What is the Subject for Student Teachers to Use ICT in Education?
− Problem Analysis of Teacher Training's Post-Survey −

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Abstract: At the Shinshu University Faculty of Education, student teachers are required to use ICT equipment in classes they teach during their student-teaching practicum. Their most troubles on using ICT in classes were not able to reflecting a notebook PC or a tablet computer to LCD monitor or projector well. In particular, they had trouble with enlarging a screen of iPad with Apple TV. We found that their needs to learn the basic knowledge and skill to use ICT in classes, for example how to connect to a wireless LAN and difference of HDMI and VGA. Student teachers had a trouble that some children played with ICT equipment in classes without permission, so it is necessary for children to have a rule of using ICT in classes. They should learn not only how to use ICT equipment but also making of rule for children and daily instruction method before student teaching. And we found that sustainable infrastructure use supported a stable class using ICT by student teacher.

Introduction

In Japan, collaborative and interactive classroom innovation is being promoted through ideas and improvement of instructional methods and the instructional system, including the active use of ICT (Information and Communication Technology). It is a goal for all teachers to be able to provide instruction using ICT as soon as possible and measures are being taken to improve teachers' ICT use instructional skills (MEXT 2013).

Improvement of ICT use instructional skills is not only desired of incumbent school teachers. In Japan, one of the global human resource development items is "ICT education as a national strategy," and all teachers are working toward acquiring ICT use instructional skills that correspond to the children's development stage.

University teacher training courses emphasize ICT use instructional skills and they attempt to improve the undergraduate education students' ICT use instructional skills. In addition to trying to enhance the aspiring teachers' opportunities to come into contact with ICT equipment and software through university classes and a student teaching practicum, the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) has pointed out the need to promote the development of new teacher training courses and to establish effective course structure, from the perspective of school affairs' computerization and use of ICT in information education and course instruction (Headquarters for the Revitalization of Education 2013).

With this background in mind, in Shinshu University's Faculty of Education requires its third-year students to conduct a class using ICT at least once during the one-month student teaching practicum; this fosters students' ICT use instructional skills (Fujii *et al.* 2016 & Morishita *et al.* 2016). Post-student teaching survey results showed that approximately 61.6% of student teachers had some sort of trouble and challenges with classes using ICT. This study aims to clarify the student teachers' troubles and challenges with classes using ICT based on records of the troubles and challenges described by student teachers who participate in the practicum.

Research Approach and Objective

After student teaching practicum was completed, using a free-form response, we asked student teachers about (1) difficulties and troubles with classes using ICT and (2) challenges and points for improvement. Responses were analyzed using text-mining software. The same software was used for morphological analysis of target sentences. We used tf-idf (Term Frequency–Inverse Document Frequency) to quantify the strength of the relationship between sentences and phrases, and we then performed cluster analysis and correspondence analysis. Previous research using the same software has shown the structural features and trends of content described in text format. The present study structurally analyzes the student teachers' troubles and challenges and clarifies what type of troubles and challenges the students face based on cluster analysis and correspondence analysis, with one sentence from each student teachers' response (Morishita & Higashibara 2014).

Results and Findings

Results of morphological analysis of student teachers' responses showed that the average vocabulary count per sentence regarding (1) difficulties and troubles was 22 and the average character count was 35. The average vocabulary count per sentence regarding (2) challenges and points for improvement was 29 and the average character count was 45. Note that these show both word and character counts in Japanese. As there were duplicates of the words "personal computer" and "PC," these words were registered in the dictionary as synonyms. In addition, the term "point for improvement" stuck out and would have interfered with analysis; it was thus excluded from analysis targets.

Table 1: Modification Relation (TOP10)

	Noun Phrase	Adjective Phrase	Freq.
1	connection	bad	4
2	connection	good	4
3	connection	not good	3
4	condition	bad	2
5	classroom	large	2
6	unit	poor	2
7	class	Smooth	2
8	personal computer	good	2
9	personal computer	bad	1
10	contact	bad	1

Table 2: Frequency of Phrase (TOP10)

	Noun Phrase	Freq.
1	class	60
2	ICT	46
3	nothing	36
4	electronic blackboard	24
5	usage	24
6	iPad	22
7	time	17
8	handout	16
9	tablet	16
10	need	15

For (1) difficulties and troubles, we saw dependency of the adjective "bad" for the noun phrases "connection" and "personal computer" (Table 1). We found that there were some troubles with ICT equipment and large monitors. For (2) challenges and points for improvement, we saw the noun phrases "ICT," "electronic blackboard," and "iPad," and found that challenges were mainly regarding how to use ICT equipment (Table 2).

