Next-Generation Human Resources Development Program

FY2020 budget: 3,908 million yen
(Budget for previous fiscal year: 3,785 million yen)
* Estimated amount included in management expenses grants

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Background/Challenge

○ In order for Japan to lead the world in science and technology in the future, it is necessary to continuously and systematically foster talented children who will be the leaders of the next generation.

Fifth Science and Technology Basic Plan (Abstract) (Cabinet decision on January 22, 2016)

In order for Japan to continually improve its science, technology and innovation capabilities, it is important to promote the development of human resources who will lead the next generation of science, technology and innovation through primary, secondary, and university education, and promote the expansion of their abilities and talents, while also increasing the number of students who like math and science. In this view, the government promotes the development of talents of children and students with excellent qualities by providing math and science learning opportunities and educational programs aimed at cultivating creativity.

Program Overview

[Purpose and objectives]

Discover students in elementary and secondary education who have excellent qualities and promote consistent efforts to develop their talents.

Development of top human resources
(Development of future global leaders)

Expand the population
(of those who are interested in math and science)

Elementary school → Junior high school → High school → University → Post-education

■ Supporting Student Contests in Science and Technology

Establish and support contests where junior and senior high school students with great motivation and skills in math and science compete in science and technology and are mutually inspired to improve their abilities (support for various science Olympiads, Japan High School Science Championship, Japan Junior High School Science Championship)

■ "Junior Doctor" Training School

Support universities ,etc. that implement special educational programs for elementary and junior high school students nationwide who are particularly motivated and outstanding in the field of math and science

■ Global Science Campus (GSC)

Develop and implement programs for developing excellent next-generation international science and technology human resources conducted by universities, etc. for students with outstanding motivation and ability

■ Support for Super Science High Schools (SSH)

Support high schools that provide advanced math and science education and are designated as "Super Science High School (SSH)" in order to cultivate students' scientific abilities and develop them into science and technology human resources who will lead society in the future

Strategic and systematic training and securing of science and technology human resources

Creation of next-generation diverse science and technology innovation human resources

*In addition, the program below is also promoted.

■ Support for Female Students in Choosing Science Courses

Encourage female junior and senior high school students to choose science careers by holding symposiums at universities and related institutions that feature female researchers from the science and technology field as role models

Support for Super Science High Schools (SSH)

FY2020 budget : 2,219 million yen
(Budget for previous fiscal year: 2,219 million yen)
* Estimated amount included in management expenses grants

Background/Challenge

○ In order for Japan to lead the world in science and technology in the future, it is indispensable to systematically develop from the secondary education stage science and technology human resources who will lead future innovation creation.

Fifth Science and Technology Basic Plan (Abstract) (Cabinet decision on January 22, 2016)

- The government promotes the improvement of learning and teaching methods from the viewpoint of "proactive and collaborative learning for discovering and solving issues (so-called active learning)" at schools, while also supporting high schools providing advanced science and mathematics education.

Education to Make Talents of All Children Blossom and Flourish (9th Proposal) (Abstract) (Decision of the Council for the Implementation of Education Rebuilding on May 20, 2016)

- The national and local governments, universities, high schools, etc. will verify the results of the initiatives of the Super Science High Schools [...] promote those proven to be effective, and disseminate best practices.

Program Overview

[Purpose and Objectives]

■Support high schools providing advanced math and science education that are designated as "Super Science High Schools (SSH)"
■Through the implementation of advanced math and science education systematically from the secondary education stage,
- foster students' scientific abilities and develop science and technology-related human resources who will lead future innovation creation.
- obtain empirical data that will contribute to the improvement of math and science curricula at high schools, etc.

✓ Period of designation of SSHs: 5 years (in principle); Grants: 6 to 12 million yen per year
Number of designated schools: 217(including 28 new schools)
○ Develop curricula that go beyond the curriculum guidelines and focus on math and science
○ Focus on proactive and collaborative learning (so-called active learning)
○ Raise students' interests in math and science through lectures by researchers, and promote voluntary research programs incorporating fieldwork
○ Implement the above-mentioned initiatives on a higher level through high school-university collaboration and corporate collaboration.

