

The Inquiry of Students' Attitude towards Group Discussion and Presentation in a Course of Mathematics Education¹

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(Received November 11, 2014; Revised December 21, 2014; Accepted December 23, 2014)

This research is a survey study on students' attitude toward a class employing small group discussion and presentation by the method of free-listing. Participants in this study were students who registered in the course of Mathematical Logics and Writing during 2011 and 2014. Senior students who took the course of theory of mathematics education previously usually registered the course. The class for this course used to be designed as a class adopting group discussion and presentation. Main theme of this research is not to demonstrate some theories or hypothesis on teaching and learning, but rather to inquire students' attitude toward a class employing the constituents first and then through analyzing the results of this study to find practical ideas and strategy for design and implementation of a class which brings cultivation of students' understanding, communication and moreover writing in mathematics. Since the survey was given in the 8th week of this class, participants of this research could be expected to have more concrete idea for positive or negative aspects of the classes employing these constituents. We compared both research results of 2011 and 2014 to view any changes in students' attitude. Research results are follows. Students began to think that group discussions and presentation bring out better learning to them. Not to give students psychological burden of discussion and presentation, instructors need to provide comfortable atmosphere through arranging suitable grouping and enough time for discussion. Moreover, simple evaluations criteria for group discussions and presentation should be well structured and more concrete guides for them are required to make students to feel comfortable and to concentrate on the given subject for discussion.

Keywords: communication, cooperative learning, free-listing, group discussion, presentation

MESC Classification: C70, D40

MSC2010 Classification: 97C70, 97D40

¹ The part of this research was presented in the Poster Sessions of the 12th International Congress on Mathematical Education (ICME 12), COEX, Seoul, Korea; July 8–15, 2012 (cf. Kim, 2012).

1. INTRODUCTION

The effect of small group discussion has been demonstrated (or revealed) in classroom experiments in the university level math courses (Kwon, 2007; Kim, 2010) as well as in the area of secondary mathematics course (Shin, Kim & Shim 2011). The authors in the researches usually tried to evaluate students' understanding of mathematical concepts or their cooperative attitude through group discussions. In this research, we had also concerns on students' presentation in mathematics or mathematics education through small group discussions and expected their presentations could be developed through sharing concept images and ideas of mathematics within each group. It is known that students really understand a concept when they become to express in their own words about the concept (Cohen, 1982; Chalice 1995). Moreover, to describe one's thought in writing a short essay in the subject of math or math education, he/she first needs to understand in depth and widely on the suggested subject. Students are not experts of contexts dealt in the classroom and hence it is helpful for them to listen to their colleague's ideas to refine and expand their concept images as well as to have deep understanding of the concept lectured by an instructor. Students also need enough time to get used to the concept so that they can connect it with the relevant concepts acquired previously before they write a short essay on a given subject. Small group discussions also provide an opportunity for students to do that.

This research is a survey study on students' attitude toward a class employing small group discussion and presentation by the method of free-listing. Participants in this study were students who registered in the course of Mathematical Logics and Writing during 2011 and 2014. The author has taught this course in the same manner of teaching and learning in the 2nd semester since 2009. Senior students usually registered the course. The class for the course of Mathematical Logics and Writing used to be designed as a class adopting group discussion and presentation. It has been studied that these are the constituents of class yielding the student-centered learning as well as bringing about students' communication skill (Kim & Kim, 2010; Kim & Choi, 2012). Main theme of this research is not to demonstrate some theories or hypothesis on teaching and learning, but rather to inquire students' attitude toward a class employing the constituents first and then through analyzing the results of this study to find practical ideas and strategy for design and implementation of a class which brings cultivation of students' understanding, communication and moreover writing in mathematics. Since the survey was given in the 8th week of this class, participants of this research could be expected to have more concrete idea for positive or negative aspects of the classes employing these constituents. We performed this study in the same course during the spring semesters of 2011 and

2014 by the method of free-listing and compared both research results to get students' attitude trend. The research result of 2011 was reflected in the same course of the following years.

