Project Research of the FY2015-2016 National Institute for Educational Policy Research Project
Survey Research Report – "Comprehensive Study on Pre-service Training, Placement and In-Service Training of Teachers to Foster Children's Competencies"
Differences in the status of interactions between teachers depending on class size and grade / school size
Focusing on formative evaluations thought to have a great influence on academic ability
Summary of the research

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1. Issues

Class composition and teacher cooperation

It is apparent that it is easier for teachers to pay attention to individual children if the class is small, but the relationship between the class size and the state of cooperation among the teachers is not as clear.

Formative evaluations and academic ability

Many previous studies have shown that even in formative evaluations, the implementation of evaluations where the results are fed back to the learner, and where the subject of the evaluation, the learner, is able to use these results to improve his or her learning has a huge effect on the learner's academic ability. In order to make a formative evaluation, criteria to be used for interpretation in order to measure the learner's level against the achievement goals should be prepared beforehand using the state of the learner's efforts in the learning process and the state of the results of the achievements, and feedback should be given to the learner using these criteria. In addition, cooperation between teachers teaching the same subject is considered to be essential when deciding how to prepare the interpretation criteria and how to effectively conduct feedback.

Technology to monitor teacher cooperation

Teacher cooperation is often carried out within a few minutes such as between lessons in a short amount of time. In order to monitor the state of such communication, use of a wearable sensor which incorporates an infrared sensor that records face-to-face situations and an acceleration sensor that records physical movements in units of 1 second or less, which is one of the technologies used for immediate and continuous measurement, was considered to be effective.

2. Purpose

This depends on the size of the lower secondary school and the class size. The purpose of this research is to clarify the differences in the status of cooperation among teachers when preparing a formative evaluation. In addition, preparing a formative evaluation means preparing the interpretation criteria necessary for feedback to be given to the students and deciding on methods of effectively giving feedback to the students.

3. Method

Survey target and contents

For the three types of schools of the same size (12, 13, 15 classes), we surveyed two schools respectively with different average class sizes, totaling six schools (Table 1). We asked the managerial staff and teachers (excluding nursing teachers and nutrition teachers) of each surveyed school to wear wearable sensors from the time of arriving at work to the time of leaving work for three consecutive days (Tuesday, Wednesday, Thursday), and also asked the teachers to answer a questionnaire giving a report on the contents of meetings and discussions with other teachers every day for the three-day period.

Table 1 School size of the surveyed schools (number of classes in the regular grades), average class size, subjects of the survey and number of teachers analyzed

Schools	No. of classes	Average class size	No. of teachers surveyed	No. of teachers analyzed		
				1st day	2nd day	3rd day
1st school	12	33.9	25	6	7	5
2nd school	12	34.8	24	9	8	7
3rd school	14	34.2	26	6	7	4
4th school	14	36.1	24	8	8	7
5th school	15	34.3	26	9	6	8
6th school	15	35.7	29	10	9	9

Analyzed teachers

Out of the surveyed teachers, only teachers who were in charge of teaching all of the lessons of all of the subjects for one grade were selected. This is because the state of cooperation among the teachers was thought to be different for those who were team teaching or teaching lessons for two grades, or where two teachers were teaching one grade. On this basis, we analyzed teachers who had been wearing a wearable sensor for two or more days during the three-day survey period for seven hours or more a day.

Communication data by face-to-face partner and content

The communication data by face-to-face partner and content was created through the following process. (1) We created face-to-face communication data for each day during the three-day survey period for each target teacher to be analyzed; (2) the target time was 11 hours in total from 8:00 am to 7:00 pm; (3) the face-to-face partner included all teachers who were wearing a wearable sensor at

each surveyed school; (4) of the data output by Hitachi's Human Big Data Service base station terminal, and of the matrix data of face-to-face situations and average frequency for every 2.5 seconds, which was face-to-face communication data; (5) the fact of face-so-face interaction was recorded using an infrared sensor, and if the body movements of the people having the interaction were synchronized at 1.0 Hz or more, it was judged that face-to-face communication had taken place; (6) the matrix data was divided according to the attributes of the face-to-face partner, and (7) the face-to-face communication time by face-to-face partner and content was calculated by multiplying the matrix data, which had been divided according to the attributes of the face-to-face partner, by the ratio of the content of the meetings and discussions by attributes of the face-to-face partner monitored through a questionnaire.

4. Results

Table 2 shows the averages and rates of face-to-face communication time according to the attributes of the face-to-face partner by school, and Table 3 shows the average times and rates by face-to-face communication content among teachers teaching the same subject.