<Priority schools>

✓ (Up to 5 years) Grant: 5-30 million yen per year; Number of priority schools: 11 schools + 1 consortium (as of 2020)
○ Among SSHs, those that promote one of the following initiatives are designated as priority schools.

- An initiative where the school works with a university to develop human resources who will lead science and technology in Japan in the future by jointly building and verifying a system to cultivate in students qualities and abilities that would be required of desired human resources, and a method to evaluate such qualities and abilities **[high school-university collaboration]**
- An initiative to improve the quality of math and science education across the region by sharing math and science curricula, teaching methods, networks, etc. across a wide area (i.e. on the prefectural level) **[wide-area cooperation]**
- An initiative to build cooperative relationships with overseas research institutes for regular exchange, in order to foster internationality in students and develop human resources who can collaborate with overseas researchers in the future **[international collaboration]**
- An initiative to develop human resources who aspire to create new value by conducting scientific research on global social issues in cooperation with NPOs and private companies **[global social co-creation]**

[Achievements so far]

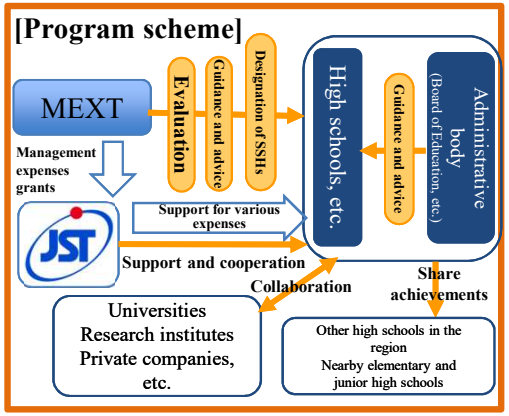
Advanced science projects

(Studies commended at the SSH Student Academic Conference in FY2019)

○ Minister of Education, Culture, Sports, Science and Technology Award: Tokyo Metropolitan Koishikawa Secondary School"Allorecognition behavior of slime mold Physarum rigidum plasmodium"
○ President of Japan Science and Technology Agency Award
・Nara Women's University Secondary School
"Moving an Object with Ultrasound ~ The Development of Contact-free Pressure Controller ~"
・Hyogo Prefectural Takarazuka Kita High School
"Former step of caramelization of sucrose ~ approach polyols structure ~"

⇒ Proactively and collaboratively study and conduct research as a science project (research that involves setting an objective related to science and conducting observations and experiments) with the support of universities and companies

[Program scheme]



International collaboration


(Ritsumeikan High School)

○ The Japan Super Science Fair is held with the participation of high school students from 20 countries and regions overseas.
○ In addition to research presentation, students from different countries and cultural backgrounds work in groups to address scientific activities related to food issues.

⇒ Develop students' motivation and ability to play an active role in the international community

Wide area collaborative research


(Fukushima Prefectural Fukushima High School)

○ The school participated in the 30th CASTIC as a Japanese representative.
○ The students conducted dose surveys inside and outside Fukushima Prefecture and overseas, and shared the results at presentations in Japan, France, and Italy.
○ The paper was published in a journal issued by the Institute of Physics.

⇒ Contribute to society beyond the borders of countries and regions

Supporting Student Contests in Science and Technology

FY2020 budget : 831 million yen
(Budget for previous fiscal year: 718 million yen)
* Estimated amount included in management expenses grants

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Background/Challenge

◯ It is necessary to increase opportunities for domestic and foreign students to compete against each other and thereby improve their abilities.

Fifth Science and Technology Basic Plan (Abstract) (Cabinet decision on January 22, 2016)

- The government will take measures to increase opportunities for highly motivated, competent students to conduct research and opportunities for domestic and foreign students to compete against each other and thereby improve their abilities.

Third Basic Plan for the Promotion of Education (Abstract) (Cabinet decision on June 15, 2018)

- The government will take measures to increase collaborative education programs with universities and private organizations aimed at greatly enhancing the talents of children and students with high motivation and abilities in math and science, while also providing opportunities for domestic and foreign students to compete against each other to improve their abilities.