In the course of Mathematical Logics and Writing, the author has treated subjects from theory of mathematics subject matter education like didactical transposition, principle of the permanence of equivalent forms. This course aimed the improvement of students' writing skill in mathematics education as well as their presentation and communication. We also expected students' deep understanding of the subjects covered in the course. Class used to be designed for students to have group discussion and then presentation of their finding on the suggested subjects before writing those as short articles by each group or individually. Students in the class were divided into 5 or 6 small groups and group discussion tips were given to them in the beginning of the course. Instructor first gives a lecture on the basic knowledge of specific subject of mathematics subject matter education and then let students to find examples relevant to the subject in the area of secondary mathematics (sometimes in mathematics of university level). And then each group was asked to present their findings after group discussion. Through this course, we used to find that students' attitude toward group discussions changed to be more positive and they even came to enjoy discussions. Moreover, it has been expected that students could learn how to think in various way and communicate in a group through discussions and presentation that finally brought them to better learning.

2. RESEARCH BACKGROUND

Many researches on teacher knowledge in mathematics instruction have been done. Fennema & Franke (1992) proposed knowledge of mathematics, pedagogical knowledge, knowledge of learners' cognitions in mathematics and belief as a model of teacher knowledge. Ball, Thames & Phelps (2008) developed some theories of teacher knowledge based on work of teaching or teaching practices and applied them to mathematics instruction. The students in the department of mathematics education are pre-service teachers. Hence, they need to practice teacher knowledge in mathematics instruction through courses as well as to learn them theoretically when students. It is necessary to provide students a class employing small group discussion or presentation so that they could practice these pedagogical knowledge in the class and finally to guide such class as a teacher in the future. One of 6 standards for professional development of teachers of mathematics appeared in "Professional Standards for Teaching Mathematics" (NCTM, 1991) is that teacher must experience the models of good mathematics teaching and they have to make decisions that affect the teaching of mathematics. Mathematics teachers

must develop and maintain the mathematical and pedagogical knowledge they need to teach their students well. One way to do this is to collaborate with their colleagues and to create their own learning opportunities where none exist (NCTM, 2000). All these demonstrations apply to our students who are pre-service teachers as well as teachers. The class of the course of “Mathematical Logics and Writing” has been designed to make students experience various class constituents which could be elements for a model of mathematics teaching, especially small group discussion or presentation. Through this research, students were expected to experience the class with these constituents, to find the positive and negative aspects of the class and also suggest the suggestions for more effective running of this kind of class from their side. At last, the instructors could set up well-designed classes with the constituents for students which are pre-service teachers.

The changes of students’ attitude toward small group discussion or presentation in the university level classes were studied (Kim & Kim, 2010; Kim & Choi, 2012; Kwon 2007) in Korea. Kim, Kim, Kwean & Han (2012) discussed the important role of presentation in the MG-CPS model of problem solving for mathematically talented students. They asserted that the model could be effective to ordinary students since it contains presentation phase so that students can communicate mathematically with others and share their finding through group discussion and presentation. Shin (2003) proposed a desirable direction of curriculum and teaching-learning paradigm for training math teachers at universities. Most researches involving classroom experiments have been done in the class of mathematics area and rare in the class of mathematics education area of university level. Hence this research is expected to devote to designing the classes equipped with small group discussion or presentation.

Free listing is a research method developed in the field of cultural anthropology. Researchers ask the respondents to list the items freely that belong to the domain of researcher’s interest, and discover the contents of the domain (Dressler, 2004). Free listing is very simple method of survey asking the respondents to list their answer on the open ended question. Since the structure and logic of free listing method is simple, analyzing data from the method can be done by manual decision making and so analyzing its result is very simple. Also, it is possible to investigate even when the size of samples is small.

For example, researchers explore the contents of the domain by asking the respondents to “list as many X’s you know”. Free listing methods have been used to investigate the contents of the diverse cognitive areas such as reasons for the students’ choice of particular courses (Flinn, 1998).

In contrast with the survey on the subjective preferences of the individuals, the Free listing method is based on the assumption that some common ideas are shared among the people in their cognitions on something instead of completely individual and independent functions. That is, free listing methods are relevant tools for exploring the common

understanding of the people on the domain (Sinha, 2003). The three assumptions that free listing rests on can be found in the article of Quinlan (2005). First, when people free list, they tend to list terms in order of familiarity. Second, individuals who know a lot about a subject list more terms than do people who know less. And third, terms that most respondents mention indicate locally prominent items. A (cultural) domain in a free listing method (whether it is related to some knowledge, cognition, attitude, experience, or feeling) may be defined as “an organized set of words, concepts, or sentences, all on the same level of contrast, that jointly refer to a single conceptual sphere” (Weller and Romney 1988). The goal of free listing is to define such domain and to investigate the internal structure of the domain.

