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TO DESIGN LESSON WELL WE'LL RECONFIRM THE SEQUENCE OF TEACHING FRACTIONS: HOW TO DESIGN CLASSROOM LESSON

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Abstract

The aim of this paper is to improve our teachers' skill of teaching mathematics under the control of National Curriculum. Though the process or its sequence of teaching fractions in Japan has been established even if whatever goals National Curriculum has, most of teachers don't reflect the reason why the sequence of the fractions is in such an order. That's, they teach it only according to National Curriculum. So to design lessons well we, especially, young students and young teachers should research and develop the sequence of the contents of fractions more (of course, other materials).

Keywords: *skill of teaching, fractions, sequence of the contents, manual for teaching*

INTRODUCTION

No teacher think this material should be taught at the suitable grade in Japan because they only obey their National Curriculum (below abbreviated to N.C.) which has been revised by each ten years since 1950s. In the result, many young teachers can't teach the materials well which has not been taught to them in their childhood.

On the other hand, though the division of the fractions had been taught at secondary school about 50 years before, now there is nobody who insists that it should be taught at the second school. In addition though the simple set theory was introduced in 1980s, it disappeared in early 2000s perfectly. But for the congruence of the figures, it has been taught at the secondary school according to the former N.C. for twenty years. And it has positioned in the 5th grade in elementary school according to the new N.C.. There has been a Math-War, to teach or not to teach any materials less, in Japan since two decades before, which led to the lower rank of both TIMMS and PISA in Japanese students.

Though the newly revised National Curriculum started in 2010, many things has been lost, for example, the way of teaching the congruence of the figures well remains lost. But fortunately, the tradition of teaching the fractions are still alive, unchanged for a few decades. But unfortunately the denominators of the fraction were limited to less than an integer 20 in spite of their learning the percentile later.

Then what is the N.C. in Japan? However whatever the goals of the N.C has, the sequence of teaching the fractions is systemized well and its way of teaching has been established. From now we'll discuss the problems left to design our lessons through the teaching of the division of the fractions or other materials. Hence I discussed about it with young participants at Sea-DR Conference held in UNSRI.

Comparing the materials in the various countries

The relation between the perimeter and its surface of the figures is one of the most difficult problem for students at elementary school. More than half students cannot solve the problem by my research. As this relation is not being taught in Japan, its

low achievement can be foreseen. But its relation is being dealt with in many foreign countries.

On one hand, for example, the simple root and power is being taught in 5th grade in Palembang, but not taught in Japan. They are taught at the secondary school, 9th grade in Japan. From where comes the difference of teaching or not teaching materials? But in the case of fractions most of teachers do not know how to teach the division of them well without spoiling its meaning of them. Hence I wish young teachers and students should design research to improve their teaching of fractions, of course, and the other teaching materials.

Some Problems in the Teacher Training Development in Japan

For seven years past I worked together with 20s, 30s, and around 40s teachers in arithmetic classroom (before moving to elementary school I had worked with secondary school teachers for about 15 years). Though I felt the big difference between secondary school and elementary school, I would like point out the education in elementary school through the teaching fractions in this paper.

A problem 1: Most teachers are in trouble in teaching the division of fractions

The division of fractions is taught now at the final grade, that's, 6-grade in Japan where most of children enter the primary school at 6 years old and graduate at 12-years old (in Indonesia it's taught at 5th grade, I hear).

A few decades ago the multiplication and division of fractions was being taught at secondary school, but now nobody insist on teaching it at secondary school. Why? On the one hand, most of elementary teachers feel it is difficult for them to teach the division of fractions.

On the other hand secondary school teachers don't know how to teach the division of fractions without spoiling the meaning of the division. And they demand sometimes elementary students should be best in calculation with respect to both decimal system and fraction besides integer.

A problem 2: The syllabus or N.C. is enough?

The conception of 1/2 or 1/3 is taught at 2rd grade intuitively in Japan. Though I think it may be taught at 3rd grade, our syllabus of arithmetic adopts the spiral way in the sense of **J.S. Bruner** and follow the developmental stage by **Piaget's** study. But generally speaking, most of teachers don't remember their names and only follow the syllabus without having any question, which was made by the administrator of Education Board of Japan, which is an obstacle to designing lesson well.

Of course many teachers devise their lessons. But they don't think and reflect the sequence of the contents and materials, at that, they don't remember the two names of Bruner and Piaget. That is, what they learnt at university or college is not useful to their teaching and designing lesson.

A problem 3: Elementary teachers have no free time to develop their lessons.
Now let's go to the third question. The teachers in elementary school teach **more than 10 subjects and the 4 regions of non-subjects** per one week in Japan. In the result Japanese teachers are so busy that they can't design their lessons within one day, which mean that arithmetic has occupied the low positioned in elementary school.

According to the social structuralist mathematics or arithmetic is only tool for teaching. And they insist its dealing is equally to other subject and other regions. Hence the social structural philosophy rules the school system, it is not expected to be higher ranking in the PISA or TIMMS.

Of course, the high ranked position is not always welcome. But if there were no room for designing and developing their lessons, the youngsters would lose their high motivation to teach arithmetic. Even secondary school teachers whose major is mathematics must teach other four regions and sometimes teach non major subtect through one year.