Program Overview

[Purpose and objectives]

- ○ Produce outstanding human resources who can play an active role in the international community
- ○ Contribute to an increase in the number of students pursuing science careers by improving the image and status of math, science and technology in schools

[Program overview and vision]

With an eye to producing outstanding science and technology human resources who can play an active role in the international community and increasing the number of students who are interested in science, the government builds platforms for highly motivated, competent junior and senior high school students to compete against each other and thereby mutually improve their science and technology abilities.

1. Support for contests for top-class high school students

⇒ Support for subject-based contests (mathematics, chemistry, biology, physics, informatics, geology, and geography) and science fairs (e.g. ISEF)

- Send Japanese national teams to international contests (dispatch and training of national team members)
- Support for the holding of domestic contests (hosting, PR, fostering motivation for participation, etc.)
- Support for the hosting of national tournaments of international contests

2. Creation of opportunities for school teams and groups

- Hold the Japan High School Science Championship (scope: high school students) and Japan Junior High School Science Championship (scope: junior high school students) (contest management / preparation of questions)
- Support for prefectural qualifying tournaments (part of expenses covered by the government)

[Program scheme]

Government → (Management expenses grants) → JST → (Support) → Organizer of Science Olympiad / Local Government

[Achievements so far]

1. Support for contests

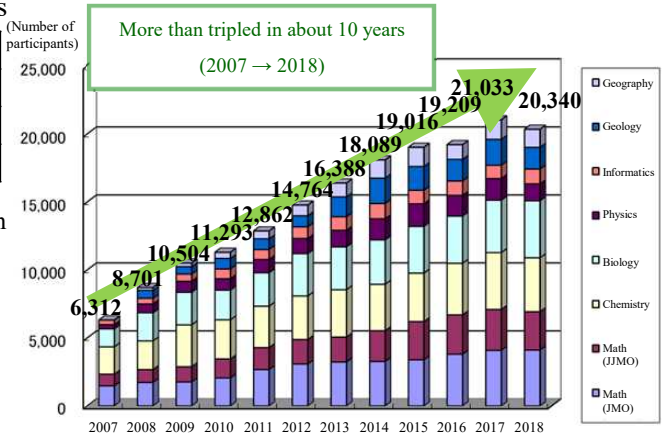
○ 2019 International Science Olympiad results

	Math	Chemistry	Biology	Physics	Informatics	Geology	Geography	Total
Gold	2	2	0	1	1	4	0	10
Silver	2	2	2	4	3	0	0	13
Bronze	2	0	2	0	0	0	1	5

○ International contests scheduled to be held in Japan

- 2020: International Biology Olympiad (Sasebo City, Nagasaki)
- 2021: International Chemistry Olympiad (Higashi Osaka City, Osaka Prefecture)
- 2022: International Physics Olympiad (Tokyo (plan))
- 2023: International Mathematical Olympiad (Chiba city, Chiba prefecture)

<Changes in the number of participants in the Science Olympiad National Tournament >



2. Japan Junior and Senior High School Science Championships

○ Results of the Japan Junior and Senior High School Science Championships

- 8th Japan High School Science Championship
  - Students from high schools and technical colleges that won prefectural tournaments (47 teams/361 students) participated in this event.
  - Kaiyo High School from Aichi Prefecture won the championship.
- 6th Japan Junior High School Science Championship
  - Junior high school students from each prefecture's national team (47 teams, 282 people)
  - The Aichi team won the championship.

	2011	2012	2013	2014	2015	2016	2017	2018
Japan High School Science Championship	5,684	6,308	6,704	7,650	8,261	8,244	8,725	9075
Japan Junior High School Science Championship	-	-	16,369	21,958	23,339	25,155	27,892	27,146

<Number of participants in the qualifying tournaments of the Japan Junior and Senior High School Science Championships> (Number of participants)

Global Science Campus

(Implementation of Science and Technology Human Resources Development Activities in Cooperation with Universities, etc.; Support for Environmental Improvement)

FY2020 budget : 429 million yen
(Budget for previous fiscal year: 419 million yen)
* Estimated amount included in management expenses grants

Background/Challenge

As globalization progresses, it is imperative to produce human resources who can play an active role in the international community. It is also important to expand students' talents through personalized learning, which school education cannot provide.

