Journal of the Korea Society of Mathematical Education Series D:
Research in Mathematical Education
Vol. 9, No. 2, June 2005, 115–124

韓國數學敎育學會誌 시리즈 D:
<數學敎育硏究>
제 9 권 제 2 호 2005 년 6 월, 115–124

Analyzing the Power Relationships in Mathematics Classroom

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(Received January 16, 2004 and, in revised form, December 11, 2004 and May 15, 2005)

Traditional mathematics education research is based on mathematics and psychology, but its function is limited. In the end of the 1980's, the social research of mathematics education appeared. The research views are from sociology, anthropology, and cultur al psychology, and then it is an exterior research. The social research considers the relations, power, situation, context, etc. This paper analyzes the power relationship in mathematics classroom. Firstly, the power is defined. The meaning of the power is the foundation of this paper. Secondly, the power relationships in mathematics classroom are analyzed. The traditional mathematics classroom and collaborative learning classroom are considered. Thirdly, the paper analyzes the power resources and finds the some important factors that affect the power distribution.

Keywords: power relationships; mathematics classroom; social.
ZDM Classification: C60
MSC2000 Classification: 97C60

INTRODUCTION

Social research of mathematics education began in the end of the 1980's; it has affected the mathematics education and will continue to affect the mathematics education unceasingly. Traditionally, mathematics education research is mainly based on the mathematics and psychology; I call this kind of research internal research. Completely differently, social research of mathematics education is based on sociology, anthropology and cultural psychology, so I call this external research. The aims of internal and external research of mathematics education are same, which is for understanding mathematics education better and prompting mathematics education and mathematics teaching and learning. But the views of those researches are different; they have their theory foundations. They answer and explain the questions and phenomena of

mathematics education according to their theory foundations. The relationships of internal and external research are parallel and supplement each other.

Mathematics education is a very complex system that deals with many fields, so it is important to choose a research unit to carry out social research of mathematics education. Here, I choose the mathematics classroom as my research unit. Why? Mathematics classroom is front line and core of mathematics education; it is a focus of both internal and external research. Classroom is a society, a special society, within which many social activities can process. My aim in this paper is to provide an analytical method that can be used to analyze and describe the teaching and learning in mathematics classroom and this analytical method also can be used in other mathematics education research.

In this paper, my task is to analyze the power relationships in mathematics classroom, including power's definition, exhibition, and origin. This paper consists of four parts. In the first part, I will give a definition of power that draw on the view of power of sociology. The meanings of power defined are our study's basis. In the second part, the power relationships will be analyzed; I will examine power exhibition in mathematics classroom. In the third part I will find the power's origin, or find what decides someone's powerless or powerful. Finally, I will briefly summarize main ideas in this paper.

HOW TO UNDERSTAND THE POWER

To begin, we must define the word "power" and "power relationships." Many related research has cited the Foucault's power ideas. His understanding of power is widely influential. Foucault thought that when society changes from a traditional organization to a modern organization, the concept of power has changed. Unlike the traditional meaning of power, the modern meaning of power is not commodity, someone possesses and others don't. Power is a kind of structure of relationship co-constructed which shapes a person's behavior. *"Power exists only when put into action."* Foucault al so thought that power and knowledge are co-existence; knowledge means power a nd power means knowledge. Furthermore, the effects of power are not all negative: *"it induces pleasure, forms, knowledge, produces, and produces discourse. It needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression."* To Foucault, there are four points about power. The first is that power is the expression in practice activity, no activity, no power; the second is that power is a kind of relationship that is co-constructed by all participants; the third is that the role of power is both positive and negative; the fo urth is the power is decided by knowledge and is showed by discourse and discur sive practice.

Draw on the view of power of the postmodernism, especially Foucault and my owe view, it can be defined as that *the power is in some discursive practice a person's relationship with the others; the factors that decide someone powerful or powerless are multiple, for example, currently discursive structure and individual traits. Among the individual traits, the related knowledge is important. Which factor(s) play(s) key role is decided by the background of practice. In fact, the exhibition of power is control to the flow of discourse in the practice.* The following is explorations of the power in details.

First, the power is represented in relationship within persons, if there is only one person, and then no power exists. When a person has relation with others, then power appears; so we usually use the phase "power relationship". Second, the group is consisted of individuals that have relationships in them. This group is a practice community; here the relationship is very important. If no relationships exist in the group, all individuals are in isolation, and then no power exists in it. Third that someone is powerful or powerless is decided by multiple, not by single factor (individual's knowledge, for example) or two factors (individual's knowledge and the structure of discursive practice, for example). In a certain background, deciding factor(s) is (are) fixed, it may be one or more than one. Deciding factors are different in different background. Fourth, the knowledge is the most important factor in individual's traits. Because a person has many kinds of knowledge, a kind of knowledge is useful just when it is used in related situation. So, the knowledge that decided a person's power should be related knowledge. For example, an authoritative physical scientist possesses plenty of physical knowledge in physical field, but in economic field, his plenty physical knowledge is not related, therefore, this authoritative physical scientist may be powerless in a activity in economic field, though he is powerful in an activity in physical field. Finally, how do we see who is powerless or powerful? We can judge it by observing the discourse in practice. He or she is powerful if he or she can control the flow of discourse, if not, he or she is powerless.

