Social class and mathematics school knowledge of two private schools in Banten Province

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Abstract. The purpose of this study was to identify school mathematics topics and mathematics learning experiences of two elementary schools in contrasting social class settings under an umbrella of one institution. A case study research methodology was used to examine data collected from those two Elementary schools. The data revealed that there were similarities in curriculum framework, curriculum materials but there were also significant differences in what was taught and what was experienced in those two schools. The data suggested that word problem and a pedagogy of critical thinking were implemented in one of the schools. The differences were assessed in terms of theoretical and social implications. It was concluded that social stratification of mathematical knowledge occurred.

1. Introduction
Social class and school knowledge have been widely discussed by scholars in United States. A case study investigating data of five elementary schools with different social class settings revealed there were similarities as well as meaningful differences in the curriculum and the curriculum –in-use among the schools. The school knowledge in the working schools focused on facts and skills rather than sustained conception. In the middle-class schools, the knowledge was externally originated and validated by experts. This meant the children from this school tended to be passive toward the ideas and ideologies. The students in the affluent schools were taught with knowledge that were useful for them and their own history, for example, the history of wealthy classes. The students were also taught conception, creativity and independent thought. The children in the executive elite schools were equipped with analytical skill and characterized as those who had consciousness about of their own group interest to oppose the interest of the other group in society [1].

Hill identified the relationship between structuralist neo-marxist with education in which schools are ruled by capitalist class. The knowledge, curriculum and assessment privilege those who come from middle-class and upper-class children but invalidate other groups [2]. Apple argued strongly that national curriculum and national testing are not neutral instead they are products of those in power. The economic system gives freedom to privates to control economic purposes including educational policies. Privates have freedom to decide what to teach and how to teach. This system creates inequalities in a way that the purpose of education is to sustain privates’ economic system [3]. Van Galen highlighted in her article about social class and schooling in new economy that social class has been shaping educational access, aspiration and achievement [4].
In Indonesia, the conversations among scholars about social class and the school knowledge is relatively rare. One of the reasons might be the different education system we have in Indonesia from that of in United States. The government takes control the education policies and purposes. However, the national curriculum document gives clear information that being able to compete globally is one of what is expected throughout the education. The students are prepared and equipped to be competitive in the changing and competitive social life throughout the curriculum developments [5].

Mathematics as one of subject curriculum is the foundation of fast increasing technology, information and communication. Mathematics knowledge is structured in such a way that the students since their early age education are equipped to think logically, analytically, critically and creatively [5][6]. The purpose of this study was to investigate what the school personals (the teacher and the student) said about mathematics topics and learning activities in two schools contrasting in social class setting.

2. Methods
A case study research methodology was used to investigate data on mathematics topics and mathematics learning activities in two schools with different social class setting. These two schools are national type schools under an umbrella of an education institution in Banten province. Participants of this study were students and teachers. There were five students from each school included in this study and each student was a representative of grade two until grade five level. Grade two and six teachers from each school were voluntarily interviewed.

The schools adapted the national curriculum with a goal that the students not only learn content of certain subjects but also find enduring understanding of a unit and direct the students for action in their daily activities. The developed curriculum framework requires a pedagogy that reflects a variety of teaching methods that stimulate the students’ creativity and critical thinking. Having the enriched national curriculum, these two schools have similarities in terms of the subject curriculum, topics included in each subject specifically in Mathematics and participating in standardized national test.

Despite of those similarities, however, one of the schools (named Y school in this research) is designated to provide a high-quality education for less fortunate people. This implies that the student of those two schools, somehow are categorized by their social economic status. The social class criteria in this research is understood as the difference in terms of the kind of work that the majority parents own in each school as well as by income level [2]. The Y school is located in the middle of the crowded neighbourhood. There is only one small gate to enter this school. 80 % of the students come from the neighbourhood with middle to low social economic status of family background. Parent mostly works as teachers and government’s official workers. Both the parent works but some families, only one parent; mother or father works to earn money for the family. The school fee for Elementary education is about three hundred thousand rupiah each month. The other school which is named here in this study as X school, is located in a neighbourhood of high social economic status. There are two wide gates to enter the school that make cars accessible to come to and leave for this school. Some securities to check who visit the schools are positioned close to the gates. Mostly parents in this school are doctors, managers in the banks or other private business, and own personal business. The Elementary students pay around two millions rupiah each month as their school fee.