Fifth Science and Technology Basic Plan (Abstract) (Cabinet decision on January 22, 2016)

In order for Japan to continually improve its science, technology and innovation capabilities, it is important to promote the development of human resources who will lead the next generation of science, technology and innovation through primary, secondary, and university education, and promote the expansion of their abilities and talents, while also increasing the number of students who like math and science. In this view, the government promotes the development of talents of children and students with excellent qualities by providing math and science learning opportunities and educational programs aimed at cultivating creativity.

Third Basic Plan for the Promotion of Education (Abstract) (Cabinet decision on June 15, 2018)

- The government will take measures to increase collaborative education programs with universities and private organizations aimed at greatly enhancing the talents of children and students with high motivation and abilities in math and science, while also providing opportunities for domestic and foreign students to compete against each other to improve their abilities.

Future Investment Strategy 2018: Shift to Society 5.0 and Data-driven Society (Abstract) (Cabinet decision on June 15, 2018)

- The government will enhance measures to further expand the talents of children with excellent math and science qualities, such as the Global Science Campus. For those who have particularly outstanding qualities, such as high school students who have accomplished excellent achievements in the Olympiad in Informatics and other science Olympiads, the government will provide them with opportunities to learn AI and other advanced fields more deeply and further enhance their abilities while they are in primary and secondary education.

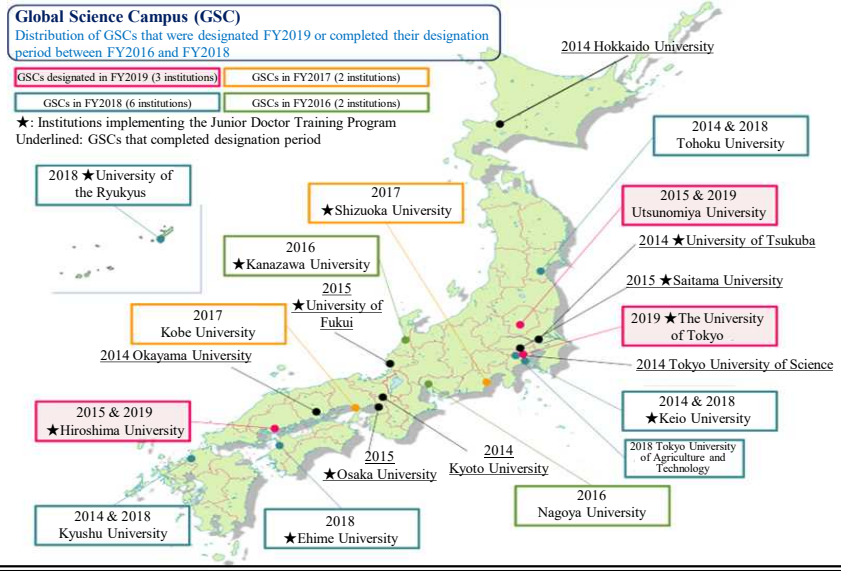
Program Overview

[Purpose and Objectives]

Develop next-generation outstanding science and technology human resources who can play an active role globally in the future

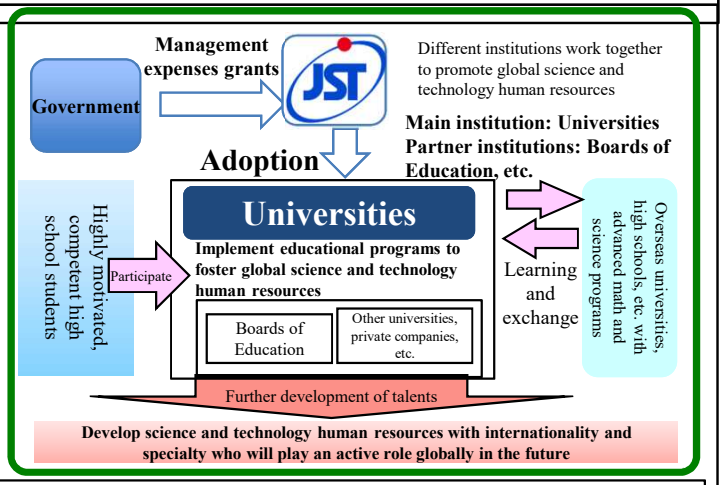
[Program overview and vision]

This program aims to support a wide range of high-school students who have outstanding motivation and abilities in the individual regions, as well as universities that provide highly advanced and practical lectures and research for selected students throughout the year. At the same time, it also is intended to provide students with broad perspectives in terms of internationality and specialty.



