July 1, 2007, OECD/Japan Seminar

Lessons from PISA: The Future of Learning

- Scientific Literacy and Proactive, Interactive and Deep learning -

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MEXT

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Summary of results of PISA 2015

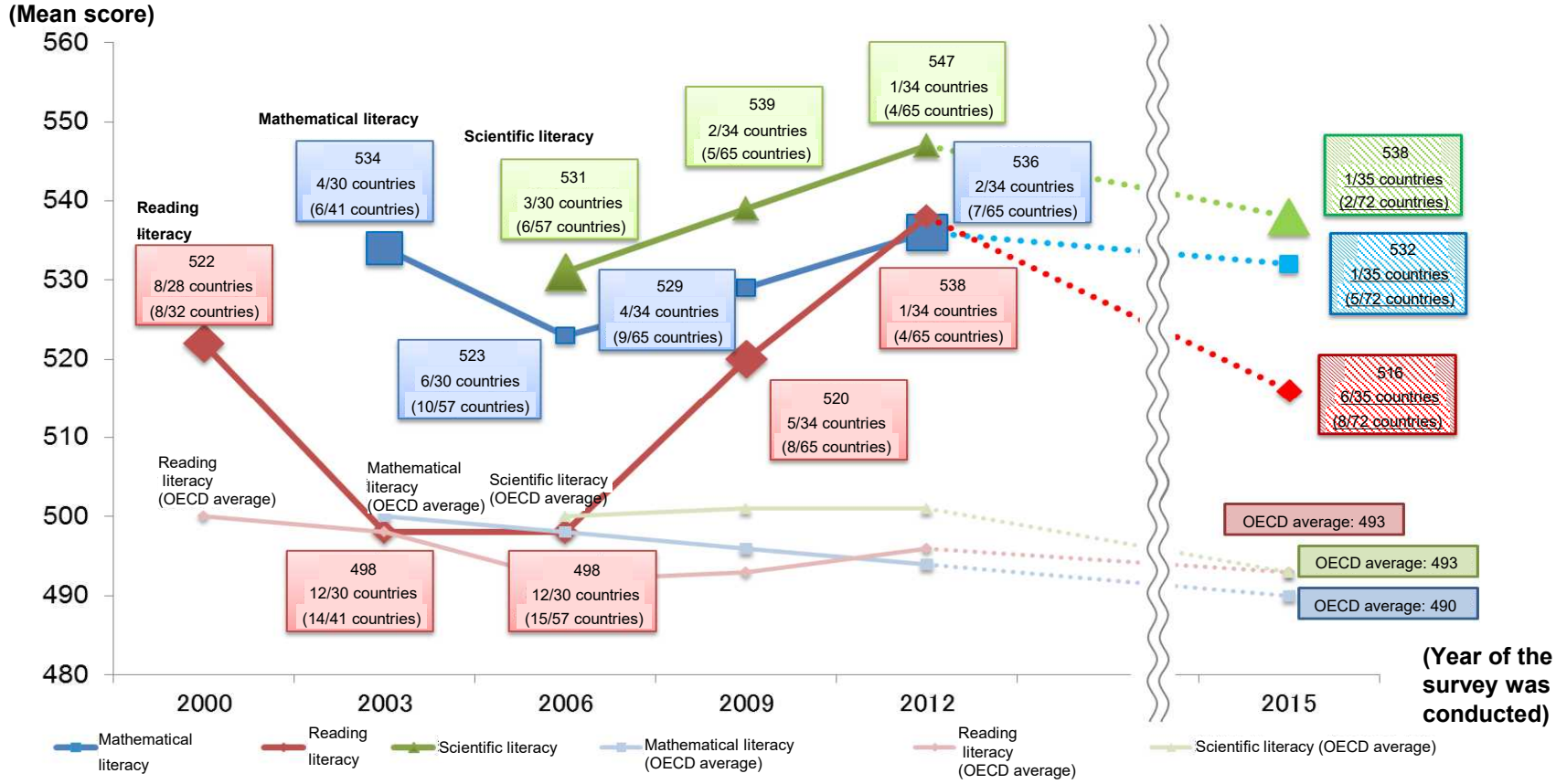
Summary of results

○ In all the domains of scientific literacy, reading literacy and mathematical literacy, Japan continues to place in top performing group with high mean score from an international viewpoint.