The data collection methods were interviewing the students and the teachers, assessment of curriculum documents such as unit plan and text books used. The interview results as primary data were transcribed and descriptively analysed.

3. Result and Discussion

3.1. X School

3.1.1. What Students and a teacher said about Mathematics instructional material. One student from each second until fifth grade were interviewed to get information about what they had been learning in
mathematics. They mentioned common topics in mathematics such as addition, subtraction, multiplication, division, fraction, angels, and diametrical construction. All the students used English terms when they responded to the topics they had learnt in Math. Four of five students mentioned word problems as one of topics they had learnt. Three students said, “Word problem”. One student responded this way “word problem as usual”.

The result of interviewing one of the teachers emphasized mathematics as word problems and the purpose of word problems is to train the student’s analysis skill. “We gave problem to be solved out. First, the students need to translate the problem into mathematics model. After that, they solve the problem by using mathematics principals that they already know. Mathematics is not only about applying one way to solve a problem. The important things are both the procedures and the result are correct. This way trains their analysis and problem solving skills”. This teacher also considered math not only about numbers but also about how to apply those numbers in daily life. This understanding informs what kind of exercises he gave to his students that was about word problem “In every topic there must be word problem. So mathematics are not only about numbers. At the end the students will ask the purpose of what they are learning. For example, fraction and percentage. When we give issues or problems, they will get an idea of mathematics application. For example; you go shopping and get a discount. The discount must be in percentage”.

3.1.2. What the students said about Mathematics Learning Activities. Another question asked what activities they have when learning mathematics specifically in the topics they mentioned. The students’ answers were various. The second-grade student answered this question using English. Her response showed her conceptual understanding about multiplication. She said “like 5+5+5+5, like that. Yeah, we keep counting every number.” This student’s conceptual understanding was as well clearly seen in the way she explained the activity she experienced when learning fraction. “There is a shape and then we like…. we shaded, the one that’s color. And then tell what parts are shaded. And then we have to tell are they equal to or not, or what part are not shaded. And we have to like the number fraction. We have to know the sentences so we don’t get to stop”.

The answer of a third-grade student tended to memorize the procedural of doing fraction when explaining what activity, she had when learning mathematics. She also used English when saying mathematics terms in fraction such as denominator and numerator. She said “Denominators need to be similar. After that, multiply with numerator. For example, one denominator 3 and the other 4, multiplied to be 12. For example, the numerator is one, then one multiplied by 3 equals to 3”.

The way a fourth grader student answered to the same question seemed to focus on drill and practice he had when learning Math and he used some English words such as group work. He said “For example, like the group work miss, we made kind of team ball”. His answer to a further question about the activity he had in a specific topic such as division and fraction, he said “We did workbook and the activity was like doing the test”. Drill, practice and test seemed to be the focus of a sixth grader student when she was asked the same question. “After we had been taught, we got exercises then we were tested”.

3.1.3. What a teacher said about Mathematics learning activities-A Pedagogy of multiplication. The teacher was asked about learning strategies they provide in Mathematics. Her answer to the question tended to use teaching strategies that engage her students to think. She said “I triggered the students to get impressed learning the lesson by using certain tools, observing around them, or discussing in a group. The most activity they like is doing experiment.” This teacher explained a specific example of teaching multiplication. Her explanation showed that she used constructivism based activities when teaching multiplication. “For example when teaching multiplication, I usually use manipulative tools and distribute them to the students. Then I said to the students “give me 3 groups of 2, or 3 groups of 3 or 3 groups of 4”. Then from that activity, they draw conclusion ah this is what it means 3 group of 4 and 4 groups of 3. Then from that activity they develop their own understanding”.

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3.2. Y School

3.2.1 What the Students said about Mathematics Instructional Materials. The interview result from the students showed that all of them mentioned common topics in Mathematics as what the students in School Y said such as addition, subtraction, multiplication, division, fraction, and plan figures. They did not use any English when saying those topics. An interesting finding was that none of them said word problem as one of the topics they learnt in mathematics. The word problem was mentioned by one of the students but when she was asked about the learning activities she had in Mathematics. She said “given word problem”.

