

Overview of Special Educations for Gifted Students in Mathematics¹

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Special educations for gifted students have not been given enough attention in Japan with a little exception. Indeed, such educations were sometimes despised in Japan by teachers and parents as well as by boards of education, because one of the features of postwar education system in Japan was an excessive egalitarianism. The other is cramming of knowledge in school education, which is necessary for high school graduates to pass entrance examinations for famous universities such as University of Tokyo, or Kyoko University.

However, in 1997, some trials of special educations for gifted students started. The Ministry of Education, Sports, Culture, Science and Technology admitted "skipping a year to enter universities."

In this paper, the following three topics would be discussed.

1. Enrollment of high school students aged 17 into Chiba University.
2. Summer seminars conducted by Japan Mathematics Foundation of Olympiad.
3. Super Science High School Program funded by the Ministry of Education.

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0. HISTORICAL BACKGROUND

Excessive egalitarianism arose from the modern history of Japan. After World War II, the most important factor in education system of postwar Japan was the abolition of militarism, which was the main theme of a directive issued by the General Headquarter GHQ presided over by US Military General Douglas MacArthur.

The US Education Mission was invited by GHQ into Japan and played a decisive role

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in creating a new democratic educational system.

The newly organized Education Reform Committee made recommendation of the new education. Based on this, the Japanese Diet passed a series of legislative acts that forged the foundation of postwar education, among which the Fundamental Law of Education and the School Education law were important. These laws guaranteed academic freedom, extended the length of compulsory education from six to nine and provided for coeducation. And egalitarianism is a key feature in both laws. Consequently, the prewar education system was replaced by a democratic single track system. Thus, state text books were abolished in favor of commercial ones. Japanese accepted and enjoyed the new education system. In 1960s, a period of high growth was born for both the economy and education. Responding to the changing economic and industrial environment, enrollments in high schools, junior colleges, and universities increased.

After decades, the reform of the content of education proceeded to reduce the strong control of the former days and to encourage teachers' initiative. The Ministry of Education, Sports, Culture, Science and Technology (MESCST) directed the development of "egalitarian and efficient schooling" in postwar era (Britanica-CD 2003).

The Central Council for Education initiated a sustained educational reform debate that set the stage for the establishment in 1984 of "the uniformity and rigidity of education" at all levels and for "the enhancement of individuality" through education. Its recommendation in 1987 included "diversity" in upper secondary education and encouraged "greater local freedom and responsibility" in developing curriculum. Japan's educational policy is being directed toward meeting the diversified needs of the future. Actually, the Committee of the Central Council for Education proposed that students who have extraordinary abilities in mathematics or theoretical physics may skip a year in high school and are able to enter universities at the age of 17. In prewar era, skipping a year was common. But in postwar era, skipping grades was not allowed. Lots of disputes erupted in favor of, or against this proposal. The Mathematical Society of Japan was against. At the end of the heated debate, the new law permitted enrollment of the 17-year-old students to Japanese universities.

1. THE PROGRESSIVE SCIENCE COURSE IN CHIBA UNIVERSITY

Chiba National University started the Progressive Science Course for the 17 year old students. Every year, about three high school students aged 17 enter Chiba University as regular university students after passing special entrance examination. They take all courses with other students. In addition, they have some special seminars (Progressive Science Seminar) three times a week. Moreover, a series of lectures by professors of

various fields is provided. At the same time, a small room is provided for these students. They can discuss and study at this room. Since the number of students in Progressive Science Course is small, two designated professors take care of these students belonging to the Course.

The number of students and their departments or divisions

- ① In 1998,
Two students in Division of Material Engineering, Faculty of Engineering
One student in Division of Image Science, Faculty of Engineering
- ② In 1999,
Two students in Department of Physics, Faculty of Science
One student in Division of Electronics, Faculty of Engineering
- ③ In 2000,
Two students in Department of Physics, Faculty of Science
One student in Division of Material Engineering, Faculty of Engineering
- ④ In 2001,
Three students in Department of Physics, Faculty of Science
- ⑤ In 2002,
Two students in Department of Physics, Faculty of Science
- ⑥ In 2003, (expansion started)
One student in Department of Physics, Faculty of Science
One student in Division of image science, Faculty of Engineering
One student in Division of Electronics, Faculty of Engineering
- ⑦ In 2004,
Three students in Division of Electronics, Faculty of Engineering
Two students in Department of Physics, Faculty of Science
One student in Division of image science, Faculty of Engineering
Two students in Division of Behavioral Science, Faculty of Letters
- ⑧ In 2005,
Two students in Department of Physics, Faculty of Science
One student in Division of Design and Architecture,, Faculty of Engineering
Four students in Division of Behavioral Science, Faculty of Letters

My comments: At first, the course might be designed for the students with extraordinary abilities in mathematics or theoretical physics. However, even though students in the course are very earnest and good at study, they seem to be without such extraordinary abilities. A few students have taken the entrance examinations. Indeed, every year about 10 students challenge these entrance examinations. Why do so few students challenge to enter this course?

