

An Exploratory Case Study on Types of Teaching and Learning with Digital Textbook in Primary Schools*

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The purpose of this study was to analyze the types of lesson and its effectiveness with digital textbook. To address those goals, we had observed five classes of the primary school, which designated as a research pilot school for digital textbook. Based on the result of observation, 3 types of lesson with digital textbook were categorized: *Teacher-directed lecture* (type 1), *Blended learning* (type 2), and *Flipped learning* (type 3). Depending on the type of lesson was analyzed the positive and negative effectiveness by means of matrix analysis method. As a result, in *Teacher-directed lecture* (type 1), there was found out the participation of the lesson in atmosphere of stable and comfortable as positive experience, also digital textbook operating immature and boring as negative experience. In *Blended learning* (type 2), there was found out the fun by sharing the product and peer feedback, and flow by learning transfer as positive experience, also digital textbook operating immature and understanding the difference between assignments as negative experience. In *Flipped learning* (type 3), there was shown the positive attitude and ownership in the lesson as positive experience, also distracting and boring in the lesson when learner was excluded in participation as negative experience. Based on the results, we suggested some strategies for improving positive experience and protecting negative experience in the lesson with using digital textbook.

Keywords: Digital Textbook, Case Study, Qualitative Study, Teacher-directed Lecture, Blended Learning, Flipped Learning

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Introduction

Beyond the knowledge information age of the 21st century, our society is developing into the intelligent information age of the fourth industrial revolution (Sung, 2017). Recently, the Korean government has been promoting SMART education as a master plan for future education. One example of SMART education is the educational use of digital textbook for teaching and learning in K-12 education (Leem & Sung, 2018).

A digital textbook is a curriculum book which “includes music, images, media and materials including characters from supplementary materials besides the printed textbook.” The Ministry of Education managed 164 schools with digital textbook in 2014, and the Ministry is planning to progressively expand the adoption of digital textbook for the entire country and for all subjects by 2018. The digital textbook has value as a form of media that assists learner-centered teaching and learning based on diverse resources. However, increase that value, it is necessary to provide information regarding the proper utilization strategy of these materials according to the in-depth analysis on application methods in the education field.

According to the examination of existing studies related to digital textbook, the number of studies analyzing how the digital textbook are actually utilized in the classroom are insufficient. The previous studies mainly were performed by emphasizing or concentrating on the design-development strategy and effectiveness analysis of the digital textbook, but the analysis of actual utilization methods tends to be limited (Byu, Ryu, & Song, 2011; Lee & Jang, 2015). Also, as most of the studies on digital textbook focused on the analysis of learning effects based on academic achievement, the systemic analysis of diverse factors which affect the learning experience and flow of the class is necessary.

Studies on the effectiveness of digital textbook have been implemented every year since 2008, led by the Ministry of Education and the Korea Education & Research Information Service. The research on the effectiveness of digital textbook

up until now placed an emphasis on the analysis of academic achievement, self-directed learning ability, learning attitude and problem-solving ability of the learner, but the analysis results varied every year, and it is difficult to conclude that the utilization of digital textbook affect academic achievement significantly. It could be more important to assist in the proper manifestation of the possibilities of the digital textbook in the education field, instead of deterministically defining the effectiveness of the utilization of the digital textbook.

In this study, a measure to increase the effectiveness of the utilization of digital textbook shall be suggested by outlining the aspects of the use of digital textbook in class through the analysis of how digital textbook are utilized, and by defining the problematic factors and positive factors in utilizing these textbooks. It is estimated that it will contribute to a more stable and successful transition for when the digital textbook is introduced to more classrooms.

The detailed research questions for this study are as follows.

- 1) What type of lesson can be used in using digital textbook in the classroom?
- 2) which activities are completed by the teachers and learners in the lesson using digital textbook, and what are the positives and negatives experienced during that process?