3. RESEARCH METHOD

3.1. Participants

Thirty-three senior students who are pre-service mathematics teachers and registered in author's class of Mathematical Logics and Writing participated in this classroom experiment during 1st semester of 2011. This course belongs to mathematics education area. For the first semester of 2014, Thirty-four students enrolled in the same course equipped with the same teaching and learning method as in 2011. There was no teaching assistant for this research. Twenty-nine students (20 female and 9 male students) participated in the survey of 2011. Around 50% of them took one more course of math education area in the next semester. Fourteen students were selected for the survey of 2014 who enrolled in the course of Mathematical Logics and Writing and all of them took the course of Mathematics Curriculum and Evaluation in the following semester. Two out of fourteen students were females. 86% of participants in the survey were male students in 2014 while 33% of participants in the survey of 2011 were males.

3.2. Post Survey

We investigated students' attitude on group discussions and presentation on the 8th week of 2011 by free-listing method. Also, in 2014, fourteen students in the class who were willing to take more course of the subject of math education participated in this survey and responded to the same questions as those in 2011. The author designed the experimental class for the course of Mathematical Logics and Writing on 2009 and has conducted the class since then and did surveys in the 8th week of 2011 and in the First week of the second semester of 2014. The main questions in the surveys are as below.

- Question 1: Free list on the positive aspects of the class equipped with small group discussions and presentations
- Question 2: Free list on the negative aspects of the class equipped with small group discussions and presentations
- Question 3: The suggestions for more effective way for the class equipped with small group discussions and presentation

3.3. Classroom Design

Classroom experiment proceeded during the first half period of the spring semester of 2011 and also the same experiment has been done in the same course of 2014. The students were divided into 5(6) small groups for group discussions and presentations in 2011(2014). The class of 75 minutes was given twice in a week for the course and class of group discussions and presentations were performed once a week from 2nd to 7th week. The experimental classes were performed in the following way.

- Instructor first gave a short lecture providing preliminary knowledge on a subject for 20–25 minutes.
- A topic relevant to the subject was given for group discussions for 15–20 minutes.
- A student from each group presented their finding from discussions. 15–20 minutes was arranged for presentations.
- Each group or each student was asked to write a short article on their finding of the given topic after presentation (2 times by group and 3 times individually during the period of classroom experiments in 2011), for 10 minutes.
In 2014, students have done this process 2 times by group and 2 times individually.
- In the 8th week, students' attitude on a class employing group discussions and presentation were surveyed in 2011. Also, this survey has been conducted in the 1st week of 2nd semester of 2014 for student who enrolled in the course of Mathematics Curriculum and Evaluation. All of them participated in this classroom experiment in the 1st semester of 2014.

3.4. Tips for group discussions

In the 1st week of each classroom experiment, the following tips for group discussions and presentation were suggested in the class.

- Set a plan for group discussion according to given time
- Find and share knowledge relevant to the subject (topic or problem)
- Find suitable strategy for solving the given problem
- Start conversation in the following manner or expression;
- My opinion (or idea) is ... I think ...
- Encourage each other to find a good idea
- Listen carefully other's opinion. Don't say "you are wrong."

- At least one member of group would better write colleague's opinions or ideas in a group discussion. Students were encouraged to take notes of some important points in each discussion.
- During the group discussion, find out who might be a good presenter (the best one for presentation)
- While presenter writes the example (finding) on the board that his/her group finds and then explains that, his/her group members are allowed to collaborate in such performance.

3.5. Weekly subjects for group discussion

In Table 1, the subjects for group discussion and presentation in this course of "Mathematical Logic and Writing" in 2011 are listed. In 2014, the topic of 'teaching and learning of functions' was not treated in the course. Instead, the subject of 'meaning reception learning' was selected.