ANALYZING THE POWER RELATIONSHIPS IN MATHEMATICS CLASSROOM

Above, we defined and understood the power, which is in general. But we concern the power in mathematics classroom. Now, we will put the power into mathematics classroom, exactly, think the power in discursive practice in mathematics classroom. Our task is to analyze the power relationship in mathematics classroom.

In modern mathematics classroom, there are two basic pedagogical models. The first is called the *traditional pedagogy*. In traditional pedagogy, the teacher is talking and

demonstrating in front of the blackboard, and students sit at the tables and are listening and writing down something. The teacher gives some mathematics exercises to students, and students do exercises all by themselves, then, all students do exercises together guided by the teacher. This traditional pedagogical model has predominated mathematics classroom for many years in China. It is still a main mathematics pedagogical model now. When the grade is increasing, this model is more used. It is not an advocated pedagogical model from the view of international mathematics education, in despite of its adoption in many mathematics classrooms. In many cases, it is a representation of behind the times. The second is called the collaborative learning, which may divide into two modes: collaborative practice and collaborative inquiry. In collaborative practice, the teacher first introduces and explains the theme of learning to all students, and then the classroom is divided into small groups. The students collaboratively solve the problems using the knowledge that was previously learned. In the collaborative learning, the teacher doesn't make any teaching. The students in every small group explore the open-end mathematics questions chosen. In the process of inquiry, the students can learn a lot, including knowledge, methods and ideas. At intervals, the groups will report their course to the classroom; so every group's ideas and methods can be discussed and shared in whole classroom. Until recently, the collaborative learning appears in mathematics classrooms in China, and mostly the collaborative practice is used, the collaborative inquiry is rarely used. Education administration and mathematics education research community advocate mathematics teachers to use the collaborative inquiry because the collaborative inquire links nearly to creativity that a person must possess in modern times. Our power analyzing aims at these two basic models.

We look at the traditional mathematics pedagogical model firstly. According to the extent of controlling of teacher, we can divide this model into two modes. The first mode is absolute traditional mathematics pedagogy. In absolute traditional mathematics classroom, the teacher and the students constitute a community. The teacher is the center of discursive practice activity. The teacher and the students are two poles of the power. One pole is teacher that possesses the absolute power and the other pole is the students are powerless. The power model can simply be expressed as *teacher has/students haven't*. The teacher controls the flow of discourse. The teacher has prepared the discursive practice activity in mathematics classroom. When the teacher steps into the classroom, the discursive practice has in his or her brain. What the teacher does in classroom is to change the plan to fact. The teacher decides the start, orientation and the end; he or she controls absolutely the flow and doesn't allow the students share his or her power. In order to keep the power, he or she often reminds the students thought some discourses, including language, gesture and expression in the eyes, to keep their powerless. For example, we can often listen to such words said by teacher: "ok, please remember the

contents studied last class", "now, let's begin today's study", "please think about those questions", "don't do that", "don't talk, be quiet", etc. Gesture and expression in eyes are also often used to warn and remind the students. For example, the teacher gives the students who do other things severe expression in eyes. At the same time, the students who are powerless are passive and biddable in discursive practice in classroom. They cannot be demurral to the teacher's saying or doing and cannot bring forward new suggestions. What they can do is listening passively to the teacher's speech, looking at the teacher's illustrations, and doing mathematics exercises procedurally. Their actions are controlled under the teacher. The absolute traditional mathematics pedagogy is very extreme; it is rarely seen now. When the teacher allows the students to share his or her power, the second mode appears. The second mode is mild traditional mathematics pedagogy. It is seem frequently now in China. In the mild traditional mathematics classroom, the teacher possesses main power, in other words, the power in discursive practices in classroom is controlled by the teacher most of the time. But sometimes some students also possess the power. They can ask the teacher to explain more, bring forward a new method, disagree with the teacher's view, etc. those behaviors may interrupt the flow of discourse planed by the teacher, make the flow of discourse break, and even make it deflection. Comparing with the absolute traditional mathematics pedagogy, the power distribution is more complex in the mild traditional mathematics classroom. This power model can be expressed as *the teacher has some students have/the other students have not.* Because there are many students in a classroom, it is impossible that all students possess power in discursive practice and affect the discursive practice. There are only a few students who possess power in discursive practice, and the others are powerless. Then we must ask a question: why are these students powerful and the others powerless? In last of this paper, I will return to this question.