Literature Review

The trends and issues with digital textbook

The digital textbook is a textbook with a broader concept that can overcome the limits of the existing printed textbooks and assist in learner-centered teaching and learning. The digital textbook offers four types of main functions. First, it assists and promotes learning through a link with diverse learning resources such as multimedia, reference data and hyperlinks. Second, the learners may search for and

learn about desired content through various information resources and also, they may interact with external professionals and institutions. Third, the fundamental function of a textbook, which is the same function that the existing printed textbook provides, is able to be increased as each of the learners can take notes, memos and use bookmarks according to their personal requirements. Lastly, its function as an evaluation and learning management system can assist in the graded learning of the learners and on the other hand, it can assist learners in composing an individual learning portfolio, and thus enables a personalized, customizable learning experience. According to the study of Jeong, Im, & Kim (2018), the use of the digital textbooks has been shown to have improved educational effectiveness in cognitive domain, social domain, and learning competency except students' psychomotor domain. These effects were higher for students with higher scores, more times using digital textbook, and higher teachers' smart education capacity. Based on the main functions of the digital textbook, learners can proceed with self-directed learning and the teachers can create a customized class according to the individual progress of the learners and an active class which may entice the participation of the learners. Based on these possibilities, the adoption of digital textbook is increasing progressively, where in 2014 research schools were set up and operated, there is a plan for its nationwide implementation in 2018.

The preceding research on digital textbook tended to be performed with the study to prepare for the adoption of digital textbook at its core, where they could be classified as: measurement of learning effects, study on design and development of class model and, the study on the relevant legal system (Byun, Ryu, & Song, 2011). Through this, it could be understood that in the Introduction stages mainly exploratory studies for the design of digital textbook were performed, specific studies for development and management were researched in the Development stages, and subsequently, effectiveness and empirical studies to reveal the success factor were researched in the final stages.

Considering that the adoption of a digital textbook was prearranged for 2014,

but ended up being delayed until after 2018, it is clear that there are still many barriers to adopting digital textbook in the educational field. For the more stable utilization of digital textbook in the education field, further studies should be done based on the experiences of users. The utilization methods of the actual subjects need to be analyzed subjectively and objectively. According to the evaluation of the suitability of teaching and learning through these digital textbook, the teachers' and learners' rating reached only 59% and could be the basis which supports this necessity(Lee, 2012). Thus, a study of the actual users of the digital textbook must be implemented with an in-depth analysis on in-class methods.

Learners' learning experiences with digital textbook

The studies which analyzed the classes using digital textbook and the experiences of learners in those processes are as follows.

First, Hwang and Cho (2014) also analyzed the problems which occur when using the digital textbook in the social studies class of an elementary school and suggested an improvement plan. They reported that the class analyzed in their study proceeded as such: 1) preparation for project performance, 2) searching and sharing of relevant data, 3) solution of task and preparation of results, 4) sharing of results, 5) introspection and evaluation. The problems in this procedure were indicated as: 1) problems with interaction (which only increased interaction between the learner-device instead of the interaction between learners), 2) problems with convenience (disturbance in learning due to issue of usability when using the digital textbook), 3) problems with utility (the verification of current condition of the learners is more difficult than in a class with printed textbooks), 4) problem with quality of the material (deficiency of diverse multimedia materials).

Lim and Oh (2014) performed a critical study on an elementary school science class using digital textbook. Their case study demonstrated that there are cases in which the digital textbook could not sufficiently assist in the class, that there

occurred the phenomena where the interaction between the teacher and learners fell short, and that the digital textbook not always contributed for the harmonious lesson development and for the achievement of the original goal of the class.

Han, Ryu, and Kim (2014) suggested that systematic interaction and explorative interaction were more frequent in the class using digital textbook than the classes using printed textbooks, but it is difficult to generalize as it may differ according to the teacher and the subject area of education.

On the other hand, Kim (2013) could verify the standardized patterns in the observation of classes which used the digital textbook with the social studies class of elementary school as the center, and suggested that it must be formalized and on the other hand the study on diverse teaching-learning methods and models must be performed even more positively. It has been verified that these standardized patterns occurred as the capacity of literacy of the teachers and learners had a limit therefore they proceeded the class based on the stable class proceeding method instead of adopting a new method of class.

