The First Step Towards Increasing Female Participants in the Olympiads in Informatics in Japan

Rie Shigetomi YAMAGUCHI\textsuperscript{1,2} *, Tetsushi ITO\textsuperscript{2,3} †
\textsuperscript{1}Graduate School of Information Science and Technology, The University of Tokyo, 7-3-1, Hongo, Bunkyo, 113-8656, Tokyo, Japan
\textsuperscript{2}Committee, The Japanese Committee for International Olympiad in Informatics, 1-10-7-301, Shibuya, Shibuya, 150-0002, Tokyo, Japan
\textsuperscript{3}Graduate School of Science, Kyoto University, Kyoto, 606-8502, Kyoto, Japan
e-mail: yamaguchi.rie@i.u-tokyo.ac.jp, tetsushi.ito@ioi-jp.org

Abstract. In recent years, with women’s social advancement, we have been asked in various locations to “increase the proportion of women in society.” Of course, the voices are particularly loud in the field of information technology in which we are engaged. However, direct use of female quotas, that is, blatantly lowering the threshold only for women, may lead to reverse discrimination. On the other hand, since including women themselves may change the criteria for selection, it is difficult to strike a balance between the two. In Japanese Olympiads in Informatics (JOI), we have received similar questions from various quarters. We are all trying to think hard about it. In this article, we shall explain the first step towards increasing the number of female participants in JOI.

Keywords: Science Olympiad, diversity, female

1. Background: Status of Women in Informatics in Japan

   a. The number of female students in informatics departments in the universities is only slightly more than 10% in the 2016 edition of the “White Paper on IT Human Resources” (IPA, 2016), although the exact number is unknown because the Basic School Survey by the Ministry of Education, Culture, Sports, Science and Technology does not include the category of “informatics” (Science council of Japan, 2020). As of 2019, the percentage of female members of the Information Processing Society of Japan (IPSJ) is approximately 12% for student members and 7% for regular members. Since higher education related to informatics is often linked

*Corresponding author.
†These authors contributed equally to this work. Contributing author.
to engineering, and there are few role models for women, female students are often stuck in following stereotyped idea

Engineering ≈ \{ male-oriented themes, few job opportunities for women \}

before entering into the field of informatics.

The White Paper on Gender Equality (Gender Equality Bureau Cabinet Office, 2000) points out that female students tend to avoid mathematics and science because of the environment rather than gender differences in ability. While more than 60% of both male and female elementary school students like mathematics and science, the percentage of female junior high school students who like mathematics and science decreased by 13.6 and 27.8 points, respectively, which is more pronounced than that of male students. This indicates that interest in mathematics and science declined for some reason between elementary and junior high school.

In Japan, according to the survey of Programme for International Student Assessment (PISA) on the academic achievements of 15-years-old students, the scientific and mathematical literacy of both male and female students are higher than that of the international average (NIER, 2015). However, a high percentage of female students with high mathematical literacy do not pursue fields in which they can make use of their scientific and mathematical abilities such as IT. Rather, they tend to make safety-oriented choices, and pursue fields in which they can obtain qualifications or licenses such as medical schools.

Reflecting this, the percentage of women in science and engineering fields at universities is low. In particular, the percentage of female researchers in the fields of engineering and science, which account for the majority of researchers, is low at 12.6% (11.1% in engineering and 14.6% in science) for researchers in universities and other research institutes and 8.1% (5.6% in engineering and 14.8% in science) for researchers in companies. The percentage of corporate researchers was 8.1% (5.6% in engineering, 14.8% in science), a low level.

