

Role of Trial Lessons and Teaching Practice to Develop Skills for Utilizing ICT in Science Education

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Abstract: This paper reveals findings on teacher-training programs of science education for elementary school. The authors pursue undergraduate students of childhood education for their acceptance to use ICT in class in the period of the end of science education methodology course and the end of teaching practice session. The result shows students' struggle in terms of the development of their teaching skills with use of ICT in science class.

Introduction

Education institutions worldwide have instituted national policies that entail educating children to acquire “21st century skills” (Griffin et al., 2011). Regarding information education, such skills are defined according to information and communication technology (ICT) literacy and information literacy. The Central Council of Education in Japan (2016) announced a conference report that the next teaching course of study for elementary school education in Japan would come into force by 2020, as many subjects now include ICT literacy and information literacy. All Japanese elementary and junior high school students will have their own tablet PC with Wi-Fi access at their school, to learn to communicate with not only their teachers but also their classmates in almost all subjects during 2020s (MEXT, 2016).

However, one of the problems with teacher training aimed at increasing pre-service teachers' teaching skills using ICT is that some active teachers are not adept at using ICT in instruction (Morishita, 2014). Universities to train elementary school teachers are wanted to be aware of pre-service teachers' ICT instructional capabilities.

Our previous studies (Kitazawa et al., 2017; Fujitani et al., 2017) reports an assessment result of the curriculum design of a science teaching method. Our findings reveal that the curriculum would need entailing pre-service teachers' trial lessons with ICT usage, one that involves not only the teacher's use of ICT in class but also students' ICT application during classes.

For pre-service teachers, teaching practice session is an opportunity to drive classes with ICT usage. In this paper, the authors report the pre-service teachers' acceptance for the use of ICT in the classroom after the end of teaching practice. In the study, the authors applied Teachers ICT Instruction Capabilities Checklist (Ministry of Education 2007; Fukumoto and Kikuchi 2008) for the evaluation of teachers' skills of ICT usage in class.

Method

Curriculum of the Science Teaching Method Course and Practical Teaching

The science teaching method that we investigated in this study was implemented in a course held in the fall semester of the third year at a teacher-training university in Tokyo. The teacher-training course that was the subject of this study was composed of students majoring in elementary education. The course had 15 class meetings and was divided into two classes, although the curriculum design and the teacher were the same for each of them (Table 1). In total, approximately 40 students were enrolled in the course (Kitazawa et al., 2017).

Table 1. Curriculum Design of the Science Teaching Method (Kitazawa et al., 2017)

Lessons	Lesson titles	Specific contents
1	Introduction	Lecture on the outline of the science teaching method: designing a detailed schedule for trial lessons; reviewing the teaching guidelines of science instruction in elementary schools; and collaborating and discussing the strengths and weaknesses of using ICT devices such as a digital camera, tablet PC, and digital science textbook.
2	Knowledge required for a science teacher 1	Pre-service teachers watch two videos (one with ICT use and without ICT) about science classes in elementary schools. Afterward, they discuss student understanding and the requirements of a science teacher. Lecture on how to write a science lesson plan.
3	Knowledge required for a science teacher 2	Lecture on accident prevention, safe instruction, classification criteria, and how to write a science lesson plan.
4–15	Trial lessons	Pre-service teachers conduct a trial science lesson for elementary school by using ICT for approximately 20 minutes independently. Afterward, they discuss how to improve the lesson.

Curriculum of the Teaching Practice Session

The teaching practice session is compulsory for all the teacher education curriculum held in every university in Japan. In this study in a teacher-training university in Tokyo, the course is held in the school-year of the fourth year. In the beginning, students have advance schooling in terms of practical situations, e.g. cooperative relationships in workplace and of issues that have to be dealt with. After the schooling, students appear in an elementary school for four consecutive weeks to have classes and to experience various kind of school scenario including classroom management and extra-curricular activities. In the end of the period, a faculty member as a supervisor also attend to the teaching practice session for the evaluation collaboratively with school teachers. Students have subsequent schooling in order to hold an evaluation meeting of the students who take the course.