Sung, Cho, Jo, Huh, Yang (2017) studied a learner-centered science class, in which students (n=37) used a digital textbook for individual, group, and whole-class activities. They found that digital textbook was mainly used for watching educational videos (100%), searching information (100%), reading learning materials (89%), and inquiry activities (50%). Digital textbook played roles in increasing accessibility to a variety of multimedia materials, promoting cognitive activities for inquiry learning, facilitating interaction among peers, and fostering instructional supports. They suggested that digital textbook should be improved for learner-centered education in four aspects: (1) functions and contents to support learner-centered activities, (2) flexibility and resourcefulness to support a teacher's design of learning activities, (3) adaptive instructional supports considering individual differences, and (4) usability to enhance the interaction between a student and a digital textbook.

The above studies concretely considered the actual phenomena and dense

experience, difficulties which could occur in the actual classroom through observation of classes, but they could also be considered as limited as they made 1 class of 1 school as specimen. But if the deduction of a series of common teaching and learning type in the diverse teaching and learning processes using the digital textbook can be achieved, the materialization of activities and experiences in each type could be possible, and if the implementation based on them is suggested, it is estimated that this study may contribute even more in the classroom field.

Method

Participants

In this study there was performed the participatory observation on digital textbook research schools to verify the current status of utilization of digital textbook. The schools which are subject of observation were 5 elementary schools, which was 1 school each from the 5 regions of the country (Seoul Capital Area, Gangwon Province, Chungcheong Province, Jeolla Province, Gyeongsang Province) to avoid the expression of the regional characteristics. Also, the subjects were selected by considering the period in which the schools participated as research school, where 2 schools managed the research school for 2 years and 3 schools managed for almost 1 year.

Procedures

The participatory observation of the class using digital textbook was performed according to the following procedure. First, there was developed a protocol for the participatory observation. Second, there were selected a total of 5 schools which were 1 school in each zone among the digital textbook research schools designated

by the Ministry of Education. Third, 1 research school was visited first to verify the propriety of the protocol for participatory observation and the implementation technology developed in advance. Fourth, the protocol for participatory observation of class and the implementation technology were corrected and supplemented based on the results of the first visit. Fifth, the remaining 4 schools were visited to perform the participatory observation of class. For last, the results of the study were deduced by analyzing the data of participatory observation through qualitative analysis method.

Instruments

There was developed a protocol for participatory observation of class for the participatory observation of class and depth interview. The protocol for participatory observation of class is a tool to check by time the behavioral characteristics which the teacher and learners use the digital textbook in the class with digital textbook. The characteristics by time was recorded with the teacher's behavior, learners' behavior and the atmosphere of learning (positive/negative factors) as center. The behaviors of the teacher and learners were analyzed with the conditions of activities as learning process which are motivation, verification of learning problems, provision of task and data, organization of contents of learning, cooperative activity and the evaluation and arrangement, and the positive experiences as pleasure in the learning atmosphere according to these factors, happiness, hope (expectation), pride, appreciation, satisfaction, relaxedness/comfort, feeling of relief, and the negative experiences as tediousness, anger, frustration, anxiety, humiliation, sense of guilt, sadness, disappointment, hopelessness were presented and recorded as examples.

Data analysis

The analysis of observation and participation in classes using digital textbook was

performed by classifying the types of classes using the digital textbook through effective matrix analysis, and by systematic analysis on the contents of procedure of class and learning activities of each type. The effective matrix analysis is one of the methods to deduce and substantiate the descriptive conclusion on the phenomena in the limited context of a single case (or small-scale cases), which is applied to deduce preliminary conclusion and implication on the respective case. The matrix is composed by intersection of lists organized by rows and columns, and it is valuable to verify the critical events and streams of each important items (space, type, effect, explanation of researcher, etc) and to analyze the interrelation. There were performed repetitive conferences among 4 professionals to secure the validity of the analyzed results. In the first conference the contents of same script were individually coded, the theme was deduced, and prepared a frame of analysis standard to mutually understand the process and reason where such contents were deduced. In the second conference, with the frame of analysis standard as the center, the results as individually deduced coding and the theme were analyzed through mutual intersection, and for the contents where the theme according to the theme was not coinciding, the core themes were deduced throughout renegotiations until the concurrence of the opinion of 4 professionals reached .80 or higher value.