Table 2 Average and rate by school of face-to-face communication by the attributes of the face-to-face partner

	Face-to-face partners											
	Teachers of the same subject			Teachers of same grade			Teachers of other subjects/grades			Managerial post		
Schools	M	SD	Rate	M	SD	Rate	M	SD	Rate	M	SD	Rate
1st school	19.23	10.14	0.04	230.42	70.09	0.49	179.05	128.47	0.38	43.81	37.82	0.09
2nd school	23.89	22.38	0.04	413.56	223.35	0.75	94.68	38.41	0.17	19.63	16.54	0.04
3rd school	79.46	104.28	0.19	267.38	221.25	0.66	58.27	43.44	0.14	2.62	3.14	0.01
4th school	5.83	16.50	0.02	167.55	136.90	0.65	70.57	58.35	0.27	13.28	11.54	0.05
5th school	26.76	38.52	0.08	214.63	70.79	0.64	55.88	62.88	0.17	35.56	36.56	0.11
6th school	33.58	43.13	0.06	312.46	120.66	0.57	139.71	109.15	0.26	61.79	49.40	0.11

Table 3 Average time and rate by three-day contents of face-to-face communication with teachers teaching the same subject

	Formative evaluation preparation		Lessons		Student guidance		School affairs		Others	
Schools	Average time	Rate	Average time	Rate	Average time	Rate	Average time	Rate	Average time	Rate
1st school	1.88	0.08	0.42	0.02	0.00	0.00	0.00	0.00	21.04	0.90
2nd school	9.29	0.32	11.9	0.4	1.63	0.06	2.35	0.08	4.23	0.14
3rd school	60.42	0.39	51.06	0.33	24.86	0.16	0.06	0.00	19.44	0.12
4th school	0.00	0.00	26.67	0.57	0.00	0.00	0.00	0.00	20.00	0.43
5th school	9.48	0.34	4.94	0.17	0.00	0.00	6.29	0.22	7.55	0.27
6th school	1.58	0.04	6.79	0.18	4.50	0.12	17.14	0.46	6.86	0.19

5. Study

As shown in Figure 2, although this is not applicable to schools with 12 classes, the study suggests that if the size of the school is the same, it is more likely in schools with smaller classes that preparations for formative evaluations will have been made such as the interpretation criteria necessary to give feedback to the students being created through cooperation among teachers of the same subject, and methods determined to effectively give feedback to the students. However, as shown in Table 3, the average preparation time for formative evaluations through cooperation among teachers teaching the same subject by school was about 60 seconds for one school, 9 seconds for two schools, and 2 seconds or less for two schools, and the preparation time itself for formative evaluations through cooperation among teachers teaching the same subject is short. In addition, as shown in Table 2, the average face-to-face communication time among teachers teaching the same subject by school was about 6 seconds for the minimum value and about 80 seconds for the maximum value, and the time spent was also short.

Many previous studies have revealed that the implementation of formative evaluations has a great effect on academic ability. In addition, in order to conduct formative evaluations, it is necessary to prepare interpretation criteria in advance to judge the level of achievement of the target goals from the state of the learner's efforts in the learning process and the state of the achievements, and to provide feedback to the learners using these criteria. Based on the findings of these previous studies, it is considered that the ease with which these formative evaluations are implemented may lead to increasing the academic abilities of the students. Moreover, the results of this study suggest that these kinds of effective formative evaluations are easier to implement in smaller classes.

