks regarding the perspectives necessary for their effective use in class based on the teacher's views of their actual use and characteristics of digital textbooks. The results suggest the following four factors as influencing the effective use of digital textbooks: the content and duration of initial instructions to familiarize students with digital textbooks, the amount of experience with learning activities using digital textbooks, student attitudes toward learning, and the characteristics of the subject matter.

As this was a case study of one subject, survey items suited to a large number and variety of teachers in future research.

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