Result

In this study there was performed the qualitative analysis on the effect of using digital textbook on the class, through observation of class/lecture. Concretely, the activity of teachers/learners in the class using digital textbook was analyzed through the effective matrix analysis, and there was examined if how it affected on the atmosphere and effect of the class.

According to the results of the exploratory analysis considering the 5 cases on types of teaching and learning using the digital textbook, there were deduced 3

types of teaching and learning with digital textbook as *Teacher-directed lecture*, *Blended learning* and *Flipped learning* based on proportion of usage (Allen and Seaman, 2011).

The *Teacher-directed lecture* is a case where the class is proceeded with the contents delivery and self-directed learning as the center which is same as the class using printed textbooks. The *Blended learning* is the class where the delivery of contents led by the teacher, active participation of the learners and their social interchange are proceeded together. The *Flipped learning* is a class proceeded with the productions prepared by each group as the center after the brief delivery of the contents on the lecture. In this study, the respective implications shall be presented by examining the characteristics of each case and the stream of the class, and by analyzing the types and effects of the classes using digital textbook.

Type 1: Teacher-directed lecture with digital textbook

The first type selected in this study is the teacher-directed lecture with digital textbook in the classroom. This class was proceeded with the teacher-directed lecture class as the center, and although the learners sat in groups the group activities were not performed but instead, the self-directed learning was performed through individual smart pads. The learners mostly used the digital textbook but some of them opened the printed textbook together with the digital textbook. In the front of the classroom there was an electronic blackboard, and the teacher showed to the learners, the prepared Power Point data or the learning materials of the digital textbook through it.

The *Teacher-directed lecture* was proceeded mainly in phases as [Review] - [Main Class] - [Finishing]. It is different to other cases of class, as it maintains the traditional stream of the class for effective delivery of the contents. In the phase of [Review] the teacher induced the learners to remind the relevant content of the class by sharing the contents of the previous class, and induced the connection of the contents of the previous and the present classes. In the stage of [Main Class]

the teacher delivered effectively the content of the class and induced the motivation by using the relevant image and simulation. After this, the teacher let the learners perform the self-directed learning by providing time for individual learning and arrangement of the main contents of the class. The learners carefully checked the

Table 1. Teacher-directed lecture with digital textbook

Stage	Procedures	Activities of Teaching & Learning							
Introduction	Arrangement of Previous Class ↓	<ul style="list-style-type: none"> Sharing contents on previous class. 							
	Motivation ↓	<ul style="list-style-type: none"> Sharing theme and goal of class watching together the digital textbook through beam projector. Attracting interest through simulation activity. 							
	Presentation of Learning Material ↓	<ul style="list-style-type: none"> Inducing concentration of students through questions and answers. 							
Development	Individual Learning	<ul style="list-style-type: none"> Learning through image of individual digital textbook. 							
	<table border="1"> <tr> <td>Checking supplementary material (image)</td> <td>Intensified learning</td> </tr> <tr> <td>Reading the text</td> <td rowspan="4">Individual learning</td> </tr> <tr> <td>Checking core contents</td> </tr> <tr> <td>Resuming core contents</td> </tr> <tr> <td>Presenting the core contents</td> </tr> </table>	Checking supplementary material (image)	Intensified learning	Reading the text	Individual learning	Checking core contents	Resuming core contents	Presenting the core contents	<ul style="list-style-type: none"> Individual reading of text within the digital textbook. Deduction of core content from the text. Resuming core content using note function.
	Checking supplementary material (image)	Intensified learning							
	Reading the text	Individual learning							
	Checking core contents								
Resuming core contents									
Presenting the core contents									
↓	<ul style="list-style-type: none"> Guide the students to present the arranged core contents autonomously. 								
Consolidation	Finishing	<ul style="list-style-type: none"> Arrangement of main contents of the class. Guide on contents of further classes. 							

learning contents using the individual device, and presented the core contents they arranged using the note function. In the [Finishing] phase the teacher arranged the principal contents of the class, provided the guide on the contents of further classes and finished the entire class.