Procedure and Method of the Survey

In our study, the authors administered a surveyance with the attendance of senior undergraduate students in 2014-2015 school year and 2015-2016 school year. For 2014-2015, 23 students (13 males, 10 females) after the teaching practice session voluntarily participated in the survey, and for 2015-2016, 20 students (11 males, 9 females) has participated. The authors administered questionnaires, 1) above-mentioned “Teachers ICT Instruction Capabilities Checklist,” and 2) awareness of trail science lesson in third school year. After their teaching practice session. The author has created online questionnaire website to answer from volunteer students. For 2014-2015 students, they have answered the questionnaire from February 2, 2016 until February 5, 2016. For 2015-2016 students, they have answered the questionnaire from January 23, 2017 until March 24, 2017.

Teachers ICT Instruction Capabilities Checklist is a questionnaire composed of five categories: (A) “ability to use ICT for materials study, instruction preparation, and assessment”; (B) “ability to use ICT in class”; (C) “ability to teach children how to use ICT”; (D) “ability to teach information morals”; and (E) “ability to use ICT for school affairs” (e.g., the teacher manages the performance and the attendance of the students). In our study, we administered this questionnaire, which totals 18 questions scored on a 4-point scale (1 = *strongly disagree* to 4 = *strongly agree*). Table 2 shows these items in a questionnaire.

Table 2. Items of Teachers ICT Instruction Capabilities Checklist (Ministry of Education, Japan, 2007)

Categories	Items
A) Ability to use ICT for materials study, instruction preparation, and assessment	<p>A-1 To enhance the educational effect, I plan a lesson on how to use computers and the Internet in a classroom setting.</p> <p>A-2 To collect materials used in lessons, I use the Internet and CD-ROM.</p> <p>A-3 To create the prints and presentation materials necessary for the course, I use word processing and presentation software.</p> <p>A-4 To improve assessment, I compile and manage students' work, learning status, and grades using computers, digital cameras, and other related equipment.</p>
B) Ability to use ICT in class	<p>B-1 To enhance children's interest in learning, I effectively present lesson materials using computers, presentation devices, and other related equipment.</p> <p>B-2 To help each child understand the projects of the subject clearly, I effectively present lesson materials using computers, presentation devices, and other related equipment.</p> <p>B-3 To explain in a way that is easy to understand, and to broaden the thinking and understanding of children, I effectively present lesson materials using computers, presentation devices, and other related equipment.</p> <p>B-4 To increase the children's knowledge when summarizing the contents of the class, I effectively present lesson materials using computers, presentation devices, and other related equipment.</p>
C) Ability to teach children how to use ICT	<p>C-1 I teach children how to select and collect information using a computer and the Internet.</p> <p>C-2 I teach children to write their ideas using word processing software and to summarize what they investigated in tables and figures using spreadsheet software.</p> <p>C-3 In a way that is easy to understand, I teach children how to express their ideas and give presentations using computers and presentation software.</p> <p>C-4 Through repeated practice, I help children acquire the knowledge and master the skills necessary for using educational software and the Internet.</p>
D) Ability to teach information morals	<p>D-1 I take responsibility for the information transmitted by the children I teach and the behavior they exhibit in the information society, and I teach them to think about others while exchanging information.</p> <p>D-2 I teach children how to collect and transmit information while they observe the rules and manners of the information society.</p> <p>D-3 I teach children to understand the correctness and safety of using information, and to take care of their health when using the Internet.</p> <p>D-4 I teach children how to acquire the basic knowledge of information security, such as the importance of passwords and other information.</p>
E) Ability to use ICT for school affairs	<p>E-1 I collect information necessary for school affairs and classroom management on the Internet, and I create documents and materials using word processing and spreadsheet software.</p> <p>E-2 To promote closer collaboration among teachers, parents, and people in the school area, I use the Internet and school network to exchange and share necessary information.</p>

Table 3. Questionnaire Items that ask Awareness of Trial Lessons with ICT use in Teacher Training Course of Science Teaching Method