Now we look at power in collaborative learning model. The teacher's role is important in collaborative learning, but the distinct character is that students form some small groups in which they learn. Simply, here we just examine a group. We want to see how the power is distributed and used in a small group. First, we look at a very extreme instance that is no power, every person in the group is powerless, and we can call it power vacuum. For example, in an investigation report, the researcher observed a two-person group. The problem they want to solve was to simplify $ab : ab$. The observer found that two students did the question independently. After finishing the question, the two students said their answers. When one said his answer, the other didn't pay attention and didn't ask any question or bring forward any demurral. In this extreme instance, no collaboration existed in the group and no discursive practice existed. The individuals were dependent in the group. The group is constituted of individual mechanically but not organically. This instance, of course, is very infrequent. Ten following are some

common instances. Learning collaboratively in the group is carrying out the discursive practice. In discursive practice of the small group, the power is embodied by produced an event. They are, for example, beginning a negotiating event, starting an off-task talking, rejecting or ignoring an off-task talking, introducing a new idea, bringing forward a method of solving problem, rejecting an idea or suggestion, endorsing an idea or suggestion, asking an explain or allegation, giving an explanation or allegation, correcting or questioning an error, designing a task for member of the group, etc. The following are some examples.

Example 1.

Student A: (to the group) I am tired, let's have a rest.

Student B: Ok, have some questions left to discuss?

Then, the group continues its activity.

Student A tries to stop the group's activity, but student B ignores student A's try. The group's activity is obviously controlled by student B, because the group doesn't stop to rest according to student A's suggestion and continues to its activity. Student A's speech doesn't affect the discursive practice of the small group. So, in this episode, student A is powerful and student B is powerless.

Example 2.

Student A: Because we cannot have three variables in an equation.

Student B: Why not?

Student B's question is productive; because his question helps the group focus on the next step of problem solving. Then the group substitutes to reduce the variables and get a function with only one variable. At last, the problem is solved by differential. So, in this episode, student B is powerful.

Example 3.

Student A: How did you multiply here?

Student B: Because (pause) I don't know.

This is a two-student group. Student A questions the work of student B. Student B find that he can't answer student A, so he checks his work and finally get a correct answer. Student A's question is challenging and productive; he is powerful.

Example 4.

Student A: $4X$ and $2X$, maybe, the answer should be $8X$ square?

Student B: No!

Student A: Oh, really?

Here, student A finds student B's error that is a basic algebraic error firstly, and puts forward the correct answer, but students B rejects her suggestion and student A gives in and agrees to student B'. Obviously, in this episode, student B is powerful and student A is powerless.

We will find many discourses that embody the powerful or powerless if we obverse the discursive practice of small groups in mathematics classroom.

ANALYZING THE POWER RESOURCES

Above, we analyzed the power relationships in mathematics classroom. Now we ask such a question: What makes a student powerful or powerless in mathematics classroom? In another words, a student is powerful or powerless, what qualification does he or she has? In the power's definition, we have known that many factors relate to power in mathematics classroom or mathematics discursive practices. So, when we analyze the power resources, we should consider many factors, that is to say, we should use multi-factor analyzing method. Single-factor will lead simplify; it cannot make us understand the power relationships in mathematics classroom profoundly and roundly.

According to some literatures and my observations and analyzing, I put forward a factor set that decides the individual's power in mathematical classroom: {*related mathematics knowledge, social assigning, gender, class, race, religion, etc*} *etc.* means the factors of the set are not complete. The following is my analyzing.

That many factors decide the power doesn't mean that all factors are same important. In general situation, some factors may be more important than others. Among the factors that produce the power in discursive practice, mathematics knowledge, exactly related mathematics knowledge, is a more important factor in a general situation. In the traditional mathematics classroom, the teacher possesses the absolute power (extremely traditional mathematics classroom) or the main power (mild traditional mathematics classroom). Of course, the teacher's power is assigned by society, but if the teacher can't master of the mathematics knowledge that he or she teaches and the mathematics teaching knowledge, it is difficult to exert the power in mathematics classroom. We can imagine that a teacher who lacks the mathematics and mathematics teaching knowledge surely can't teach mathematics successfully, even if in the extremely traditional mathematics classroom. In other words, he or she can't efficiently control the discursive practice. In the same traditional mathematics classroom, one teacher's teaching is better than the other teacher's. One teacher is welcome and the other teacher is not. We can't explain these phenomena with power; and related mathematics knowledge may be main reason. In the collaborative learning, the related mathematics knowledge of the members

of the small group affects undoubtedly the power's distribution. No related mathematics knowledge, students can't put forward a method of solving a problem, introduce a new idea, give an explanation or justification, correct an error, etc. that is to say, a student who possess more related mathematics knowledge may be powerful, or else, he or she may be powerless.