Introduction stage of the lesson: Review and delivery of theme of the learning

The detailed activities of each stage of the class are as follows. The teacher, after resolving the problem related with the beam projector, proceeded the class very stably and intensively. Even in the situation with malfunction of device, the learners were untroubled and waited silently. The learners concentrated and participated in the learning according to the guidance provided by the teacher, and they participated in the class within a comfortable and stable atmosphere. The teacher induced the remembrance of the previous class to effectively deliver the learning contents and presented images and simulation data to motivate the learners, and the learners were concentrated in the data and presentation of the teacher.

Development stage of the lesson: Delivery of principal contents of learning and inducement of individual learning

From the Development stage of the class, the teacher directly delivered the principal learning contents but also used the questioning methods to induce the active participation of the learners. The teacher tried to give questions evenly and proceeded the class giving continuous questions instead of the regular explanation. The learners were not nervous but they participated in the class concentrating comfortably.

The teacher, after finishing the delivery of the principal learning contents, induced the learners to learn individually using the learning materials of the digital textbook. The learners autonomously and intensively read the learning contents using each of their devices. The teacher observed the learning process of the learners going around the classroom. The teacher let the learners underline or

memo on principal contents during the learning and checked if each learner did not do any irrelevant activity or was not seeing other learning contents.

After finishing the individual learning the learners had to share the contents they arranged. The teacher wrote the principal keywords on the blackboard and induced the learners to answer with the contents they arranged on each keyword.

Consolidation stage of the lesson: Arrangement of principal contents of the learning and guide on the further lessons

During the Consolidation stages of the class the teacher briefly paused and arranged the contents learned that day, and also arranged the contents to be remembered by the learners. The learners were concentrated on the explanation of the teacher and most of the learners were standby until the teacher finished the class. Some of the learners touched the digital textbook or put their head down on the desk, but generally the attitude in class was proper.

Type 2: Blended learning with digital textbook

The second type selected in this study is the *Blended learning*. In this class, the learners sat in groups and participated in the class using their individual smart pads. The teacher used the digital textbook and the prepared digital learning material to proceed with the class, and got learners to participate and perform a group activity using the 'Wedurang' online community.

The *Blended learning* took place in phases such as [Motivation] - [Main Class] - [Transfer Promotion]. It tended to use more actively the advantages of the digital textbook while maintaining the basic process of the lecture type class when compared to the class of [Type 1]. In the [Motivation] phase the teacher guided the learners to access to the relevant learning material by using the QR code and induced their interests on the contents of learning through simple activity. Also, by presenting a detailed learning goal, it helped the learners to form an expectation

about what they were going to learn in the class. In the [Main Class] phase the teacher got the learners to participate by letting them: read the digital textbook and highlight principal content, upload, share and give feedback for each task through an online community. As there were not so many learners, the feedback was provided for almost every learner, and the lesson was finished with a formative evaluation. In the [Transfer Promotion] phase, the answers of the evaluation were checked and discussed, and the class ended with the return of the digital textbook.

Table 2. Blended learning with digital textbook

Stage	Procedures	Activities of Teaching & Learning
Introduction	Motivation ↓	<ul style="list-style-type: none"> • Provided learning material through QR code. • Presented the learning goal.
	Presentation of Learning Material ↓	<ul style="list-style-type: none"> • Shared the theme and goal of the class viewing together through the beam projector. • Read the digital textbook together and highlighted on the principal contents. • Induced the concentration of learners through questions and answers.
	Individual Learning ↓	
Development	Learning using online community	
	Guide on the task.	Provision of task.
	Uploading the task.	Solution of task
	Interchange of results of the task.	
	Feedback.	
Arrangement of principal contents.		
↓		<ul style="list-style-type: none"> • Explanation on the task. • After individual solution of task, shared it with all group members and learners.
		<ul style="list-style-type: none"> • Feedback for the production of the learners. • Arrangement of principal content by the teacher.
		<ul style="list-style-type: none"> • Solution of formative evaluation task. • Returning of the digital textbook.
Consolidation	Transfer Promotion	<ul style="list-style-type: none"> • Solution of formative evaluation task. • Returning of the digital textbook.