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1. Trial lesson is helpful to use ICT in teaching practice session
 2. Trial lesson is needed to use ICT in teaching practice session
 3. Experiencing trial lesson make me feel like wanting to use ICT in teaching practice session.
 4. Since our school had not have ICT devices yet, trial lesson is not valuable for my teaching practice session.
 5. I realize ICT devices are prevailing in school settings.
 6. I remember my experiences in trial lesson when I am in teaching practice session.
 7. Trial lesson is important to be engaged on teaching practice session.
 8. Experiencing trial lesson make me feel adaptive to use ICT in teaching practice session.
 9. I have become less anxious to use ICT in teaching practice session after experiencing trial lesson.
 10. I have become confident to use ICT in teaching practice session after experiencing trial lesson.
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Table 3 shows questionnaire items that ask the students' awareness of trial lessons with ICT use in teacher training course of science teaching method. For these questions, the authors paid attention to whether the student use ICT in class during their teaching practice session, because their awareness may vary according to their practical ICT use.

For the evaluation of their answer in survey, we focused on both Mann–Whitney's U test and Spearman's rank correlation coefficient.

Results

Especially for the results of Spearman's rank correlation coefficient, the relation between “Teachers ICT Instruction Capabilities Checklist” and students' awareness of trial lessons with ICT use is different depend on whether the student practically use ICT in the teaching practice session.

The difference is clearly indicated in their perception of ICT instruction capabilities in class according to their practical use of ICT in class during their teaching practice session. For those who use ICT equipment during the teaching practice session, the results of ICT instruction capabilities checklist after the teaching practice session become weaken. That means their self-confidence even become worse on some items. According to the result of ICT instruction capabilities checklist at the end of trial lessons, the teacher-training course students become confident and, so to say, they built their momentum in teaching practice session. But after finishing their teaching practice, the students may feel weaken in some points.

For the correlation between ICT instruction capability and the awareness of trial lessons with ICT use, the result is different by their ICT usage experiences in teaching practice session. Those who do not use ICT equipment during the teaching practice session have felt confident about ICT instruction capability after their teaching practice. On the other hand, the authors saw some possibility of loss of confidence in use of ICT in the teaching practice according to the results from students who use ICT in teaching practice session.

The authors obtained a finding that students, in a manner, gain experiences in terms of ICT usage in school settings from both trial lessons and teaching training and earn intermixed feelings of confidence and nervousness for future work.

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References

Conference of the Central Council of Education (2016). About the improvement and a necessary policy of the courses of study of kindergarten, elementary school, junior high school, high school and the special support school (report). Retrieved December 21, 2018 from http://www.mext.go.jp/b_menu/shingi/chukyo/chukyo0/toushin/1380731.htm (In Japanese).

Fujitani, S., Kitazawa, T., & Fukumoto, T. (2017). Expertise regarding Digital Equipment Use in Elementary Science Teacher-Training Course. In Proceedings of the Society for Information Technology & Teacher Education International Conference 2019, Chesapeake, VA: Association for the Advancement of Computing in Education (AACE), 2100-2104.

Fukumoto, T. & Kikuchi, H. (2008). Research on Teacher-Librarian's ICT Education Skills using Pathfinder. In K. McFerrin, R. Weber, R. Carlsen & D. Willis (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2008. Chesapeake, VA: Association for the Advancement of Computing in Education (AACE). 3752-3754.

Griffin, P., McGaw, B., & Care, E. (2011). *Assessment and Teaching of 21st Century Skills*. Springer.

Kitazawa, T., Fujitani, S., & Fukumoto, T. (2017). Assessment of the Curriculum Design of a Science Teaching Method: Increasing Pre-service Teachers' Teaching Skills Using ICT. In Proceedings of Society for Information Technology & Teacher Education International Conference 2019, Chesapeake, VA: Association for the Advancement of Computing in Education (AACE), 1666-1673.

Ministry of Education, Japan. (2007). *Teachers ICT Instruction Capabilities Checklist*. (In Japanese). Retrieved December 21, 2018 from http://www.mext.go.jp/b_menu/shingi/chousa/shotou/039/check/07021605/001.pdf

Morishita, T. (2014). Current Status and Issue for Teacher Training Around ICT. *Bulletin of the Educational Research and Development, Faculty of Education, Kagoshima University*, **23** (p.201-208). (In Japanese)