Table 1. Subjects for group discussion (2011)

Week	Subjects	Activities done
1	Introduction of course Tips for discussion and presentation Didactical transposition	Lecture
2	Didactical transposition	Discussion, presentation, writing
3	Principle of the permanence of equivalent forms	Discussion
4	Principle of the permanence of equivalent forms	Discussion, presentation, writing
5	Teaching and learning of functions	Discussion, writing
6	Teaching and learning of functions	Discussion, presentation, writing
7	Problem solving by the strategies of generalization and specialization	Discussion, presentation, writing
8	Midterm exam	

4. RESEARCH RESULT AND ANALYSIS

We analyzed the results of post surveys in this section. On the 8th week of the 1st semester in 2011 and on the 1st week of the 2nd semester in 2014, students participated in the surveys. In 2011, 86% of the respondents wanted to take this kind of lecture again.

97% of students both presented their views and listened to others in group discussions. Average frequency of each student's presentation is 2.8 (3.6 times for male and 2.4 for female students for 6 weeks) in the courses equipped with group discussion and presentations that each student took by the First semester of 2011. In 2014, at least four students from each group gave presentations for their finding on the given subject in the experimental class. Students who never gave a presentation were sometimes required to hand out short essays on the finding that they got in their group discussions.

Table 2. Frequency of each student's presentations by the first semester of 2011

Gender Group	Male	Female	Average
Number of Presentations	3.6	2.4	2.8

29 students (20 female and 9 male students) responded in the survey after the experimental class of 2011. 33% of respondents of the survey were male students. For Question 1, they free-listed 87 items and so the average of free list is 3 items. We categorized them into 7 items (see Table 3). For Question 2, they free-listed 58 items and hence the average of free list is 2 items. We categorized them into 7 items (see Table 4). For Question 3, they free-listed 54 items and hence the average of free list is 1.86 items. We categorized them into 6 items (see Table 5).

In the survey of 2014, fourteen students (2 female and 12 male students) responded. 86% of respondents of the survey were male students. For Question 1, they free-listed 36 items and so the average of free list is 2.6 items. We categorized them into 7 items (see Table 3). For Question 2, they free-listed 33 items and hence the average of free list is 2.36 items. We categorized them into 6 items (see Table 4). For Question 3, they free-listed 32 items and hence the average of free list is 2.29 items. We categorized them into 7 items (see Table 5).

Table 3. Numbers of items free-listed in 2011 and 2014

Question	Positive aspects		Negative aspects		Suggestions	
	2011	2014	2011	2014	2011	2014
Number of items free-listed	86	36	58	33	54	32
Average number of free lists	3	2.6	2	2.36	1.86	2.29
Number of items in category	7	7	7	6	6	7

In both years, student free-listed more positive aspects than negative aspects for the class equipped with small group discussions and presentations. In 2014, students listed

freely more suggestions for an effective way for such class than those of 2011.

The students' free listing on the positive and negative aspects of the class equipped with small group discussions and presentations, and also the suggestions for more effective running of this kind of class are exhibited in Tables 4–6. The items that students free-listed were categorized as in Tables 4–6. The tables summarize the responses of the students.

Table 4. Positive aspects

	Item	Frequency (2011)	Frequency (2014)
1	Variety of opinions	25 (86.2%)	9 (64.2%)
2	Confidence in presentation	17 (58.6%)	5 (35.7%)
3	Communication	14 (48.3%)	5 (35.7%)
4	Problem solving	10 (34.5%)	1 (7.1%)
5	Interesting	8 (27.6%)	5 (35.7%)
6	Positive attitude	8 (27.6%)	5 (35.7%)
7	Teacher training	5 (17.2%)	0
8	Better learning	0	6 (42.9%)

Table 5. Negative aspects

	Item	Frequency (2011)	Frequency (2014)
1	Monopoly, free-rider	18 (62.1%)	7 (50.0%)
2	Psychological burden	13 (44.8%)	6 (42.9%)
3	distraction	9 (31.0%)	8 (57.1%)
4	Shortage in time	17 (58.6%)	3 (21.4%)
5	Difficulty in evaluation	6 (20.7%)	0
6	Managing discussion	4 (13.8%)	6 (42.9%)
7	Difficult topic	1 (3.4%)	3 (21.4%)

In 2014, around 43% of students responded that discussion and presentation in the class yields better learning. Students can spend time on a subject and become to understand in depth when they exchange their opinions on the subject through group discussion. Meanwhile, students could not relate them to training for pre-service teacher and only one

student thought them to bring problem-solving ability. In fact, it is natural to agree with that group discussion and presentation are needed for all kinds of classes.