Changes in mean score and ranking

*The scores are estimated based on OECD average of 500 points when each domain first became the major domain (reading literacy: 2000, mathematical literacy: 2003, scientific literacy: 2006). The results since the survey in which mean scores can be compared over the year for mathematical and scientific literacy. The marks for the years where the literacy became the major domain are larger.

*Wave line is drawn between 2012 and 2015, due to the shift from PBA to CBA and the changes in way of scaling and scoring.



Summary of results of PISA 2015

Characteristics of results for Japan

○ Regarding four index values of “Enjoyment of science”, “Instrumental motivation to learn science”, “Science self-efficacy”, and “Science Activities, which are comparable with PISA 2006 survey, the proportion of Japanese students who responded positively in the “Instrumental motivation to learn science” index, etc. is increasing, although Japanese index values are lower than OECD average.

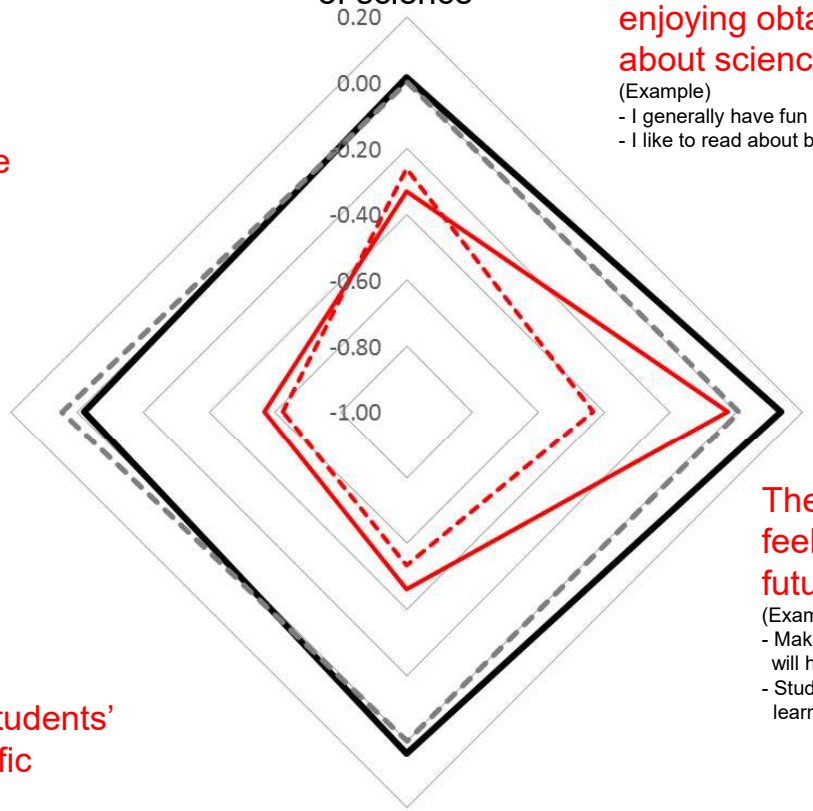
- Change in index values in Japan

Index of “Enjoyment of science”

The higher the value, the more students are enjoying obtaining knowledge and learning about science.
(Example)
- I generally have fun when I am learning broad science topics.
- I like to read about broad science.

The higher the value, the more students are actively engaged in activities related to science.
(Example)
- Visit web sites about broad science topics.
- Watch TV programmers about broad science.

Index of “Science activities”



Index of “Instrumental motivation to learn science”

The higher the value, the more students feel that science study will be useful in the future.
(Example)
- Making an effort in my school science subjects is worth it because this will help me in the work I want to do later on.
- Studying my school science subjects is worthwhile for me because what I learn will improve my career prospects.

The higher the value, the greater the students’ confidence in their ability to use scientific knowledge in a certain context.
(Example)
- Explain why earthquakes occur more frequently in some areas than in others.
- Describe the role of antibiotics in the treatment of disease.