Based on the results of the PISA survey, it is thought that these are not necessarily due to a lack of girls’ academic ability in science and mathematics subjects, but are influenced by the environment, such as the trend of girls around them going on to higher education, parents’ intentions, and the absence of role models, etc. It is necessary to foster an environment that allows students to understand the connection between their knowledge and the real world, and to provide an environment in which students can understand the connection between what they have learned and the real world. In addition, it is also important to provide support not only to students but also to their families and guardians. An environment is needed that helps students understand the connection between the knowledge they have learned and the real world, and to provide support not only to students but also to their families and guardians.
2. The Information Olympiad is a Programming Contest

The International Olympiad in Informatics (IOI) is one of the International Science Olympiads for high school students and below. Japan currently sends delegations to seven International Olympiads (mathematics, physics, chemistry, informatics, biology, geography, and geology).

As with the other International Science Olympiads, the IOI is designed for students up to high school age to identify and help develop problem-solving skills in mathematics and information science, and to promote international exchange among athletes and educators from different countries. The IOI is an internationally well-known programming contest, with approximately 90 countries participating each year. Up to four competitors from each country are allowed to participate, and Japan has participated in four of these contests every year.

The competition is an individual competition, with five hours per day to work on three to four problems. The competition lasts for two days (twice), and the final total score determines the ranking. There are partial points, and points are not awarded for fastest solutions.

The problem-solving task is to devise an effective algorithm to solve a given problem, write a program based on the algorithm, and compete on the correctness of the output from the execution on the computer. Since there are limitations on memory usage and execution time, high mathematical skills are required to design efficient algorithms (Fig. 1).

The Japan Information Olympiad is a place to select members to be sent to the world competition, and the number of participants is rapidly increasing from 978 in 2017 to
1,720 in 2022. As shown in Fig. 2, the number of participants has been increasing despite the Corona disaster, and both the number of female participants and the ratio of female participants have increased significantly since 2021, partly due to efforts to increase the number of female participants in particular.

3. Establishment of the European Girls’ Olympiad in Informatics

The European Girls’ Olympiad in Informatics (EGOI) (EGOI, 2023; EGOI, 2024) was launched in 2021. The EGOI aims to encourage women to enter the field of informatics by targeting only women, whereas the IOI has been held for both men and women. At the time of its inception, this competition was intended to provide a platform for young women to enjoy and deepen their interest in computer science.

The basic rules themselves are almost the same as those of the IOI, with the difference that, as the name suggests, one of the eligibility criteria is gender, and only women can participate. In addition, the number of participating countries is limited to Europe, and countries outside Europe, such as Japan and the United States, are allowed to participate only when there is room for more participants. On the other hand, this is the only programming contest for women on a global scale, making it an international “Women’s” Information Olympiad to determine the actual world’s best.

Japan has been sending its delegation to the EGOI since 2021, with online participation in 2021 due to the Corona disaster (Fig. 3), but in 2022, a delegation was sent to Turkey, where delegation participated on-site for the first time (Fig. 4). In 2021, Japan established the Japanese Olympiad in Informatics for Girls (JOIG), which is a programming contest for female high school students and younger. From 2022, Step 1 is the same as the Japan Olympiad in Informatics First Preliminary Round, but Step 2 (JOIG Main Round) and Step 3 (JOIG Spring Training) are open to female participants only, and the contests are conducted.
The existence of such competitions for women has encouraged more active participation by female contestants, and the participation rate of women has increased rapidly since 2021. We believe that participation in competitions for women, as well as the existence of international competitions, has become a clear goal for female students participating in the Information Olympiad. In conjunction with this, introductory courses for women have been held, and online programming courses (JOI introductory courses) not limited to women have been held regularly to create a framework in which interested students can more easily participate.

4. Women Role Models in Informatics

As described in the chapter “Status of Women in Informatics,” there are few role models for women in informatics, and we started a role model course in October 2021. This lecture is recorded on video in advance and distributed on YouTube (Japanese Committee for the IOI, 2024).
The interviewees are women who use programming and related technologies and knowledge. We interviewed these women about their work and student days, and asked them why they decided to pursue a career in the information field. The contents of this report are also published in book form as shown in Fig. 5, and sent to high schools throughout Japan.