3.2.2 What the Students said about Mathematics Learning Activities. A second grader student was asked about activities she had when learning Mathematics. She answered the activities she experienced in learning addition, subtraction and fraction. Her response on activities in learning addition tended to be more activities themselves instead of her conceptual understanding. “The activity was playing games. There were two bowls and we put some seeds into the bowls, for example 3 seeds were put into the bowl then 3 more seeds were put into the bowls then we counted there were six altogether.” An interesting thing from this student’s answer on activities she experienced in learning subtraction was not only about how she memorized steps of doing subtraction using her finger but also how she obeyed on what her teacher said to her. She said “If subtraction, the teacher said that we can just use this way 7 minus 2 equals 5 but the teacher said, the easiest way, to think this way. 10 minus 1 is 9, 10 fingers minus 1 is 9”. She also added about the procedure of doing subtractions with tens or hundreds. She said “if the numbers are many, use vertical addition strategy”.

This second grade student also said the activity she had in learning multiplication. Her response tended to show her activities instead of her conceptual understanding in mathematics. Moreover, she again strongly remembered what her teacher instructed to her. “Once, every group was given points, the teacher said that we need to write the answer on our note book and if the answers are correct, we will get points”.

A third grader’s response to the activities she had in learning multiplication considered multiplication as a memorization. She said “if subtraction, we stood in line, then before entering the class, we were tested.” She was then asked “What kind of test?”. She said “For example the teacher asked how many is 7 multiplied by 7. Then we need to answer the question before entering the class”. This student referred to long division strategy and memorized the steps as to respond to what activities she experienced when learning division “Division, for example 100 is divided by 10. Think how many 10 that results 100 or we can use the first two numbers, if the first two numbers cannot be used then use the whole numbers”.

Instruction, drill and practice were the activities a fourth grader student remembered when responding to the same question. She said shortly “Latihan soal” She was then asked another question “Were there any other activities you had in learning Math?”. She answered “Learning with the teacher first, explained by the teacher and then do the exercise”. A fifth grader student answered the same way as the fourth grader did. “Do the exercise”. His response to the activity on learning speed was as following “given problem solving”.

The same question was asked to a sixth grader student. Her way to see activities in learning Mathematics was a review as she expressed as following “Oww, in Mathematics, we reviewed the material from grade 4 and 5. Then in grade 6 we learn like how to collect data using diagram like mean, median, modus like that”. Her further answer about another activity she had in learning Mathematics tended to focus on the steps of doing certain mathematics problem. She said “We have learnt about fraction. Now we are learning about mix fraction, we were told how to do that with the easiest way”.

3.2.3 What the teacher said about Mathematics learning activities _A Pedagogy of multiplication. The same question about mathematics teaching strategies used was asked to a teacher of grade three. She
gave a specific example in multiplication. Her answer emphasized memorization as a strategy of learning multiplication in grade three since it is the first time the student meet multiplication topic and she thought difficult for those of her grade three students. She also mentioned that memorization the fact about multiplication is still hard for her students. She said “When learning multiplication, the first step they need to memorize. This is difficult for grade three students because the materials in grade two and three is a lot different. The multiplication begins to be taught in grade three so it is hard. So Memorizing multiplication according to me is hard moreover they just got into grade three”. Her explanation about her techniques of getting her students memorize show her strong belief about multiplication as the fact to be memorized. She said “With me, every day, every time the students get into the classroom after break time, they must memorize, otherwise, they cannot get into the classroom. So I do not only expect the students to memorize but I need to check on their memorization”. This teacher’s further explanation tended to show that she informed the students concept of multiplication that is repetitive addition. Instead she guided the students to conclude that multiplication is repetitive addition as expressed in the following statement “The first step, they need to know multiplication 1-5. We gave the concept that multiplication is repetitive addition. We let them know about it but we ask them to memorize until 10 gradually. Usually I asked them to write on their agenda that they need to memorize multiplication 5 tomorrow so that they get ready tomorrow with multiplication 5 and the whole day what I asked is all about multiplication 5. The following day I will upgrade what they memorize. We do it step by step consistently”. The result of an interview with the sixth grader teacher also emphasized that memorization is a still good strategy of learning multiplication and that belief was shaped by her experience of learning multiplication when she was at school. She said “For example, Mathematics is all about how to do counting, addition, subtraction, multiplication and division. That’s all. According to me, I do not know I might be affected by the curriculum when I was at school. Must memorize, like that. So, I asked the students to memorize the multiplication. But I did not ask the grade 6 students to memorize multiplication 1-6. I asked them to memorize the material related to grade 6. For example, at that time I taught about cube. So the way I taught them is to use a song that they can memorize the material. So they sang because I think it is important. Using that way, I will be able to teach them faster”.