Only physics department and some departments of Faculty of Technology and a department in Faculty of Letters admit students into this course. However, mathematics department dose not admit these students aged 17. Moreover, Chiba University might be

one of good universities, but not so famous. Thus it fails to attract very bright students. Students in the course enjoy excellent environment of studies such as special seminars, series of lectures and a room and desks provided for them. But this trial in Chiba University is not education for gifted students.

Recently, Meijo University (private university near Nagoya) started another program for gifted students for mathematics. From this year University of Aizu follows.

2. SEMINARS BY JAPAN MATHEMATICAL FOUNDATION OF OLYMPIAD

In Japan, there are 4 mathematical competitions held every year.

- ① Japan Mathematical Olympiad (JMO), for high school students, around 1000, by The Mathematical Olympiad Foundation in Japan (President: Prof. K.Kobayashi),
- ② Junior Japan Mathematical Olympiad, for middle school students, around 1000, by The Mathematical Olympiad Foundation in Japan,
- ③ Japan Elementary Mathematical Olympiad, for primary school students, a few thousands, by The Elementary Mathematical Olympiad Association (President: Prof. Hironaka)
- ④ Japan Junior Elementary Mathematical Olympiad, for primary school students aged less than 11, a few thousands, by The Elementary Mathematical Olympiad Association (President: Prof. Hironaka)

Besides the activities concerning with mathematical competitions, Mathematical Olympiad Foundation in Japan conducted summer mathematical seminar every summer. The first seminar was held at Shirahama, Wakayama, which was organized by Iitaka 12 years ago. At least 5 seminars were held. But the foundation had some financial problem and the summer seminar did not continue. Five years ago, the new summer mathematical seminar was started by university students who were medalists of IMO. Last summer, I was invited to deliver 3 hour lecture at the fifth JMO summer mathematical seminar at Kawaguchi Lake.

Organization of the Fifth JMO Summer Mathematical Seminar at Kawaguchi Lake.

Organizer: executive committee of the fifth summer mathematical seminar
 participants: 17 high school students who attended the final stage of JMO and ten more high school students who wish to attend the seminar(who got high scores in mathematical problems presented by JMO), plus 10 university students who attended the IMO.

1. Expenses: 10000 yen each for hotels. Each has to pay his/her travel expenses. (funded by Mathematical Olympiad Foundation in Japan)
2. Date: from August 25 to 30.

3. Place: Hotel at Kawaguchi lake near Mt.Fuji

4. Schedule:

In the morning three math professors deliver 3 hour lectures.

In the afternoon, and nights: seminars by students without tutors.

They read math books. The titles of books are

- ① 30 Lecture on sets (Japanese)
- ② Reciprocity law of quadratic residues (Japanese)
- ③ Topology (Japanese)
- ④ Geometry of Partitions (Japanese)
- ⑤ New Theory of Games (Japanese)
- ⑥ An Introduction to Geometry of Numbers (Cassels)(English)

Invited three lectures are Professors Noumi (Analysis), T. Yoshida (Geometry), S. Iitaka (Algebra)

At the final day, students presented what they learned in front of senior members of the seminar.

This seminar is mathematics oriented. Another summer seminar (called “Wing for Mathematical Sciences”) is held by Japan Association for Mathematical Sciences (President: H. Hironaka). Moreover, another summer seminar for elementary school students will start from this summer by Hironaka.

3. SUPER SCIENCE HIGH SCHOOL PROJECT

20 high schools are selected and they get funds for science and mathematics from the Ministry of Science and Culture.

At a high school, in mathematics, professors were invited to deliver lectures for high school students.

In 2004 academic year, the titles of lectures are.

- ① Introduction to Knot theory
- ② Cryptography and number theory
- ③ Elementary transcendental functions – elliptic integrals
- ④ Introduction to Morse theory
- ⑤ Introduction to fractal theory
- ⑥ Grammar of Science, birth of Statistics
- ⑦ Geometry of $SO(3)$
- ⑧ Introduction to integral geometry

4. CONCLUSION

Special education for gifted students in mathematics has started from the late 1990's. But so far such education is not successful, because egalitarianism is still very strong in Japan. On the other hand, the gifted students are eagerly participated in the summer seminars like the mathematical seminar conducted by the Mathematical Olympiad Foundation in Japan or the Science Seminar by Japan Association for Mathematical Sciences. After all, the motivation to study modern mathematics further is the key for such students, which is much more important than the reform of the educational system.

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