Index of “Science self-efficacy”

Japan (2015) Japan (2006) OECD average (2015) OECD average (2006)

Summary of results of TIMSS 2015

Characteristics of results by subject

- Fourth and eighth grade student achievement continues to maintain a high rank in all subjects, and average scores are significantly higher compared to the previous survey.
- From 2003 onwards, the tendency is that the proportion of students scoring less than 550 points is decreasing while the proportion of students scoring 550 points or more is increasing over time.

Trends in average score

		1995	1999		2003		2007		2011		2015	
Grade 4	Mathematics	567 (3/26 countries)	(Not surveyed)		No significant difference	565 (3/26 countries)	No significant difference	568 (4/36 countries)	Significant increase	585 (5/50 countries)	Significant increase	593 (5/49 countries)
	Science	553 (2/26 countries)	(Not surveyed)		Significant decrease	543 (3/25 countries)	No significant difference	548 (4/36 countries)	Significant increase	559 (4/50 countries)	Significant increase	569 (3/47 countries)
Grade 8	Mathematics	581 (3/41 countries)	No significant difference	579 (5/38 countries)	Significant decrease	570 (5/45 countries)	No significant difference	570 (5/48 countries)	No significant difference	570 (5/42 countries)	Significant increase	586 (5/39 countries)
	Science	554 (3/41 countries)	No significant difference	550 (4/38 countries)	No significant difference	552 (6/45 countries)	No significant difference	554 (3/48 countries)	No significant difference	558 (4/42 countries)	Significant increase	571 (2/39 countries)

*The score of each country/region is a value indicating the change from the reference value in the 1995 survey (500 points (standardized to give two thirds of target children from 400 points to 600 points)).

Summary of results of TIMSS 2015

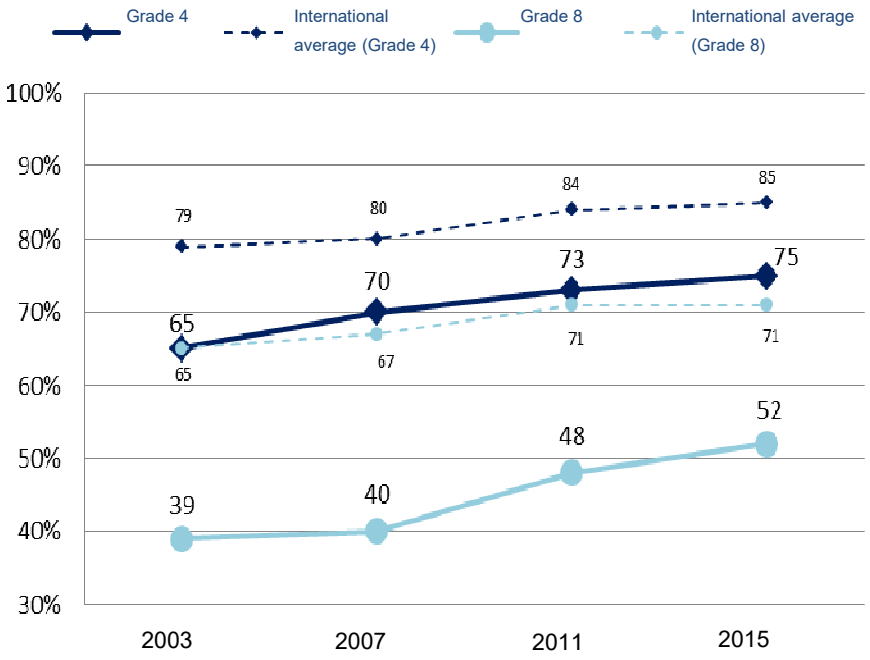
Summary of results of the questionnaire

○ Regarding attitudes towards mathematics and science:

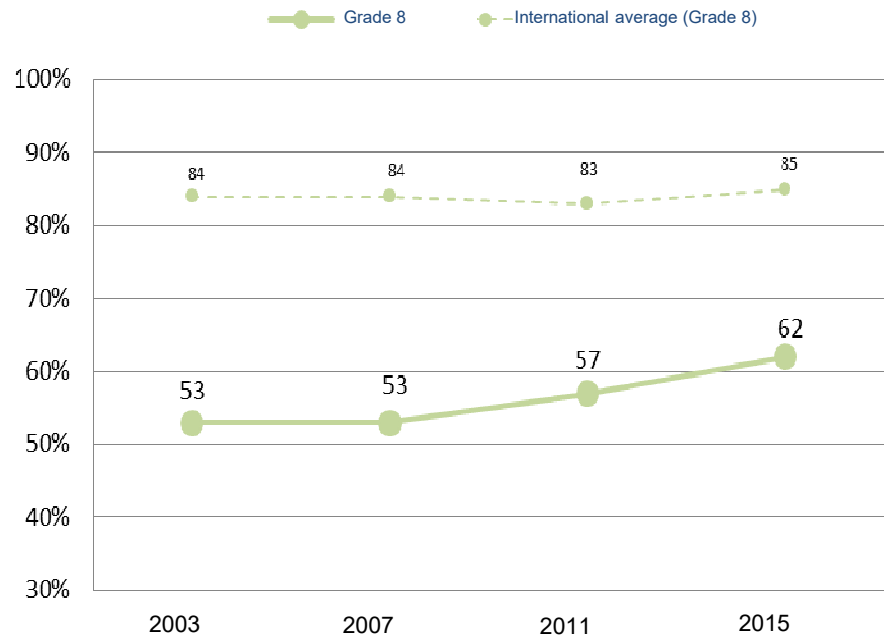
- As in the previous survey, many items are below the international average with the exception of "I enjoy learning science" in the fourth grade, but the proportion of students who enjoy learning mathematics and science is increasing, and the trend for the eighth grade is that the difference with the international average is shrinking.
- In the eighths grade, the proportion of students who respond "Will help me in my daily life," "Need to do well to get the job I want" concerning mathematics and science is increasing, and the difference with the international average is tending to shrink.

● Changes in positive responses for each question item

I enjoy learning mathematics



I think learning science will help me in my daily life



Transition in National Curriculum Standards

Revised 1958–1960

Clarification of characteristic as standard of curriculum
(New introduction of time for moral education, enhancement of basic academic ability, improvement of science and technology education, etc.) (emphasis on systematic learning)

(Implemented)
Elementary schools: FY1961, junior high schools: FY1962, high schools: FY1963 (implemented by class)

Revised 1968–1970

Further improvement of educational content ("modernization of educational content")
(Introduction of educational content corresponding modern developments) (Introduction of sets in mathematics etc.)

(Implemented)
Elementary schools: FY1971, junior high schools: FY1972, high schools: FY1973 (implemented by class)

Revised 1977–1978

Realization of a comfortable and fulfilling school life = adjustment of learning burden
(Goals and content for each subject etc. narrowed down to core items)

(Implemented)
Elementary schools: FY1980, junior high schools: FY1981, high schools: FY1982 (implemented by class)

Revised 1989

Development of spiritually rich people who can respond to changes in society
(New establishment of Living Environment Studies, enhancement of moral education)

(Implemented)
Elementary schools: FY1992, junior high schools: FY1993, high schools: FY1994 (implemented by class)

Revised 1998–1999

Ensuring acquisition of the foundations and basics, and fostering a "competency," such as the ability to learn and to think actively
(Careful selection of educational content, new establishment of "the Periods for Integrated Studies")

(Implemented)
Elementary schools: FY2002, junior high schools: FY2002, high schools: FY2003 (implemented by class)

Partially revised 2003

Further realization of the objectives of National Curriculum Standards (e.g. clarification that content not indicated in government curriculum guidelines may be taught, teaching by proficiency level at elementary schools as illustrated by teaching according to the individual and addition of supplementary curriculum for elementary and junior high schools)

Revised 2008–2009

Cultivation of "competency," acquisition of basic/fundamental knowledge/skills, and balance of the ability to think/make decisions/express oneself etc. (Increase in class hours, enhancement of teaching content, introduction of foreign language activities at elementary schools)

(Implemented) Elementary schools: FY2011, junior high schools: FY2012, high schools: FY2013 (implemented to all classes)
*Advance implementation in FY2009 for elementary and Junior high schools, and in FY2010 for high schools

Background to the revision of government curriculum guidelines

Won't our occupations disappear with the evolution of AI?

Won't what I am taught at school become obsolete in the future?

To realize school education that can foster the necessary competencies for children to become creators of the future, even during rapid social changes such as informatization and globalization.

