

The Crisis of Math Education, why it is so difficult to overcome ——— Japanese Experience (ABSTARCT)

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Now in Japan, where many people have considered mathematics educational practices had been most successful among advanced countries, based on the statistical data like TIMSS, is obvious to all people the **seriously critical situation of students' lack of basic skills and knowledge of mathematics**.

But the simple lack of the basic mathematical skills might not be the fatally serious point, because in the age of ICT revolution today, we should admit that people can dispense with basic skills not only of elementary arithmetic but also of higher mathematics. The most advanced Computer Algebra System(CAS) is nowadays no more a dream tool for privileged people!

In my view the most serious aspect of the crisis of math education in Japan is to be found in the general tendency of young generation for **less and less intellectual thinking**. A special attention should be paid to the fact that 'less thinking' here is not a synonym of 'less practicing' or of 'fewer exercises'!

Traditionally the students' learning in Japan has been motivated by the severe competition for 'better schools'. This is a reason why many people find the main cause of the present crisis in the economic improvement of people's life, or in the decrease of young population against the increase in the quota of university students. But if they were really true, it would be impossible to find a way out of the crisis without becoming poor again or without forcing educational services reduced.

We should make more comprehensive and more intensive studies to find the real cause of the present crisis but it cannot be a trivial task. Cultural changes in progress among young people as well as the social change of industrial structure should be countered as a cause of the crisis. We should keep in mind also a kind of stagnation of exact science which has been a leading force of science education for more than a few decades.

We should also be reminded of the various efforts which were made to innovate mathematics education or to overcome the decline in the status of mathematics in schools. Adopting new **technologies** in learning, **interdisciplinary approaches** toward mathematics including history of mathematics, more frequent appeal to the applications to the '**real world**', or a new style like **collaborative learning**, **open distance education**, etc. appeared as the most modern/hopeful/challenging/ideal ways to follow.

But we should be aware that all these ideas to innovate the traditional method of teaching are not necessarily harmonic with our **Asian tradition** of teaching and learning. Especially in the countries where Confucianism has been very popular or dominant among people's mind, the traditional one-directional way to teach a certain number of students at the same time using 'blackboard and chalk' can be still now the most effective style to teach highly condensed mathematical way of thinking in many cases.

We have had a lot of important discussions about the innovation of the methodology of mathematics education. In comparison to the older conception '**Problem Solving**' advocated by many pedagogues a few decades ago, the now fashionable '**Open Ended Approach**' sounds

more challenging, but we should be very careful not to forget the possibility of overestimating the 'openness' in mathematics education to lead general people to trust on school mathematics less and less. In other words, the classical model of 'problem solving' in the entrance examination was the lighthouse for all students and teachers to get the clear image of the goal of learning mathematics.

We should also mention to a lot of proposals about a new goal of mathematics education, from classical '**mathematics for all**' to the more modern combination of dual goals, '**mathematical literacy and mathematical thinking**'. But the seriousness of the crisis of mathematics education appears to reveal the importance of the **reconstruction not only of mathematics education but also of mathematics itself**. In Japan, the 20th century's philosophy of 'mathematics for mathematics' or popularized modification of Bourbakism in short, has brought the serious effect upon mathematics education.

Discussions by mathematical pedagogues have often been focused on the evil effect of entrance examination which disturbs all efforts to innovate mathematics education they propose. Only few have taken into consideration the educational/ scientific significance of students' activities for 'better schools'. The serious present crisis of mathematics education in the midst of far less competitive environment today shows that the cause of the crisis is not the entrance examination but non-existence of the serious recognition that we ourselves have not been successful in planning the educational policy and in designing school system when we lose the strong supportive power of entrance examination.

With small exaggeration, the 'ethos' of mathematics education in Japan is an amalgam of **realistic utilitarianism** for better results in the examinations on one hand and **opportunistic optimism**, which ascribing all problems in education to the severe competition for upper schools, draws a too simple sketch of rosy future of mathematics education without taking into deep consideration the initial condition of the present situation of education system and the boundary condition of the society which is very difficult to change only by changing a small super structure.

The most serious aspect of mathematics education in Japan is that it is now separated too far apart from mathematics as a research subject of mathematicians.

As for this tragic situation of Japanese mathematics education, I must refer to the abolishment of Senior Normal School (Kohtoh-Shihan) after the World War II. Senior Normal School was the special institution established by the Government to nurse the highly esteemed high school teachers with academic leadership and scientific backgrounds. In the days of militarism, the graduates of Senior Normal Universities were also the leaders of militaristic education. This was the reason why GHQ ordered their abolishment.

Since then, Japanese system to nurse teaching professionals of mathematics has been provided by faculties of education of local national universities chiefly for elementary school teachers, and by faculties of science or of engineers of various universities chiefly for high school teachers. Most mathematics teachers of high schools are graduates of department of mathematics, therefore they have learned almost nothing about teaching high school mathematics, beyond what they learned when they were high school students. During the half century after the World War II, the political ideal of democracy and the social ideal of equity were officially the leading principles in Japan. Negative attitude of the leading journalism toward severe competition for prestigious schools had been supported by the above trend, which have brought an unhappy effect to education: the

non positive attitudes among school teachers toward learning mathematics beyond thinking out a new plan of how to teach, a kind of divide (mathematical divide) among teachers who are eager to prompt their students for more and more drills and those who are pleased with their efforts to give non-standard course materials to students. And the people's opinions on education are divided into Honne (honest opinion, usually hidden in one's heart) and Tatemae (official opinion which can be publicized).

To overcome the crisis, it is the most important to start with the serious criticism of the past, but it is very difficult in Japan to criticize ourselves.