All of the stories are very interesting we have been able to hear from people in the information field who are now making positive efforts despite having had to face setbacks at various points in their careers. For example, a person who once found a job that he had dreamed of since high school but returned to university to study informatics again, or a person who came from an experimental research background but found that the informatics field, which does not require midnight experiments, was the best choice for conducting research and working while raising a child. Many of the stories convey the advantages of working in the information field.

5. Manga Booklet for Female Participants

Many people are inspired by popular manga and TV dramas to pursue careers in the information field. As a side note, the year after the broadcast of Dragon Zakura, the ratio of entrance examinations for the University of Tokyo increased significantly, and after the publication of Animal Doctor, Dobutsu-no-Oishasan, the number of students who aim to become veterinarians at Hokkaido University increased. Manga and TV dramas
have been shown to have a direct impact on the future dreams of high school students, especially in Japan.

The reason why more female students aspire to become doctors or pharmacists than those in the information-related fields is not only because of their confidence in their qualifications, but also because they can easily visualize their professions and student life through manga and dramas. On the other hand, women in the information-related fields who are portrayed in manga and TV dramas are sometimes treated as “geeks,” and it is difficult to imagine them aiming for such positions in a cheerful and attractive manner.

Although we would like to create a more grandiose manga, due to budget and resource constraints, we decided to start small story manga, and have already published three issues of a manga booklet (Fig. 7). We have already published three issues (Fig. 6). We are not only sending these to high schools nationwide, but are also sending a large number of copies to girls’ schools to encourage their participation.

6. We Need to Advertise the Whiteness of the Information Field

The Information Olympiad has never refused the participation of women, but the participation rate has increased significantly in recent years after a long period of slow growth. The main reasons for this increase are the existence of a clear international
competition, EGOI, and the establishment of a women’s division in the national competition. At the same time, there may be a slight improvement in the understanding of society as pointed out by the Science Council of Japan and other organizations. One of the most impressive stories in the Role Model Lecture was that many people talked about the “ease of returning to work after childbirth” in the information-related field. If this kind of understanding is promoted in society as a whole, it will help programmers escape from the black image of simple work and show that all workplaces are white.

7. After a Young Girl was Even Slightly Interested

Once the various promotions reach young women and non-binary people, the next challenge is how to get them to settle into our field. The Japan Information Olympiad Association has been trying to establish this by offering introductory courses, but it is still not enough. Unfortunately, Japan has long been said to be a country where women’s participation in society is weak (OECD, 2023). There are various reasons for this, but in particular, it is said that there is a large generation gap in science education for women.

We believe that there are various factors that hinder the young generation from taking an interest in science. In order to solve this problem, Japan should study the methods used in other parts of the world. Japan has a tendency to favor uniformity in education, which makes it difficult for new types of education, such as information education, to make inroads. We have high hopes that the Information Olympiad will help to break through the above problems, as the name of the Olympiad gives a clear image of the activities that will follow.

The Information Olympiad is a part of primary and secondary education that is closely related to the family and society, and there is a need to turn the cycle of human resource development into a virtuous circle through various publicity activities.

References

The First Step Towards Increasing Female Participants in the Olympiads ...

https://joi.ioi-jp.org/support-message


R. Yamaguchi, Associate Professor of Graduate School of Information Science and Technology, The University of Tokyo. She received Master degree in mathematics from Tsuda College, now Tsuda University, in 2003, and PhD degree in Information Science and Technology from the University of Tokyo in 2006. She joined Information Security Center, National Institute of Advanced Industrial Science and Technology, AIST, in 2006 and concurrently serve in National Information Security Center at Cabinet Secretariat, now National center of Information Incident readiness and Strategy for Cybersecurity from 2007 to 2011. Current position since 2013.

T. Ito is an associate professor of Graduate School of Science at Kyoto University since 2009. He earned a Ph.D. (Mathematical Sciences) from the University of Tokyo in 2003. His research interest is in number theory, algebraic geometry and related areas. He was a participant of IOI in 1994 and 1995. He is now a board member of the Japanese Committee for International Olympiad in Informatics.