In both years, more than or at least 50% of students responded that free-rider or monopoly in group discussion bothered them. Cooperation is a character which can be tamed through long period. Hence, the instructor warned that free-rider could not get a credit for the participation of group discussion in the experimental class of 2014 and hence more students tried to share their opinions in group discussion than the one in 2011. That seems to cause more distraction or difficulty in managing discussion in 2014. From the fact that 86% of participants in the experimental class were male students in 2014, this distraction and difficulty could be conceived. This can be asserted from the next research results. In a study on students' behavior in a class of coeducational high school, male students tended to answer teacher's question by creative opinion while female students were well in concentration and cooperation (Chung & Chung, 2003). More male students responded teacher's question without caring their answers' truth or falsehood than females did (Chung, Yoo & Kim 2009). This tells male students seem more aggressive on showing their opinions in group discussion and presentations.

Table 6. Suggestions

	item	Frequency (2011)	Frequency (2014)
1	Free, comfortable atmosphere	20 (68.9%)	5 (35.7%)
2	Active participation	16 (55.2%)	8 (57.1%)
3	More discussion time	8 (27.6%)	1 (7.1%)
4	Clearer topic	4 (13.8%)	9 (64.2%)
5	Varied evaluation	3 (10.3%)	0
6	Even grouping	3 (10.3%)	1 (7.1%)
7	Leadership	0	4 (28.6%)
8	Knowledge	0	4 (28.6%)

Since students who participated in the classroom experiment of 2014 had absence from theories of mathematics education during 2013, many of them had no enough basic knowledge on the theories and hence students needed to spend more time to understand given topics clearly. The instructor gave them enough time for group discussion and also spent more time to lecture the theories before group discussion, but they still feel difficulties to find examples of school math relevant to the theories. Some of them expected group leader to fulfill their inadequacy of knowledge relevant to the given subjects. Simple and clear evaluation criteria were given in the experiment of 2014 and so student

didn't complain about evaluation (see Tables 4–5). Student who never give any presentation in the experimental class were asked to write a short essay on a subject suggested for group discussion to get a credit.

5. CONCLUSION

The students' attitude toward group discussions changed to be more positive, and they even came to enjoy discussions. Freudenthal (1991) said that the essence of mathematics is mathematical activity. Students became to realize what Freudenthal means. They also came to realize that they could learn how to think and communicate by listening to colleagues' thoughts that never came across their minds before, and by exchanging various opinions in group discussions. They even found that they could understand math concepts in depth when they express them in their own words.

The result of the survey by free-listing method tells that group discussions and presentation brought out better learning to students. Various opinions obtained from their communication were considered to be helpful for learning especially in 2014 as their response in Table 4. Students responded that through the class they became to be confident in a presentation and to have positive attitude in group discussions.

We know that many students didn't feel comfortable when they give a presentation in a class (Table 5). To reduce students' psychological burden in discussion and presentation, instructors need to provide comfortable atmosphere through clearer topic and arranging suitable grouping with suitable group leader and enough time for discussion. We can make the above assertion through students' response on negative aspects of the class. In 2014, some simple evaluations criteria for group discussions and presentation with well-structured and more concrete guides were crucial to make students feel comfortable and concentrate on the given subject for discussion. The instructor set up the improved evaluations criteria for group discussion and presentation in 2014 compared with 2011. Overall, students responded that this kind of class is necessary for better learning. Their experience of the experimental class would lead them to understand their future students in various aspects. Through this research, students might realize by themselves what elements should be prepared in a teaching of mathematics.

The author suggests that students have to achieve enough basic knowledge on the theory of mathematics education in the previous academic year before they take the course of Mathematical Logics and Writing to understand the discussion topics clearly. The instructor should provide students enough time for group discussion with pleasant and comfortable atmosphere and simple evaluations criteria.

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