More than 25 years ago the core subjects of elementary school were Japanese and arithmetic that the teachers whose major is arithmetic or not were proud of teaching. Now the pride is lost.

A problem 4: Teaching manual is good for designing lessons?
Elementary school teachers don't have enough time to design or develop their lessons as above mentioned. So what should do they? However they have **a powerful friend**, that's, a manual for teaching. This manual is edited well educationally and pedagogically. Then, **who made** this manual? It's made by a textbook maker, company **(There are five company-makers).**

In fact this teaching manual is "well made", whose teaching method is written such as of the following patterns;

(1) the explanation of the concepts of mathematical topics or materials by making students do various activities
(2) if necessary, indicating classroom or small group discussion, making problems
(3) exercising
(4) extra problems or worksheets

In short it appears understanding-exercising style repeatedly on the manual. So whomever they are can use this manual without so hard training. Needless to say, the other subjects have their own manuals similarly. Therefore arithmetic can be taught by most of teachers without having certificate of mathematics teaching, where there is no idea for designing lesson. In the result, the teaching arithmetic has become not so important work. But until the middle of 1990's the attainment of TIMMS by the Japanese students had been at the first or high ranked.

Since the latter of 1990's there occurred the voice from the secondary school teachers such that there increased the number of students who could not do fractions well. So I researched, and got an conclusion that their regarding is correct. Long ago all the students were good at mathematics who could do the calculation of fraction too. But at that time more than half students had proved not to be good at doing fractions who could have the ability to do mathematics well.

A problem 5: On the materials not taught to young and old teachers

Some problems on the figures had appeared first time in the textbook when new syllabus(N.C.) started **since 2010**. But unfortunately some teachers asked me to teach how to teach them or design them. Even if they read the manual, they could not understand the content or the aim of dealing with it. But why? The reason why is some problems were made for Japanese students to get a higher marks at PISA. The materials have never been taught to young girls and boys at their elementary school.

Especially the procedure of teaching fractions has been changed in the textbook in one school district where I worked. A new method of teaching division of fractions was like below;

$$\frac{2}{3}\div\frac{4}{5}=\left(\frac{2}{3}\times\frac{5}{4}\right)\div\left(\frac{4}{5}\times\frac{5}{4}\right)=\frac{5}{6}\div 1=\frac{5}{6} \qquad (\text{In Netherland } \frac{2}{3}:\frac{4}{5})$$

After learning the calculations with respect to integers like $360\div30=(360\div10)\div(60\div10)=(36)\div(3)=12$, $72\div6=(72\times5)\div(6\times5)=360\div30=12$ etc., that's, after using the property of both sides equality when multiplying and dividing by the same integer, students do the division, whose way of teaching is different from the old one before 2010. At that, this new way has no relation of the meaning of fractions.

By the way only teachers of 6th grade notices this new way, but other grade teachers do not notice this process until they shall become a classroom teacher of 6th grade. Because they are very busy and have a good manual for teaching at each grade.

When do we learn differential and integral calculus?

When did we learn differential and integral calculus? Many students of college and university have learnt the calculus at their high school 1990 before even if they would not become school teachers.

Of course, all the students shall not become mathematician or teacher. But the rarest was the nation like Japan where many learned the calculus in spite of not knowing whether their points of achievement tests were low or high.

On the other hand new born countries like Mozambique or South Sudan there are lack of many teachers. But in Indonesia there are many good teachers who are eager to study how to design their lessons. When we encounter unknown problems to be solved as mentioned above, what instruments may we use? Probably they are the **inductive** and **deductive** thinking cultivated by the calculus or geometry studying. If there emerged many people who learnt the calculus, the nation may develop economically and educationally without any help. But the good educational tradition was lost in 1990's in Japan.

CONCLUSION

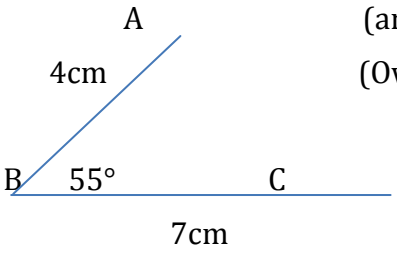
This paper deal mainly with the division of fractions. But for designing lessons well we teachers need to study advanced mathematics hard involving **inductive** and **deductive** thinking. Because the meaning of fractions are basic for understanding the **differential and integral calculus** at their high school or university.

And for the sake of shaping up our designing and developing class lesson, it is needed to relate the materials to Piaget's development stage and Bruner's spiral, which nobody remember in teaching.

To develop the lesson more besides collecting many lesson studies and literature studies we need to do many researches by ourselves and stock the results of them. For example, when I moved to one high school (commercial and industrial school), I found the fact that the rate of understanding the surface of circles is same from elementary school to high school students. About half of them can calculate the surface of circles. How do you think about this rate?

On the one hand the contents of geometry are not common to many countries. And the link between elementary school and secondary school is weak in Japan. Especially the contents of geometry is not linked to ones in the upper school well. Let's see the following example. After long later this deductive drawing way shall never be used.

e.g. Accomplish the following parallelogram ABCD. How do you draw it on the blackboard?



(any protractors, rulers, compasses can be used)

(Owing to the help by Mr.**Irham.)**

Answer: Using two rules is deductive drawing way.

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