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Taking up the pure mathematics career led by friends I met during the Math Olympiad, and by my respected teachers

Dr. Katsura says he was first induced into mathematics by friends whom he met during the Japan Mathematics Olympiad and studied together with them before choosing the career of a mathematician. Later, he met co-researchers from other disciplines and teachers under whom he would study. In addition to these assets, also supporting Dr. Katsura, now as a researcher, are various valuable experiences he gained in Japan and overseas as well as his family.

What was your childhood like?

I was born and raised in Muko City, a so-called “bedroom” suburb community in Kyoto Prefecture. My father was so fond of board games and puzzles that all sorts of playthings, such as Othello and backgammon (board games) and Rubik’s Cube, were everywhere in my home, with which I used to play almost everyday in my childhood. It was customary that I enjoyed board games together with my family members.

We guess you were good at arithmetic since childhood, is that right?

I was good at arithmetic but not at calculation at all. Even today, calculation is my weak point. What I liked were puzzle-like problems and diagram-based problems like those often set in IQ tests.

I experienced a regretful setback when I was taking a test for admission to a junior high school. Despite months of hard work preparing for admission to Rakusei Junior/Senior High School, I struggled with one arithmetic question I simply couldn’t solve. So attached to that question, I had little time to review the other questions, which resulted in many calculation mistakes. After all, my friends were admitted to Rakusei and I was the only one going to Todaiji Gakuen. Since that time, I’ve made it a rule to take other approaches and check my answers to math problems three to four times. The bitter experience in the junior high school entrance exam was a good lesson for me after all (*Laughter*).

About when did you make up your mind to focus on mathematics?

Toward the end of my high school second year, I was chosen as one of the twenty Japanese candidates for the International Mathematical Olympiad (IMO). This event turned out to be an opportunity for me to find fun in pure mathematics for the first time in my life. Until then, I had never met students of my age who were better at mathematics than myself, which was a tremendous stimulus.

At that time, I was left out of the final selection of six representatives to my regret. However, in the summer of my third year of high school, I had an opportunity to participate in a camp mostly for IMO representative candidates. It turned out that some of the fellow students I met there would change the course of my life. They invited me to go to the University of Tokyo to study mathematics together, so I decided to go to the university instead of the nearby Kyoto University. Then I was admitted to the university’s Natural Sciences I, left for Tokyo and began living there alone.

After entering the university, I seldom attended classes. Rather I made it a rule to attend a weekly reading circle with those friends after deciding which textbooks to read. In those days, I was desperately voracious for mathematical knowledge, spending quite some time to study.

Then do you mean you devoted yourself to mathematics during your undergraduate years?

Not at all times. Besides studying mathematics, at the invitation by one of the reading circle friends, I took up a part time job as a math lecturer at a cram school, teaching university-class mathematics to junior and senior high school students. I was actively involved in the cram school, drawing up original curricula and creating textbooks of our own, for example. The experiences I gained at the time seem to have paved the way for what I’m doing now – teaching students.

I was also a member of an inter-college mountaineering circle, mingling with students from other universities. In a typical itinerary of three nights and four days, we climbed 3000-meter-class mountains such as those in the Southern Japan Alps, carrying a tent of our own. Some of the circle members were from Keio University. I made a friend of Mr. Kenichi Tanaka from Keio (now Associate Professor, Keio University Department of Administration Engineering) in the circle activity. Just as with the case of Dr. Tanaka, I met my future wife through this circle.

You skipped a grade when you were an undergraduate, didn’t you?

Yes. Again at the invitation of those friends, I challenged the grade-skipping exam, an opportunity allowed only for juniors. All of us passed the exam, so we quit the undergraduate course halfway in the third year and advanced to the master’s course. While two of my friends chose the number theory, I joined the lab of Professor Yasuyuki Kawahigashi who specialize in the operator algebras theory.

At the Kawahigashi lab, we were required to speak without looking at notebooks. At my own lab, we are following suit with





this style of learning. It was a tough practice in the beginning, but I soon found that it is a superb method to accurately understand the problem and nurture the ability to restructure the problem – far from compelling us to memorize things. Not limited to mathematics, training yourself in this way will be surely useful even after you go out into the world.

In the second year of my master's course, I studied abroad at the Mathematical Sciences Research Institute (MSRI) near the University of California, Berkeley for a little less than a year.