Introduction stage of the lesson on Blended learning with digital textbook

The detailed activities of each stage of the class are as follows. First, during the Introduction stages of the class, the teacher guided the learners to access to the relevant data by using the QR code, but as some learners had difficulty the next activity could be proceeded after resolving their problems. In this process there was a little distraction, but the teacher proficiently resolved the problem. The teacher drew the learners' interest through questions, and when there was no answer, took care of the situation by ordering the children to turn off their digital textbook and to concentrate on the teacher. The teacher then questioned if there was any learner who could answer the question, and after listening to various answers from many learners, provided the real learning goal.

Development stage of the lesson on Blended learning with digital textbook

During the Development stages of the class the teacher ordered the learners to read the relevant data on the digital textbook and to highlight the principal content. The learners learned how to use their digital textbook on their own, but some learners did not understand the teacher's orders and requested help. Every learner highlighted the respective section according to the orders of the teacher, but one learner said that it was more convenient to do so by hand instead of with the digital textbook pen, thus the teacher took care of the situation. Then, after performing the digital textbook reading and Question-Answer activity, the teacher ordered them to upload the tasks of each learner through the online community.

When some learners were confused, they were told to turn off the digital textbook and then the teacher proceeded with the class using the large screen. After explaining sufficiently the contents of the lesson and showing them how to access the community gain and upload the pictures, but the learners questioned how to do it and some requested help. The learners who successfully uploaded checked their productions and found amusement in them, and the teacher helped the learners who requested when they were sharing their productions.

The teacher, after the learners finished uploading what they needed to upload, provided feedback on the content uploaded by the learners. As there were not so many learners, feedback was provided to each learner one-on-one, and in this process the learners acquired a more precise understanding of the content. The teacher reactivated the digital textbook and guided them through the last activity (simulation). The learners debated due to a difference of opinions during the activity and some learners showed difficulty in operating the device. The teacher let the learners turn off the digital textbook and arranged the respective activity through the screen, and the learners seemed to have understood sufficiently the content of the lesson.

Consolidation stage of the lesson on Blended learning with digital textbook

During the Consolidation stages of the class, the teacher promoted the usage of the contents learned by letting the learners solve evaluation tasks. The learners individually used their digital textbook to solve the problem and the teacher assisted any learner with the problems by going around the classroom. After all the learners solved the evaluation task, the teacher explained the correct answers and the reasoning behind them and finished the class by guiding the learners to turn off and

Type 3: Flipped learning with digital textbook

The third type selected in this study is the *Flipped learning* with digital textbook in the classroom. This class proceeded with a group activity and one smart pad was provided to each group. One learner used a digital textbook and others used a printed textbook. At the left front of the class there was a small television monitor and the websites accessed or searched by the teacher are demonstrated to the learners.

The *Flipped learning* with digital textbook in the lesson was proceeded in phases such as [Motivation] - [Main Class] - [Finishing]. This type of learning is different to

other cases as, at the beginning of the class the teacher proceeded a teacher-directed class through the learning materials prepared by the teacher and questions, and from the Development-Consolidation phase of the class the learners interchanged the productions they've prepared and thus, proceeded a learner-directed class. This case can be considered as a case where the learners' participation was the highest when compared to the other two cases. First, in the [Motivation] phase the teacher

Table 3. Flipped learning with digital textbook

Stage	Procedures	Activities of Teaching & Learning
Introduction	Motivation ↓	<ul style="list-style-type: none"> • Introduction on the theme of the class. • Induced interest through Question-Explanation Activity.
	Guidance on Principal Contents ↓	<ul style="list-style-type: none"> • Reproduction of image related with principal contents of the class.
Development	Question-Answer Activity ↓	<ul style="list-style-type: none"> • Question-Answer activity related with the principal contents.
	Group Presentation	
	Guidance on presentation method.	Guidance on presentation
	Presentation of Group 1 + Related explanation	Group presentation and provision of additional explanation.
	Presentation of Group 2 + Related explanation	
Presentation of Group 3 + Related explanation		
Presentation of Group 4 + Related explanation		
	↓	<ul style="list-style-type: none"> • Guidance on method of group presentation. • Proceeded group presentation and provided relevant additional explanation.
Consolidation	Finishing	<ul style="list-style-type: none"> • Finishing after providing guidance on further classes.