What is social assigning? Here the social assigning is that the teacher or the student's power in classroom is decided by society. Using a kind of teaching method but not the other, it seems to be decided by the education development, some even think that it is decided by education theory research or the teacher. Research discovers that the teaching method is not decided by the education itself, the deciding factor is society. Classroom of school is the projection of the society, what the society is, what classroom or school is. Whether the traditional or the collaborative learning is decided by the society. In an advocating authoritative society, the mathematics classroom must use the traditional pedagogy and not use the collaborative learning. In an advocating liberty, pursuing innovation society, the mathematics classroom must be the collaborative learning and not the traditional pedagogy. The social assigning makes the teacher in traditional pedagogy grand even dictatorial position. Similarly, the social assigning makes the students in collaborative learning have the power.

Gender is one of the important factors that affect the power's distribution. A very traditional idea is that the male is preponderant in learning mathematics, boy students are good at mathematics and girl students are not. Although we can put forward adequate suspicion to this traditional idea from the social and cultural view, this idea is so deeply rooted in human minds that students, including boys and girls, parents and teachers believe it without doubt. Many people may claim equity in learning mathematics in public situation, but they still identify with the traditional view. I talked with some mathematics teacher about gender differences in mathematics learning, they admit their identification with the traditional view. The traditional idea about gender difference in mathematics learning affects the power distribution in the discursive practice in the mathematics classroom. The boy students often are powerful and the girl students are powerless. Many researches have confirmed this. For example, Walker dines and Redmond's researches offer us some examples. Our observations and conversations also offer same information. Someone has observed that the objects of the teacher's communications are mainly male students. In the example 4 of this paper, student A is a girl. She points out the student B's error, because of her lack of self-confidence and the student A's self-confidence and distrust to her, student B insists his error and student A gives up her correct suggestion. Here student A's powerlessness and student B's power can be explained by gender.

Now we look at the class, which is seldom considered the factor in China. To avert to

talk about it doesn't mean its inexistence. The class, exactly the class of student's family, is a factor that cannot ignore and affects the power distribution in mathematics classroom. Bernstein's work involves in the relations between the power groups in the society and the pedagogical practice in schooling. He offers us good analyzing tools to examine how the student's class affects his or her power in classroom. We believe that some relation exists between the student's family background and his or her power in classroom. The theories analyzing and practical observations have approved it. The family background and the parents' social positions can partly decide the student's self-confidence, and the student's self-confidence will lead to his or her power in classroom. Many researches have indicated that the mathematics achievements of the middle class's children are better than that of the working class's children. These researches illustrated that the class affects the student's power in mathematics classroom.

In addition to related mathematics knowledge, social assigning, gender and class, race and religion, in some situation, may affect the power's distribution. About this, there are some researches. But in a general situation, race and religion don't affect the power's distribution. In some countries and regions, races and religions are inequitable and the hegemony of the race and religion exists, the manifestation of the race and religion in classroom are obvious.

CONCLUSION

One of the themes of the social research of mathematics education is the focus on the power in mathematics classroom. The meaning of the power is the research's starting. The resource of my understanding to the power is post modernistic sociology. The power's distribution is different in the traditional mathematics classroom and collaborative classroom. In the traditional mathematics classroom, the teacher possesses the absolute power. In the collaborative learning, students may be powerful or powerless. The factors which decide the power are multiple, including related mathematics knowledge, social assigning, gender, class, race and religion, etc.

REFERENCES

Barnes, M. (1998): *Analyzing power relationships in collaborative groups in mathematics, the paper from Mathematics Education and Society International Conference 6th–11th.* University of Nottingham.

Foucault, Michel (1972): *The Archaeology of Knowledge, Alan Sheridan, trans. Pantheon.* New

York.

Lerman, S. (1998): A moment in the zoom of a lens: towards a discursive psychology of mathematics teaching and learning. In: A. Olivier & K. Newstead (Eds.), *Proceedings of the Twenty-second Annual Meeting of the International Group for the Psychology of Mathematics Education, Stellenbosch, South Africa, Vol. 1* (pp. 66–81). South Africa: Karen Stellenbosch Univ. MATHDI **1999c.**02168

_____ (2000): The social turn in mathematics education research. In: J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 19–44). Westport, CT: Ablex.

Lerman, S. & Tsatsaroni, A. (1998): *Why children fail and what the field of mathematics education does about it: the role of sociology*. Paper presented at First International Conference on Mathematics, Education and Society (MEAS1).

Rabinow, Paul (1991): *The Foucault Reader*. London: Peregrine.