Returning to Japan, I completed two years of doctoral course before getting married. Then I continued research activity at the Graduate School of Mathematical Sciences, the University of Tokyo in the capacity of a postdoctoral fellow (PD) of the Japan Society for the Promotion of Science (JSPS). During this period, I also experienced an extended stay in Oregon, U.S.A. Then, I had an opportunity to spend three enjoyable years of research at the Hokkaido University Graduate School of Science (Faculty of Science) as Superlative Postdoctoral Fellow (SPD) of JSPS. Those three years were fruitful as I could fly around the world and cultivate valuable human relationships, which became the foundation supporting my current research activities.

There is one more thing I gained during the years at the Hokkaido University. Inspired by the *manga* "Hikaru-no-Go," I was awakened to the fun game of "Go". Currently, I'm a third grade rank holder of Go.

While mathematicians today are in great demand by businesses, it is said finding employment is difficult for mathematics researchers

Because securing a post as a mathematics researcher is highly competitive, one needs good timing and luck in addition to ability. When I completed the doctoral course, an increasing number of young people wanted to become researchers but the number of posts available was on the decrease. Naturally, they were faced with keen competition. In my case, following the service with the Hokkaido University, I had to serve as a PD at the University of Tokyo for half a year then at the University of Toronto. Since I got a preliminary offer for a post from Keio just before leaving for Toronto, I put an end to my six months of stay in Toronto much earlier than the initial plan. In April 2008, I reported to Keio University Department of Mathematics, Faculty of Science and Technology as an assistant professor. Because I was able to find employment with such a highly reputable university as Keio, I feel the five years of my PD period were not useless after all.

A good thing about Keio University Faculty of Science and Technology lies in that the relation between teachers and students is close, reflecting the Keio policy of "Half Learning, Half Teaching." Unlike mathematics departments of other universities (Japanese or overseas) I know, Keio's Department of



Mathematics not only pursues pure theories of mathematics but also emphasizes application aspects of this study. Of our students, only a few become mathematics researchers after graduation. Their future courses are diverse, some becoming school teachers and others finding employment with businesses and so on. At Keio, interactions among teachers from various departments, such as labs specializing in statistics and computer sciences, are also active. Speaking of myself, I feel my field of vision has expanded considerably thanks to such an open culture.

Do you sometimes engage in joint researches yourself?

Yes. I studied alone in the beginning. But while I was in Toronto, a set theory specialist, who had read my paper, visited my office and offered a joint research on a certain problem. It was a difficult problem left unsolved for 30 to 40 years. By joining forces, however, we could solve that problem. Since that time, I'm willing to call out to other researchers when I feel joint research approach would be better.

On what occasions do you usually get inspiration?

When trying to solve problems, the first thing I do is find out things in common in several instances and phenomena and then arrange them in writing. Thinking it over for some time, there may come a moment of inspiration while I'm relaxing. Or it may come while I'm taking a shower, or walking. Such moments vary according to the situation. One day I suddenly got an inspiration. So excited with joy, I phoned up my co-researcher in spite of myself.

This is why the existence of my family, with whom I can relax in comfort, is so important. I have a family of four: my wife who is my good supporter, the first son who is an elementary school third grader, and the second son who is a preschool senior class student. The first son is already a third grade rank holder in the game of Go, the same level as me. He defeats me at times (*Laughter*). He was even chosen as a Go representative for Kanagawa Prefecture. The second son loves playing board games just like myself and is getting stronger and stronger. I'm proud of him and looking forward to his future.

◎ **Some words from students** . . . ◎

● I joined the Katsura lab simply because Dr. Katsura's class lectures were overwhelmingly interesting, where I could image even difficult problems in an understandable way. It's a tough requirement that we shouldn't look at notebooks when speaking in seminars. But this rule helps me a lot in understanding things accurately and speaking logically in public.

(Reporter & text writer : Madoka Tainaka)

For the full text of this interview
<http://www.st.keio.ac.jp/kyurizukai>

To get close to the truth, we need to repeat seemingly endless calculations and thought experiments. But once we have reached it, we will find it extremely simple and exquisite. I'd like my students to meet many exquisite truths from now on.

Takeshi Katsura

Born in Kyoto, Dr. Takeshi Katsura specializes in the C^* -algebras, a field of the operator algebra theory. In particular, he focuses on C^* -algebras related to dynamical systems and the set theory. In 2003, he completed the doctoral course at the Graduate School of Mathematical Sciences, the University of Tokyo. Doctor of Mathematical Sciences. After serving as a postdoctoral fellow at the Hokkaido University, University of Tokyo and University of Toronto, Dr. Katsura assumed a spost as an assistant professor of Keio University Faculty of Science and Technology in April 2008, then assumed the current post as an associate professor in April 2012.