The data suggested that, despite the similar curriculum framework that is the developed national curriculum these two schools have been using, there were some subtle differences in mathematics curriculum topic and the pedagogy of multiplication have been implemented. The differences will be assessed for theoretical and social implication. The first assessment in term of theoretical implication, will be focused on high order thinking and low order thinking as classified by Bloom [7]. Bloom categorized cognitive process into six levels of thinking. Remembering is considered as the low order thinking since it emphasizes on remembering facts (names of person, dates and events) and mathematics formula. As it goes to the second level that is understanding, the thinking process becomes higher it gets to Applying, analysis, evaluating and creating process which are called as high order thinking [7].

Echoing to Bloom, Gagne categorized intellectual skills by its complexity which including discrimination as the lowest in its complexity then followed by concepts, rules and principals and problem solving. Problem solving is the highest level [8]. According to Bloom, the ability to solve problem is part of the applying level. He divided this third level of thinking process into two; applying and implementing. Implementing is considered higher order thinking than applying since it solves problem where the students do not know which procedures to be used to solve the problem. The ability to do an exercise where the students already know which procedures to use is what Bloom defined as applying process [7].

In the X school, there was mathematics material that required high order thinking that was the word problem mentioned by the students as one of topics learnt in mathematics and as well considered by the teacher as characteristic of mathematics. Doing word problem is more complex since it involves two thinking processes at the same time. First, the students need to represent the words into
mathematical model which Bloom classified as understanding and then to apply the mathematical principal [7].

It is interesting how the second grader child responded to the activities she had when learning multiplication and fraction. She would rather express her conceptual understanding of multiplication and fraction than tell the activities she had when learning those two concepts. Multiplication at this point was not considered as fact nor the concept to be memorized. This student did not say a statement that multiplication as a repetitive addition which is that is the concept of multiplication. Instead she expressed her understanding of the multiplication concept by saying “5+5+5+5 yeahh we keep counting”.

In keeping with multiplication, the pedagogy of multiplication implemented by the teacher was a pedagogy that led the students to understand the concept instead of memorizing the result of multiplication. The teacher provided tools and used those tools along with questions she posed. She engaged the student not only cognitively through her questions but also physically by asking them to use the tools to make a group of certain numbers she instructed. Her questions then led the students to make a conclusion with their own sentences as mentioned by that grade two student “we keep counting” a contextual word for such grade two student. This pedagogy of multiplication pushed the student to think critically.

Using word problem as mathematical material at school as well as pedagogy of critical thinking implied socially in a way the students are prepared to be skillful in thinking which the highly-required skill in order to survive in the competitive, uncertain, and changing global life [5]. Having that kind of skill allows the students as they graduate to have more promising job opportunities such as manager and others professional jobs. It can be concluded the material, the pedagogy and assessment the students have in their education experiences, can predict their future social status. As Hill [2] noted boldly there are differences based on social class in educational system including differences in patterns of teaching methods, curriculum material, achievement and job destination.

Moreover the use of English as a second language in learning give a strong prediction of what kind of future social status they may have. Subkan noted there more opportunities to access fast growing knowledge since the development of knowledge comes from the West that uses English [9].Therefore, those who master English might be able to survive in this global and competitive life.

Basically, the mathematics topics learnt both in the X and Y schools are the same since they use government national curriculum. The difference is that most of the students in the X school mentioned word problem as one of the topics learnt in Mathematics. This may indicates that the teacher included word problem in learning every topic. However, this may not indicate that word problems were never implemented in the Y school. Perhaps, the teachers seldom or sometimes used word problem that the students even did not remember that. Also, none of them used English as telling topics they learnt in Mathematics.

In keeping with the pedagogy of multiplication, the multiplication was considered as a series of facts to be memorized. Experiencing this kind of pedagogy, cognitive process occurred was only in the lowest level thinking that is remembering. The students were not engaged to think critically instead they accepted all the facts about multiplication one until ten and memorize those facts all the way. Mathematics specifically algorithms as procedural knowledge according to Bloom [7] is a typical knowledge that concern the how. Thus, a series of steps to be followed is the characteristic of mathematics. The steps here are not to be memorized instead, an understanding of the mathematical concepts is highly required that the steps will be possible to follow. Each step may require certain mathematical concepts. This understanding of mathematical knowledge calls not a pedagogy that informing each student series procedures to follow but the pedagogy that engaging them cognitively in finding out the steps. This means inquiry, posing question, problem based learning, critical thinking are possible teaching methods to make the knowledge accessible to the students as its nature.