Dendrogram	Category Names	Number of Sentences	Representative Phrases
	television	9	television/fashion/handling/projection/projector
	personal computer	20	personal computer/powerpoint/point/power/classroom
Cluster 1	class	19	class/equipment/interest/truble/voice
	time	15	time/setting/ready/tablet/connection
	usage	4	usage/use/artifice/first/application
Cluster 2	Apple TV	5	Apple TV/write/how to write/plan/teaching plan
	use	4	use/borrowing/student council/projector equipment/projector
	iPad	15	iPad/Nagano/sceen/mirroring/play
	connection	8	connection/movie/cable/connection cable/digital
	fact	5	fact/how to connect/connection/not check/line
	place	61	place/jumpy/share/picture/writing on blackboard
Cluster 3	Internet	4	Internet/ACSU/streaming/give up/authenticity
	teacher training	5	teacher training/student teacher/net/education/practitioner
	movie	7	movie/rethink/start/example/example movie
	electronic	17	electronic/electronic blackboard/blackboard/children/class
	nothing	47	nothing

Figure 1: The Results of Student Teachers' Responses about Difficulties and Troubles

Figure 1 is the results of cluster analysis of the student teachers' responses about (1) difficulties and troubles. The dendrogram in the figure automatically groups content by extracted categories. It is represented in the tree diagram, and the greater merging on the right shows higher similarity. "Category Names" are expressed by representative phrases of the group, and "Representative Phrases" are shown by characteristic phrases that were frequently expressed in the categories out of the words present in the text of the category. "Number of Sentences" shows the number of sentences included in the category. Note that numbers in the figure correspond to the cluster number in the text.

Cluster 1: For time (during the entire sentence, about 13.9%), we noted that it took a long time to connect devices and the class did not proceed smoothly, and the student teachers were unable to make use of ICT as they hoped due to the lack of devices, with responses such as "It took time to connect the tablet device and monitor" and "There was a small number of large monitors, and there were overlapping times when other student teachers wanted to use the monitors."

Cluster 2: For iPad×Apple TV (during the entire sentence, about 11.4%), we found that student teachers had a lot of trouble using the Apple TV and projecting the iPad screen.

Cluster 3: For connections (during the entire sentence, about 33.9%), we found that there was insufficient understanding about the types of cables and how to connect using them, as well as failure to maintain equipment, with responses such as "I didn't know how to connect the cable," "There was contact failure/defect with the cable," and "I had difficulty connecting to the Internet."

We found these three clusters for ICT troubles during the student teaching practicum. However, since both Cluster 2 and Cluster 3 are related to equipment connection, the main troubles student teachers faced can be largely divided into two categories: "time" and "equipment connection."

Dendrogram	Category Names	Number of Sentences	Representative Phrases
Cluster 4	ict	23	ict/use/class/ict-use/ict-use class
	class	20	class/use/movie/student teacher/training
	ict	14	ict/active/positive/teacher/chance
	check	15	check/course material study/ict equipment/real part/setting
Cluster 5	usage	12	usage/use/pre-instruction/textbook/apple
	report	6	report/time/create an environment/loss/condition
	ipad	11	ipad/number/investigative learning/investigative/luxury
	handout	5	handout/memory/three/work/medium
	power	5	power/point/power point/projection/real projector
	connection	59	connection/what/complete/everyone/environment
	affiliated school	3	affiliated school/school/affiliated schools/affiliated/teachers
Cluster 6	slide	4	slide/sheet/word/volume/back
	tablet	8	tablet/function/operation/limit/usability
	manner of utilization	8	usage/own/use/challenge/how
	electronic blackboard	17	blackboard/electronic blackboard/electronic/screen/half
	nothing	35	nothing

Figure 2: The Results of Student Teachers' Responses about Challenges and Points for Improvement

Figure 2 is the results of cluster analysis of the student teachers' responses about (2) challenges and points for improvement.

Cluster 4: For advance preparation and confirmation (during the entire sentence, about 29.4%), we found answers related to practicing how to deal with the equipment and preparation of equipment before class, with responses such as "I should practice in the actual classroom before class" and "It is important to get used to dealing with the equipment." Student teachers also requested creating an environment for them to gain experience with the equipment before the practicum, with the response "It would be good to be able to use it in a university trial lesson."

Cluster 5: For the materials (during the entire sentence, about 38.0%), there were responses that reflected on material presentation methods, such as "I think if I had had more interesting slides, I would have been able to better hold the students' interest" and "It is important to choose effective videos and materials." Although there is a wide range of materials used through ICT, which is great, student teachers are unable to understand which materials are important and how they should present them, and it is necessary to have this guidance/instruction in university classes.