[Program scheme]

- ✓ Designation period: 4 years
- ✓ Scale: 14 institutions (including 2 new institutions)
- ✓ Maximum amount of grants: Around 25 million yen to 35 million yen/institution per year
- ✓ Target: High school students
- ✓ Number of students: About 40/institution per year



[Characteristics]

- ○ GSCs provide training programs for applicants who passed the screening. The first stage of the programs mainly consists of lectures and exercises that equip the students with a wide range of basic knowledge and techniques that will constitute the foundation of research activities. The second stage is for the students who were selected to receive more intense training where they can further expand their talents through research and other activities.
- ○ The emphasis of the program is put on the second stage (research activities) with an eye to promoting long-term research on more advanced levels.
  - → More meticulous care from TAs and teachers (establishment of an individualized guidance system)
  - → It is also possible for students to shorten the period of the first stage or to immediately start the second stage after enrollment.
- ○ Initiatives covering different fields and those tapping into regional characteristics are promoted.

“Junior Doctor” Training School

(Implementation of Science and Technology Human Resources Development Activities in Cooperation with Universities, etc.; Support for Environmental Improvement)

FY2020 budget : 241 million yen
(Budget for previous fiscal year: 240 million yen)
*Estimated amount included in management expenses grants

Background/Challenge

- It is important to promote the development of human resources to create the future, from an early stage of education, with a view to the Fourth Industrial Revolution.
- There have hardly been any initiatives to support elementary and junior high school students with outstanding motivation and ability in the fields of math, science, or informatics.

Education to Make Talents of All Children Blossom and Flourish (9th Proposal) (Abstract) (Decision of the Council for the Implementation of Education Rebuilding on May 20, 2016)
The government will provide guidance to elementary and junior high school students with outstanding motivation and skills in the fields of science and mathematics through a series of educational programs provided by universities and private organizations, promoting new efforts throughout the country to greatly expand students’ abilities.

Japan Revitalization Strategy 2016 (Abstract) (Cabinet Decision on June 2, 2016)
The government will review existing initiatives to foster outstanding human resources who will lead a new era, develop and promote new initiatives, and provide special educational opportunities for elementary and junior high school students with great motivation and outstanding abilities in the fields of math, science, and informatics to further expand their talents to a greater extent.

Program Overview

[Purpose and objectives]

Further expand the talents of elementary and junior high school students nationwide with great motivation and abilities in science and mathematics through special educational programs provided by universities

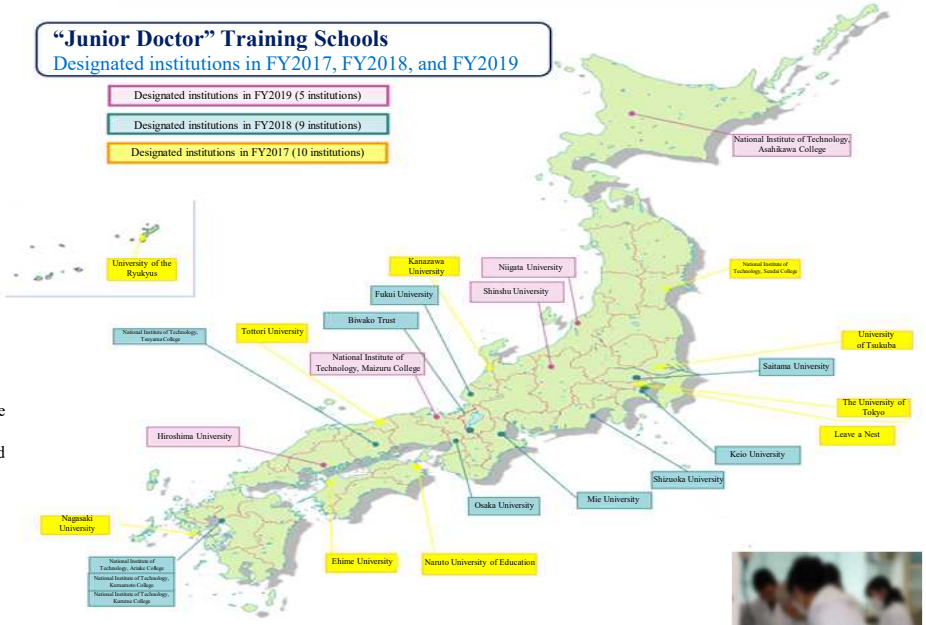
[Program scheme]