Schools and society share and achieve **the goal** of **creating a better society through better school education**

As the structure of society and industry changes and there is a transition to a mature society in which qualitative affluence supports growth, we are required not only to efficiently discharge prescribed procedures, but to consider what sort of future to create and how to further improve society and life, while exercising our sensibilities, and to create new value through continuing proactive learning to draw forth our capabilities, conducting trial and error, and collaborating with other diverse people. As such there is an opportunity in forming a shared recognition between schools and society of the importance of fostering the competencies required for the new era including the knowledge to live and work through school education.

In order to **further develop the excellence of school education, National Curriculum Standards shall be indicated and widely shared** as a **"map of learning"** that gives an easy-to-understand picture of the competencies children should acquire and the content they should learn through school education.

- Clarify the competencies that are required in the new era and incorporate them into educational targets. This makes children aware of the significance of learning and its outcome and reflects them to the next learning, facilitating the realization of curriculum management by sharing educational targets between the school, the community and the family.
- Clarify the characteristics of learning in each subject to realize a high-quality learning process that fosters the knowledge, and clarify the perspective of class improvement ("Perspective of active learning"). This achieves deep learning according to the characteristics of the subject and further improvement of the class through "lesson study," which is a strength of Japan.

Philosophy of the future curriculum

The school and society share the target of creating a better society through better school education, and each school will realize this through collaboration and cooperation with society while clarifying how to learn the necessary educational content and how to acquire certain competencies.

<Curriculum open to society>

(1) While taking into consideration the conditions of society and the world, to set and share the goal, "creating a better society through better school education via school curriculum.

(2) To clarify and foster the competencies required of the children who will create the society of the future to face and participate in society and the world and to move forward with their own lives.

(3) In implementing the curriculum, local human and material resources will be utilized, coordination will be made with social education that utilizes after school time and Saturdays, etc., and the aims of school education shall be realized while sharing them and collaborating with society, without limiting school education to within the school.

Direction of the National Curriculum Standards Revisions

Fostering competencies necessary for the new era and enhancing learning evaluations

Cultivation of **human nature and the ability to pursue learning** so that one strives to apply learning to life and society

Acquisition of the **knowledge and skills** necessary to live and work

Developing the **abilities to think, make decisions, and express oneself** to be able to respond to unprecedented situations

What can be achieved

By sharing the goal of bringing about a better society through improved school education, we will realize "**curricula that are open to society**," that develop the qualities and abilities of students to become creators of the future in conjunction with society

Realization of "**curriculum management**" at each school

What to learn

Introducing new subjects and subject subdivisions, and reviewing objectives and content based on the qualities and abilities necessary for the new era

Adopt foreign language education as a subject at elementary schools and introduce a new subject "Public (provisional name)" at high schools

Clarify the qualities and abilities to be developed in each subject and show the goals and content in a structured manner

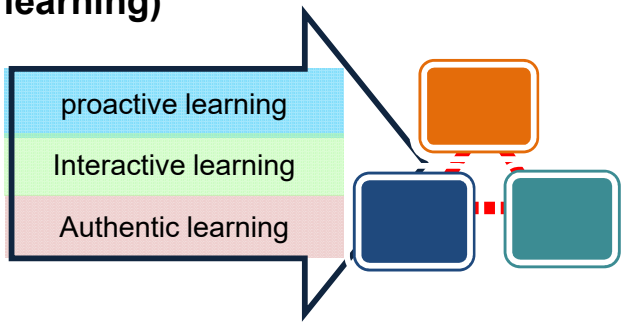
The learning content will not be reduced*

How to learn

Improving the learning process from the perspective of proactive, interactive, and authentic learning (active learning)

Develop the qualities and abilities needed for the new era, including acquisition of the knowledge and skills necessary to live and work

Improve the quality of the learning process to achieve quality understanding without reducing the amount of knowledge



*With regard to high school education, comprehensive reforms to build connections between high schools and universities will be carried out in order to overcome the current system for selecting university entrants, which involves the simple memorizing of trivial knowledge.

Three Pillars of competency required in new era

Ability Geared Toward Learning
Human Nature Etc.

How can I lead a better life and how can I interact with society and the world?

"Solid academic ability", "rich sense of humanity" and "sound body" are comprehensively structured.