Cluster 6: For ICT equipment usage methods (during the entire sentence, about 56.3%), we found that there was a lack of knowledge and skills regarding ICT equipment, with responses such as "I didn't really know how to use the electronic blackboard" and "I was unable to have good command over the iPad." In fact, undergraduates are not provided with the opportunity or environment to freely operate electronic blackboards and tablet devices at their universities. It may be necessary to provide opportunities to freely experience ICT devices before the practicum. With the response "When I gave students the tablets, students used them for other purposes," we see that it is necessary to learn how to instruct students during a class using ICT.

To clarify the challenges regarding ICT equipment that student teachers faced at particular schools, we performed correspondence analysis (behavior analysis) targeting each antonym pair "able to–not able to" and "use–do not use" (Figure 3). As well, student teachers went to five affiliated schools in Shinshu University during this teacher training; Kindergarten, Nagano Elementary School, Matsumoto Elementary School, Nagano Junior High School and Matsumoto Junior High School.
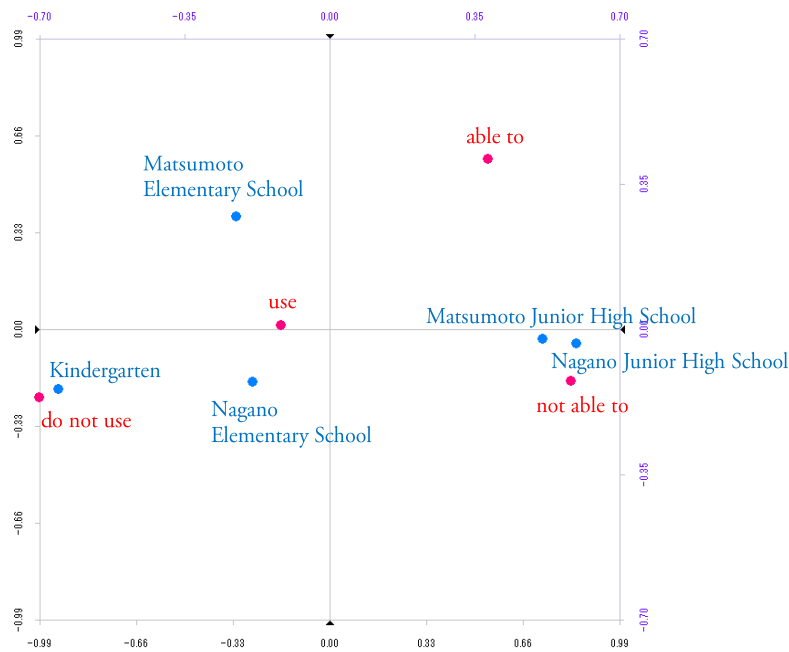
Figure 3: Correspondence Analysis (Behavior Analysis) about Challenges and Points for Improvement

For Kindergarten, we found a bias for "not able to"; however, as ICT equipment for Kindergarten has not been established, student teachers were unable to conduct classes using ICT. Nagano Elementary School was in a position closer to "not able to" following Kindergarten. This is because Nagano Elementary School is a school to which equipment has been introduced early and a sufficient number of equipment could not be organized within the budget. However, for Nagano Junior High School and Matsumoto Junior High School, we found a bias for "do not use," and we understood that student teachers did not use ICT very much in classes. This is because the practicing junior high school teachers instructed student teachers not to use ICT. This reinforced the need for improved awareness of the teachers who guide/instruct student teachers.

Conclusions

This study aimed to structurally clarify what types of troubles and challenges student teachers faced in classes using ICT. Results from analysis using text-mining methods showed that student teachers mainly faced troubles and challenges with "time" and "equipment connection." Due to insufficient knowledge about how to connect cables for tablet devices and electronic blackboards, student teachers were unable to smoothly operate these during classes; this hindered class progression. We also found that there were few opportunities to actually use ICT equipment at universities; student teachers thus did not understand how they should present materials to children during their student teaching practicum or how they should instruct ICT learning and they felt that these were challenges. This is influenced by the equipment environment in each school and the supervising teachers' beliefs, and suggests the need for improved awareness among school teachers and promotion of ICT equipment environment maintenance in affiliated schools.

Future challenges include clarifying solutions to the troubles and challenges identified in this study. Therefore, while preparing equipment environments that allow for student teachers to comfortably use ICT in classes, it is critical to continuously provide opportunities to learn more practical ICT use instructional methods. We would like to evaluate the influence of equipment environment maintenance and classes on ICT use instructional methods on undergraduate teachers-in-training's ICT use instructional skills.

Acknowledgements and Additional Statement

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