2. The Evolution of Mathematics Education
-forwarding the research and practice of teaching knot theory in mathematics education-

2.1 Overview

Our project team has compiled the report ‘Teaching Knot Theory in Mathematics Education’ written in Japanese into three issues since 2005. Luckily, the researchers representing mathematics educations in Japan gave us their comments in response to this report. We take them as instructions and encouragements to our project. We introduce some of them here first.

Next, referring to the historical developments of arithmetic and mathematics education in our country, we state what has motivated us to tackle the challenge of ‘teaching knot theory in mathematics education.’

2.2 Comments to our second issue

H. Fujita who was the chairman of the Mathematics Education Society

“I am appreciative of your second issue of the report, ‘An approach to Teaching Knot Theory –in elementary, junior/senior, high schools’ sent to me this time.

How remarkable it is that knot theory, based directly on the perspective and methodology of new mathematics, can possibly be practiced in mathematics education for pupils and students alike. The concept and way of thinking underlying in Knot Theory is all the more important because this is part of the frontiers of mathematics, and the fact that this does not need much preparatory practice also appeals to me.

History shows that there are turns and twists before such developments are led into school curriculums. Differential and integral calculus also needed Perry movement and it took as long as two centuries to have it introduced into the secondary education. I should say the theory of probability took much longer.

Patience may be needed in making knot theory into a curriculum, unlike in introducing the computer well responsive to the trend of the world. However, I find your pioneering mathematics education of full significance. Keep up the good work.”

S. Okabe who was the chairman of the Society of Practical Research of Mathematics Education

“I’ve learned a lot through reading your papers, “An Approach to Teaching Knot Theory -in elementary school.” Pretending to be an elementary school pupil, I actually
made a knot with a string and tried to move it.

As for ‘spatial visualization,’ in particular, as you had written, I really have come to realize that what was left unseen can become visible through changing operational forms, such as moving an object, looking at it from the reverse, seeing it from the back of the paper (a reflected image). I find this an epochal practice indeed.”

Y. Yamagishi, Researcher of Mathematics Education.

“I thank you very much for your summary of an elaborate practice and research of ‘Teaching Knot Theory in Mathematics Education’ in cooperation with elementary, junior/senior high school /university. What a laborious work this is! I could see you all working well on this in high spirits. I know it is really tough to sum up contents of new mathematics education, but I do pray and hope that your research result is in a great success.

About twenty years have already passed since I left from teaching. In the meantime, and even before that, various kinds of sciences, including mathematics, have rapidly made progress, which, needless to say, has brought about more or less changes in teaching contents of various kinds. Keeping in mind what kind of arithmetic and mathematics education to aim at, I had not a few opportunities to give lessons with the contents far from textbooks. Since the pupils and students to teach in my charge were still on their way to learning and development, I strained every nerve for them, because it is basically of utmost importance in education to properly grasp their way of thinking, levels of their perception and their comments.

“The practice in elementary school” in the report gave me some food for thought. I thought of a possibility of letting pupils freely make “a knot” and then make it into a seal as regards “the question of turning a knot over” in the post-research. This could look like ‘花押’, Kaou used by farmer feudal lords, rather than “a seal”, because I thought you can assign this process to them as a new challenging situation, where each of them makes his or her own thing, so that they will find something more positive and fulfilling in learning through this process, which leads to their deeper understanding of what they have studied. This is my real hope.

I think of the same as for junior/senior high schools. The contents they’re learned should depend on their grades, that is, so to speak, closed ones, but as I mentioned before, I would rather you went ahead with your research centering around your ideas since I’ve left from teaching.

Still, I highly respect your laborious work of having conducted together with ex post facto researchers even advanced researches, whose necessity should arise and whose