What do I know? What can I do?

knowledge and skill

How can I use what I know and can do?

Ability to think, make decisions, express oneself.

Realization of self-directed/interactive and deep learning (Improvement of class from the viewpoint of “active learning”) (image)

Realize high-quality learning in school education, deeply understand the contents of learning, acquire qualities and abilities, and enable lifelong active learning by improving classes from the viewpoint of “proactive/interactive and deep learning”

[Proactive learning]

Is “proactive learning” realized, by which one works tenaciously with vision and reviews one’s learning activities to reflect to the next step while maintaining curiosity and an interest in learning and associating learning with the direction of one’s career development?

[Example]
- Have curiosity and an interest in learning, work tenaciously with vision each class, review one’s learning, and reflect it to the next learning
- Leverage “career passport (tentative name)” etc. to obtain a picture of one’s learning situation and career formation, and to review them

Proactive learning

Interactive learning

Authentic learning

Fostering the **ability to approach learning and human qualities, etc.** that intend to make use of learning in life and society

Learning the **knowledge and skills** to live and work

Nurturing the ability to **think/judge/express oneself** etc. to be able to respond to unknown situations

[Interactive learning]

Is “interactive learning” that broadens and deepens one’s thoughts through collaboration among children, interaction with teachers and local people, consideration based on the thoughts of great thinkers of the past, etc.?

[Example]
- Expand idea by studying how people working in the real world cooperate to solve problems seen in society and by listening to the stories of people living in the real world
- Notice new ways of thinking and make one’s own ideas more appropriate by exchanging opinions and discussing what one thought of individually in advance
- Aim for interaction between children and teachers, children and local people, and through books with their authors etc., in addition to interaction between children

[Authentic learning]

In the learning process consisting of acquisition, application and exploration, while applying “viewpoints/ways of thinking” according to the characteristics of each subject etc., is “authentic understanding” being realized for creation based on thoughts and feelings by mutually correlating knowledge for deeper understanding, by examining information to formulate ideas, and by identifying problems and considering solutions?

[Example]
- Engage in the process of investigation through identifying one’s own questions from events, and examining and solving issues
- Form one’s own ideas based on the information examined, communicate according to purpose, context, circumstances, etc., and form ideas as a group through communicating ideas
- Exercise sensibility to create rich meaning and value based on thoughts and feelings