briefly explained on the principal contents of the class and induced the interest of the learners on the contents of the class, through the question-explanation activity. In the [Main Class] phase, the teacher reproduced some images related to the principal contents of the class and assisted the richer understanding of the learners by providing additional explanation after the image reproduction. Then, the group presentation was initiated, but the class was interrupted a little due to device and network errors during the presentation. The teacher explained additionally on the parts, which required additional understanding during the group presentation process, and due to the little insufficient time, in the [Finishing] phase there was provided a guidance on the further presentations and the entire class was ended.

Introduction stage of the lesson on Flipped learning with digital textbook

At the beginning of the class, the teacher provided guidance on the theme and principal contents of the class and the learners attended the explanation of the teacher. The teacher induced the participation of the learners by providing simple questions, and the learners answered simply to those questions. The teacher assisted in the deeper understanding of subject of study by providing additional explanation on the questions. Some learners tended to be distracted but generally most of the learners paid attention to the teacher.

Development stage of the lesson on Flipped learning with digital textbook

The Development stage of the class was mainly classified as two phases. They were the teacher-directed class phase and the learner-directed class phase. In the teacher-directed class phase the teacher demonstrated the prepared image and assisted the comprehension on the principal learning contents and provided questions and explanations for the sufficient understanding. The learners tended to concentrate when the image was presented, but also showed tediousness with the course of the time. In the learner-directed class phase the teacher provided simple guidance on the group presentation and assisted the groups of learners to make presentations before other learners with the contents they prepared and to explain

to other learners on the contents of their presentations. During the progress of the group presentations, the learners concentrated and showed interest on the explanations of the presenter but when the problems as interruption of image reproduction or error in page changing, the ambience of learning was discontinued, and the learners were a little distracted. To resolve this problem, the teacher and research teacher assisted the learners together, but they were confused as they could not resolve the problems properly, and the learners showed tediousness in such situation.

Consolidation stage of the lesson on Flipped learning with digital textbook

While the group presentation was going on, the class had to finish because of the class finish bell ringed. However, the group that was presenting the presentation finished presentation in responsibly. The learners were in a state of low concentration, and the teacher finished the class with notice of next class.

Main activities and effectiveness of teaching and learning with digital textbook

This research is difficult to say that the three types of teaching and learning are contains all the type of teaching and learning with digital textbook in the classroom, it can be said that it represents the most common type of teaching and learning with digital textbook in the class.

Summary and summarization of main activities and effectiveness of teaching learning by types of the *Teacher-directed lecture*, *Blended learning* and *the Flipped learning* result is below <Table 4>.

Participating learners in the *Teacher-directed lecture* has been done on an internal/personal rather than externally/socially. It is the closest to the traditional class style and it is the best controlled by the teacher, so that it is stable and focused. However, it can be said that the learner's activity is relatively excluded.

The *Blended learning* can be regarded as an appropriately mixed class, which is includes a teacher-directed lecture and a class with a high level of learner participation. Learners are following the class by teacher's guide and resolve problems

Table 4. Main activities and effectiveness in types of teaching and learning with digital textbook

Types	Main Activities	Effect				
		+		-		
		frequency	ratio	frequency	ratio	
Teacher-directed lecture	Introduction	• Reflection on previous lessons	7	25.9%	0	0.0%
	Development	• Present video/simulation • Drive self-directed learning • Presentation of self-organized contents	14	51.9%	4	14.8%
	Consolidation	• Summarize main contents of class • Provide guide of next class	1	3.7%	1	3.7%
	Total		22	81.5%	5	18.5%
Blended learning	Introduction	• Provide materials/suggest learning goal	4	8.2%	5	10.2%
	Development	• Reading/highlighting • Question – Answer Activity • Description of the assignment • Sharing the output after solving the task • Feedback about the output • Summary of main contents	27	55.1%	10	20.4%
	Consolidation	• Formative evaluation • Return digital text-books	3	6.1%	0	0.0%
	Total		34	69.4%	15	30.6%
Flipped learning	Introduction	• Introduction of lesson's subject • Question-Answer Activity	2	4.4%	1	2.2%
	Development	• Suggest related videos • Question-Answer Activity • Group presentation method guide • Group presentation progress /additional explanation	17	37.8%	23	51.1%
	Consolidation	• Guide of next class	0	0.0%	2	4.4%
	Total		19	42.2%	26	57.8%