6. Issues of the research

The objective was to clarify the differences in the status of preparing formative evaluations through cooperation among teachers teaching the same subject depending on the size of the school and the size of the class, but the difference in the average class size through a combination of schools with 12 classes was 0.9, the average class size through a combination of schools with 14 classes was 1.9, and the average class size through a combination of schools with 15 classes was 1.4, and the problems remain that although comparisons were made depending on the size of the class, there was little difference, and face-to-face communication itself among the teachers fluctuated widely within the same school and with other schools. In addition, since the surveyed schools were six schools in a specific region, the results of this research can only be taken as examples.
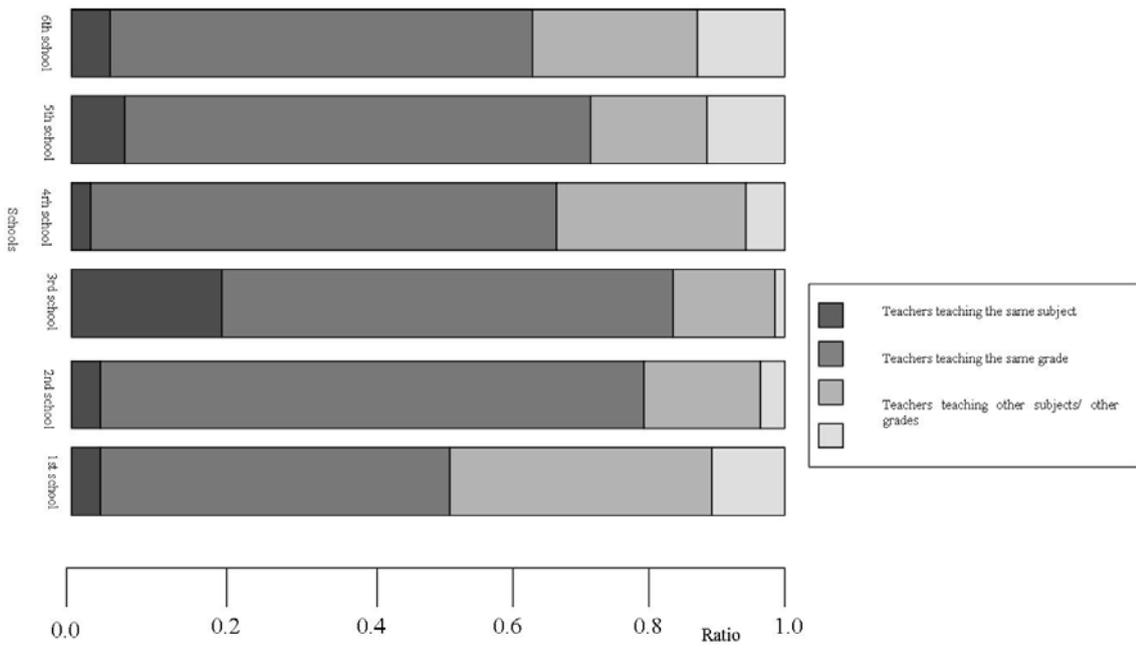
Figure 1 Percentages of face-to-face communication time by attributes of the face-to-face partner by school
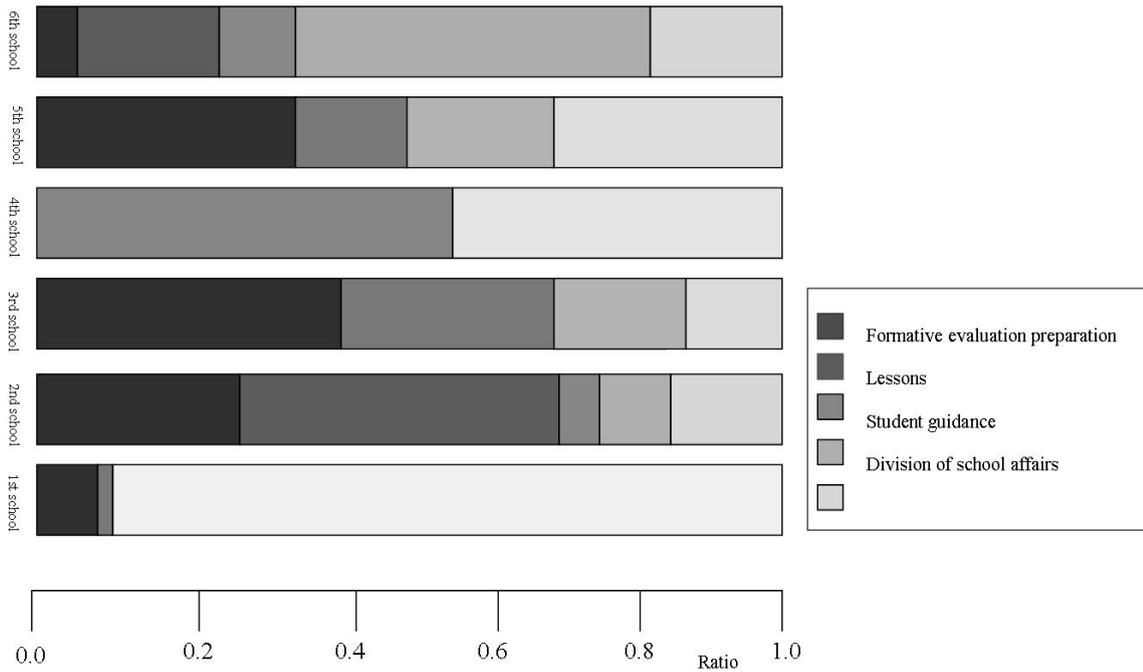

Figure 2 Percentages of face-to-face communication with teachers teaching the same subject