

ADVISORY OPINION

Importance of introducing gender perspectives into elementary and secondary education and creating a desirable environment for STEM education in order to accelerate the advancement of women into science and engineering fields.



22 September 2023

Science Council of Japan

**Gender Diversity committee for science and
technology, Section III**

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Subcommittee on Gender and Diversity Committee, Section III, Science Council of Japan.
 Subcommittee on Gender Perspectives Desired for Science and Mathematics Education in
 Elementary and Secondary Education and the Roles of Universities and Industries

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This English version is a translation of the original written in Japanese.

EXECUTIVE SUMMARY

1. Current Status and Challenges

In international surveys of students' understanding of science and mathematics subjects, male and female Japanese elementary and junior high school students score highly. However, the survey shows a lack of interest in applying science to their daily lives. In particular, many female students do not consider science and engineering a future career option.

While the government and some companies are actively working on workstyle reforms and awareness of work-life balance in the workplaces and supporting female students interested in science and mathematics, more effort must be made to reach out to parents and teachers who influence children's course choice process.

Education reforms have been called for Japanese government education guidelines, such as active learning, inquiry-based learning, and STEAM (Science, Technology, Engineering, Arts and Mathematics) education. In addition, "personalized optimal learning is emphasized as online access to education becomes widespread. Those aim to bring up the student's various abilities, but none pay attention to eradicate gender gap in science and mathematical education.

We are concerned about women's underrepresentation in primary education. Female science and mathematics teachers are natural role models for girls. However, the number of female science and mathematics teachers in educational institutions above junior high school is overwhelmingly small.

Even in elementary schools, where the number of female teachers is relatively high, female teachers who teach information science, science and mathematics are very few. It is necessary to give opportunities for teachers to develop their skills to teach these subjects.

There are no clear national guidelines on preventing gender bias in primary and secondary education. In the government guidelines on teacher education, mention of gender equality is limited in social studies and home economics, but there is little emphasis on science and mathematics education. The teachers should be more informed on danger of gender bias in girl's performance and proper actions to motivate the students.

Research on the effects of gender bias continues to be difficult to study due to the limited availability of statistical data by gender in school education. Surveys on teachers' awareness have shown that it is not unusual for teachers to have stereotypes against the abilities of girls in science and mathematics. The correct information based on the gender study has not been provided to teachers. One reason may be that many science and mathematics teachers are educated in science and engineering departments, but there are few opportunities for gender education at these universities.

2. Content of the recommendation

In Japan, girls tend to lose interest in science and mathematics at an early age, more markedly than in other countries, due to a persistent gender bias in society. The low ratio of women in science and engineering occupations leads to losing human resources. Japanese public-school education has not adopted proactive measures to eradicate the gender gap. However, considering the current situation, there is an urgent need to introduce a proactive approach to elementary, secondary, and higher education.

1. The government should actively collect objective data to understand female students' learning environment and affective tendencies. MEXT should actively disclose gender-specific data on primary and secondary education for gender study and promote appropriate intervention education based on the data. The collection of quantitative data is essential for new educational measures such as STEAM education and personalized optimal learning to be effective.

2. Since female students are affected by gender bias regarding science and math subjects from an early age, it is necessary to specify in the general provisions of the "Courses of Study" elimination of gender bias that persists in society as one of the efforts to achieve diversity, inclusiveness and to promote educational reform.

3. It is desirable to incorporate appropriate ways to deal with various gender-related issues as a mandatory item in the teachers' training courses, recruitment, and training of teachers by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) so that teachers will have correct knowledge about gender and classroom management. Promoting understanding of gender bias should be added to the core curriculum for teaching. Measures, including the amendment of the Teacher Licensing Law, should be taken as soon as possible so that students from any university department can take courses on gender-equal education if they want to become teachers.

4. It is important to resolve the gender balance of teachers in charge of science, mathematics subjects and information education for female students upon understanding that science and mathematics subjects are related to themselves. The boards of education must set numerical targets for the ratio of female teachers. In addition, MEXT should urgently establish guidelines to increase and support female teachers in charge of ICT and elementary school science and mathematics subjects.

5. It is necessary to raise awareness of gender equality in science, mathematics, and society to increase women's participation in technology development-oriented companies. In particular, gender education in undergraduate and graduate science and engineering schools at universities is insufficient. Universities should introduce required gender equality education courses or other proactive measures.

6. Female students, their parents, and teachers are not sufficiently aware that women are expected to take active roles in technical development jobs. Various stakeholders should make more coherent efforts to encourage girls in elementary and junior high schools. For example, universities, industries, and the government could collaborate to introduce science and technology outreach activities with regular classes.