In fact, mathematics knowledge has been a series of procedures to be memorized. It has been a series of numbers to be plugged into a certain formula. Questions to reflect are; what has been driving
the teacher using their pedagogy in their mathematics classes? Is there any power that the teachers are not conscious of that steer the way they access mathematics knowledge to their students?

Au defined curriculum and structure of knowledge as an expression of social, economic, and political power relation [10]. Foucault in Martono argued there is a relationship between power and knowledge. Power needs knowledge to work effectively and knowledge is the result of power [11]. Mathematics is the foundation of the growing and increasing technology, information and communication. This means government must control the mathematics mastering in order the country will be competitive enough in the global life [5]. Some ways the government controls mathematics curriculum are, for example, by determining the structure of mathematics knowledge at schools and by evaluating nationally the students’ mastery of mathematics knowledge. Standardize test is one of the ways to measure the students’ mathematics competence. A conclusion may be drawn that the students are categorized and classified based on the determined mathematics knowledge by the government. This relates with Foucault’s argument that standardized test as an evaluation technique aims to classify and categorize individual based on the given standard [11].

Kurikulum Satuan Tingkat Pendidikan (KTSP) National curriculum 2006 explained the goal of learning mathematics. Since mathematics plays significant role in this technology and modern world, it is required to give Math to all of the students since their young age education in order to equip them to think logically, analytically, critically and creatively. Those thinking skills will equip them to be able to survive in the competitive global life and to rule over the world [5]. The government organized the national curriculum 2013 in such a way that involving religious, social, knowledge and knowledge implementation competences. The fourth competence is required the students to perform critical, logical, analytical and creative thinking [6].

The goal of learning Mathematics controlled by the government clearly shows that the children need to be productive member of society and there will be a selection of individuals or position in society which are implication of sociological education proposed by Emile Durkheim in Hidayat [12]. Emile Durkheim argued that the basic function of education is to ensure that children grow up to be citizens and workers, to take up the function for which they were intended [12]. A more practical statement highlighted by Payne that some principals of teaching method is to be intended to look for and use the social power, to work in social life in order to develop capacity to adjust in social life [13]. This means that the goal of education that is to produce individuals taking their roles in society, informs all teaching practices in the classroom including the pedagogy. As quoted above that knowledge is never neutral. It is socially, politically and power rooted [10,11], neither is one’s pedagogy.

In one way, this goal can be considered is acceptable to sustain the country in the global world. However, having controlled Mathematics like that, the students are indoctrinated with such abstract knowledge that the students do not end up being able to think critically but the other way around [9]. In order to achieve the standardized mathematics materials, the common pedagogy is the pedagogy of transmitting mathematics principals to the students, the pedagogy of getting the students practice and drills and the pedagogy of testing the students. This kind of pedagogy will shape the students to be good listener and mechanical while the competitive social life required those who are skilfully critical and analytical thinking. The questions remain the same. What has been driving the teacher using their pedagogy in their mathematics classes? Is there any power that the teachers are not conscious of that steer the way they access mathematics knowledge to their students? Another reflective question is, are the mathematics pedagogies implemented, drive into inequality in which the students are positioned to be workers because of their inability to think critically? Are the mathematics teachers’ pedagogies liberate [14] from that predestined position in the society or the other way around?

4. Conclusions
Mathematic knowledge taught by the teachers in the classroom influence the pedagogy implemented in the learning process. The mathematic pedagogy experienced by the students implies socially. The pedagogy could liberate a student from his/her from low social life status or the other way around that
could get the student remain living in a certain social life status. Critical thinking pedagogy in learning Mathematic could shape the students to be skillfull in thinking critically and creatively. Thus it can be said in another way that information transferring pedagogy in learning Mathematics could shape the student to be more listening rather than thinking.

An Individual’s skill of thinking critically and creatively allows him/her to be more attractive and more needed in professional work that promising higher salary. Those kind of skills are important for problem solving and innovation at work places. Listening pedagogy tends to lead to an attitude of listening without thinking. Professional work need people who are able to think rather than listening.

Social class impacts Mathematics knowledge taught and the pedagogy implemented by the teachers. Thus it is recommended that the teacher should be more aware of knowledge taught as well as their pedagogy used in the classrooms. This might be possible if a vision of loving those who are coming from low social economic status is there. The vision will lead to actual actions that is on the way the teachers understand Mathematics and the ways it is taught. Beside that, an institutional reflection regular will carry to the learning process evaluation.

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