- ✓ Designation period: 5 years
- ✓ Scale: 27 institutions (including 3 new institutions)
- ✓ Amount of grants: 10 million yen /institution per year
- ✓ Target: 5th grade to junior high school students

Government → **Management expenses grants** → JST → **Adoption** → Universities, technical colleges, private organizations, etc.

Meticulous support from mentors (faculty members, graduate students, etc.)
* 3 on 1 to 1 on 1

The Training Schools provide programs to further enhance the creativity and specialty of elementary and junior high school students, especially those with great motivation and abilities, designed according to the students’ interest and progress identified based on their reports, comments, interviews, attendance rates, examination results, etc.



Application

- Self-recommendation (parental recommendation)
- Recommendation by a Board of Education or a school
- Participants of various Olympiads and the Japan Junior High School Science Championships
- Recommendation made as part of initiatives of science museums
- Others (recruitment by methods unique to individual institutions)

Screening → Motivated elementary and junior high school students in each region

Primary stage (about 40 students per institution)

- Students thoroughly study the basics of science through various lectures, seminars, experiments in small groups, tours of cutting-edge facilities, and the role of science in ethics and society. Students build a foundation necessary in order to become science and technology human resources.
- After studying a variety of fields, students discover their areas of particular interest.

Screening → Elementary and junior high school students with great motivation and abilities

Secondary stage
(about 10 students per institution)

- Students expand their creativity, ability to define research topics, and specialty skills through working with their assigned lab, receiving individualized guidance by faculty members in research and dissertation, and making presentations on various occasions.

Nationwide events
(Target: Outstanding elementary and junior high school students)

- Hold a joint camp and research presentation program over several days for outstanding children from each region
- Provide opportunities for elementary and junior high school students to get together and grow through competition beyond the borders of regions and areas of specialty

Examples: Lectures by and experiments with Nobel laureates, presentations of research by students, research in uncharted territories, exchange with top-level domestic university and high school students, etc.

Experiment with Nobel laureates

Support for Female Students in Choosing Science Courses

(Implementation of Science and Technology Human Resources Development Activities in Cooperation with Universities, etc.; Support for Environmental Improvement)

FY2020 budget : 42 million yen
(Budget for previous fiscal year: 43 million yen)
* Estimated amount included in management expenses grants

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Background/Challenge

- It is difficult for female students to imagine a future career in the science and technology field.
- The proportion of women in natural sciences in undergraduate and graduate schools is lower than in humanities and social sciences.
- The active participation of women is indispensable in stimulating science and technology innovation by incorporating excellent ideas from diverse viewpoints.

Fifth Science and Technology Basic Plan (Abstract) (Cabinet decision on January 22, 2016)

- The government will promote initiatives to deepen the understanding of female junior and senior high school students and their parents for science and technology and spark their interest in these fields, so that the next generation of women can play an active role in science and technology innovation in the future. At the same time, the government will strive to strengthen collaboration among relevant ministries and agencies, industry, academia, and private organizations in order to promote the public understanding of women's participation in science and engineering.

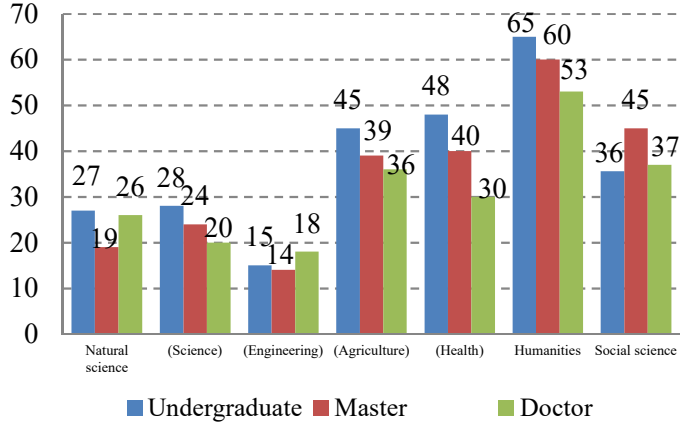
Fourth Basic Plan for Gender Equality (Abstract) (Cabinet Decision on December 27, 2015)

- The government will work with universities, research institutes, academic organizations, companies, etc. to raise the awareness of female students, parents and teachers on the merits of majoring in science and engineering, and promote their understanding of jobs, work styles, and careers in these fields.