proactively based on the community and participate in the class through activities to share ideas with each other. Learners are showed various kind of activities such as 'having fun' or 'surprise', share their output with the community, and 'controversy' about different parts of each other's thoughts. On the other hand, teacher is constantly trying to control learners are handling of digital textbook, some This was a negative effect that some learners feel difficulty in participating in community activities and assignment upload activities.

The *Flipped learning* is the most learner-directed class type. Through activities to collaborate with the learners in the group and share their work output with the class learners, learners participated actively in class with their own consciousness and the teacher supported the presentation process and assisted learner's understanding with additional explanation. However, this was a negative effect that learners were bored such as video playing, page turn over error, and device related problems are occurred during the presentation process, and repeatedly presented video.

Discussion

The purpose of this research is to clarify the type of teaching and learning with digital textbook in the classroom and the experiences of learners by performing a qualitative case analysis on the use of digital textbook.

The purpose of this research is to investigate what universal class types can be appeared by using digital textbook and clarify what kind of positive expectations and concerns can be expressed by class types. The implications of case analysis are as in the following.

First, this research can be divided into three types of teaching and learning with using digital textbook, classify the types of teaching and learning positive and negative effects by effective metrics analysis.

The *Teacher-directed lecture's* positive effects include the fact that learners

concentrate on the teacher's presentation and explanation, Learners concentrate on self-directed learning such as they read the main story and highlight or make notes, etc. using the digital textbook. The *Blended learning* or the *Flipped learning* allows learners to have a more fun, enjoyable active participation in the group in such ways as community activities or group presentation. Each learner can ask their teacher a question or improve their understanding through individual feedback on assignments uploaded to the community.

On the other hand, one negative effect which appears in all types of teaching and learning with digital textbook is that learners cannot understand the teacher's explanation or activity guidance, or the learner has trouble due to device errors. In addition, while the participation of the learners increases, the lecture of the class can be cut short by issues such as video playback problems or page turning errors and the teacher can become flustered, and learners may quickly lose interest. It was confirmed that these negative effects were more influential as these issues continued.

Second, teachers were making considerable efforts to control learners' utilization of digital textbook. Teachers had to make sure that learners were able to open the digital textbook and read, participate in activities, and turn off the digital textbook in all cases. It helped to make the class effective, but there are also always some learners who complain about not being able to use autonomously, or who feel uncomfortable about being pointed out. Active participation of the learner and proper control by the teacher are very important factors to improve the utilization of the digital textbook, but it is very difficult to balance, so it will be necessary to support teachers to share their know-how.

Finally, it should be addressed that not only the purpose and content of the class but also a gap in how digital textbook are used depending on the characteristics and usage context of digital textbook may also exist. In other words, using digital textbook may have different effects depending on the teachers who prepare and operate classes. The success of digital textbook depends on teachers who

understand the value of digital textbook, and not only its assistance in optimizing possibilities but also that it helps learners to recognize and actively use digital textbook as a successful learning method (Ahn & Leem, 2013). To this end, the quantitative and qualitative process of digital textbook is necessary, preparing phase-in thorough research, select application to possible grade • subject, and phase-in possible grade • subject gradually expand and it should fully introduction made by gradual development direction in final (Lim & Hong, 2013).

In this way, use of digital textbook cannot prescribed 'it is teacher-centric', 'it is learner-centric', it might a big burden if obstruction to teacher that it should be different from traditional class. It would not be appropriate attitude if the teacher sticks with traditional way of teaching while using digital textbook, we need to reexamine the meaning of digital textbook in the context of traditional class. In order to go forth with both the stable operation and utilization, it is necessary to considerate and research all the way of further enhancing the effect, based on the possibilities of digital text-book to support success learner-directed class.

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