Future Investment Strategy 2018: Shift to Society 5.0 and Data-driven Society (Abstract) (Cabinet decision on June 15, 2018)

- In order to promote women's career choices in the science field and their success in advanced fields including AI, the government will promote measures such as presenting diverse role models and special classes by external specialists at local governments, schools, etc. across Japan.

(Reference) Proportion of women in undergraduate and graduate students (%)



Created based on the FY2018 School Basic Survey (Preliminary)

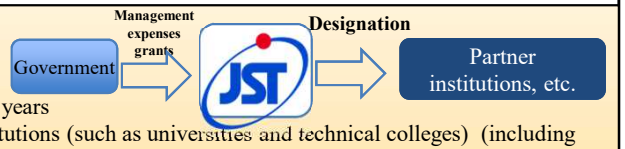
*The figure for the "Health" department is the total for the medical, dental and pharmaceutical departments.

Program Overview

[Purpose and objectives]

- Promote ongoing initiatives in communities to raise the interest of female junior and senior high school students in the science field and allow them to include science as one of their career choices in an unbiased manner
- Increase women's active participation in diverse fields by promoting junior and senior high school students' unbiased career choices
- Promote science and technology innovation in Japan through the active participation of women in science and technology

[Program scheme]



- ✓ Designation period: 2 years
- ✓ Scale: 17 partner institutions (such as universities and technical colleges) (including 12 new institutions)
- ✓ Maximum amount of grants: Around 15 million yen to 30 million yen/institution per year
- ✓ Target: Female junior and senior high school students, parents, and teachers
- ✓ Content: Holding symposiums, experiments, lectures by external specialists, science career consultation, etc.

Example of a program implementation system

<Characteristics of the program>

1. Build the foundation for program operation

Promote the public understanding of women's participation and present a variety of role models through industry-academia-government collaboration

2. Stimulate the interest of students who are unsure whether to major in sciences or humanities

Actively hold workshops by external specialists, in addition to symposiums and experiments. Stimulate interest in those who are less interested in majoring in science or those who are unsure whether to major in sciences or humanities. Help students to choose their major from a broader perspective.

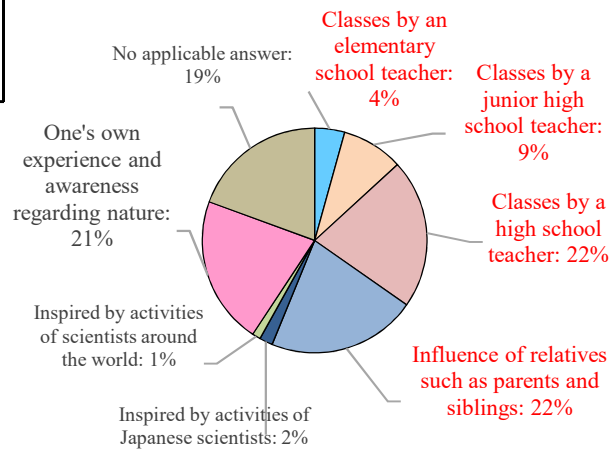
3. Approach to parents and teachers

Proactively implement initiatives for parents and teachers who have a significant effect on students' career choices, with an eye to establish interest in students for sciences at an early stage of education.

4. Continuation of the program on a similar scale by municipalities

Promote the participation of new institutions by conducting locally focused activities. Coordinate with municipal Boards of Education to make use of school events and increase the number of school visits. Aim for the continuation of the program on a similar scale even after the expiration of the government's support.

(Reference) Reasons why female students chose a career in science



Source: "Survey on the Degree of Satisfaction of Female Students Majoring in Sciences" by NIHON L'ORÉAL (August 2014)