Three aspects of curriculum management

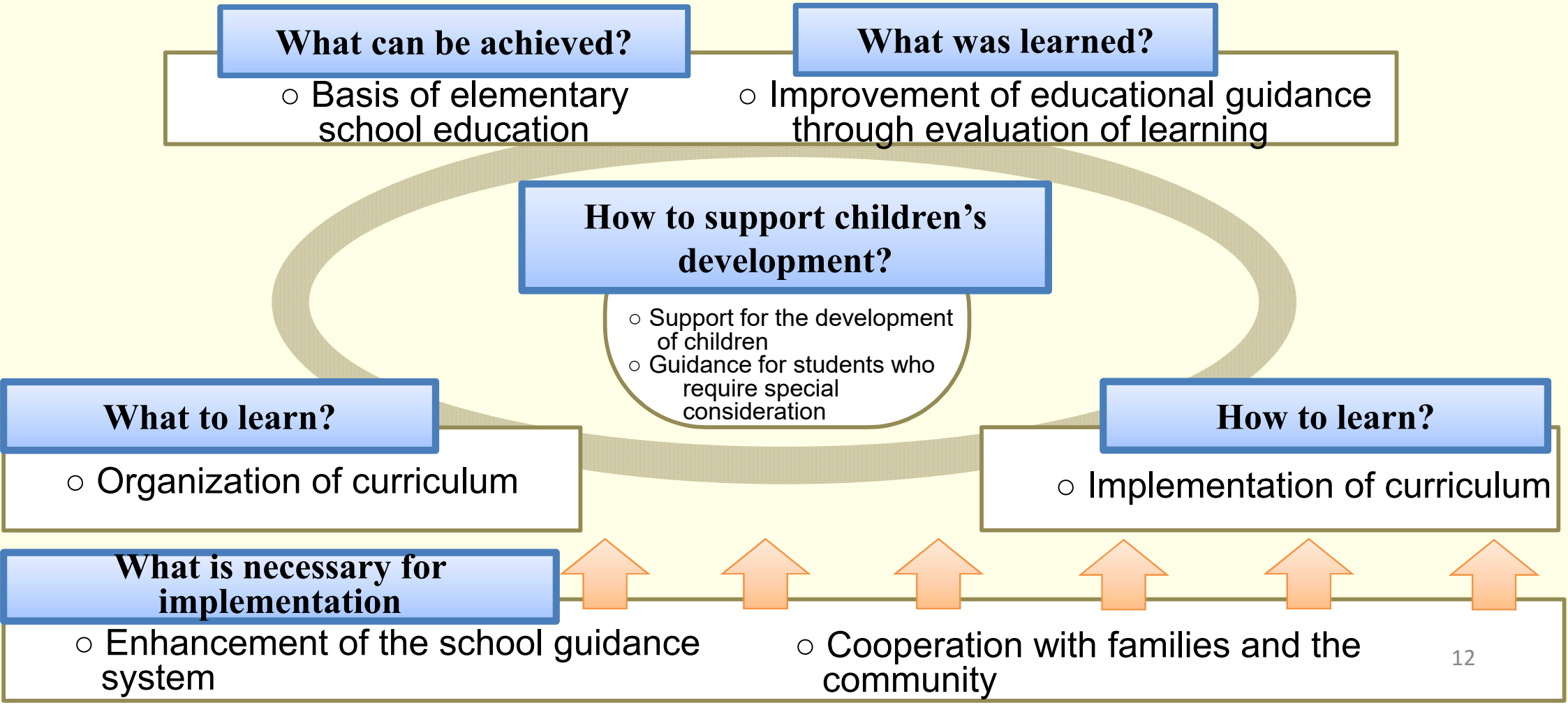
(1) Grasp educational contents of each subject etc. in their mutual relationship and systematically arrange the contents of education necessary for the achievement of targets from a cross-curricular perspective based on the school's educational target.

(2) Establish a PDCA cycle to organize, implement, evaluate and improve the curriculum based on surveys and various data, etc., on the state of children and the current situation of the community etc. in order to improve the quality of educational content.

(3) Utilize and efficiently combine educational content and human/material resources etc. necessary for educational activities, including local and other outside resources.

Structure of the government curriculum guidelines general provisions and image of curriculum management

Concerning the structure of the curriculum, the nature of the qualities and abilities required for the new era and the concept of active learning, etc. in order that **all teachers can deepen understanding** through in-school training and at diverse training sites, **fundamentally improve the "general provisions" that are the keystone of the government curriculum guidelines and set forth basic principles of the curriculum** from the perspective of "What skills will be learned?" "What to learn?" "How to learn?" and **indicate the basic principles of the curriculum, and clarify and organize the necessary matters**.



Structure of Subjects and Subject Subdivisions at High Schools

… Compulsory subjects

…Compulsory elective subjects

※Subject names are tentative translations.

* Existing subject subdivisions are indicated by a gray text box

Japanese Language

- Ethics and Japanese Language
- Literature and Japanese Language
- Japanese Language Expression
- Classics Research
- Contemporary Japanese Language
- Language and Culture

Foreign Languages

- English Communication II/III （Integration of “listening,” “reading,” “speaking,” and “writing”)
- Logic and Expression I/II/III (Speeches, presentations, debates, and discussions)
- English Communication I (Integration of “listening,” “reading,” “speaking,” and “writing”)

* To be considered based on the results of English skills surveys, CEFR levels, and in response to the diverse range of learning needs of high school students.

Geography and History

- Geography Research
- Japanese History Research
- World History Research
- Integrated Geography
- Integrated History

Civics

- Ethics
- Politics and Economy
- Public

Home Economics

- Basic Home Economics
- Integrated Home Economics

Information

- Information II
- Information I

Science and Mathematics

- Advanced Science and Mathematics Research
- Basic Science and Mathematics Research

Period for Integrated Research

- Period for Integrated Research

* The principle of the Period for Integrated Research will be clarified: to develop the research ability of students through the practice of researching challenges that the students themselves have discovered in the real world and everyday life while making connections to their own career formation.

Mathematics

- Mathematics III
- Mathematics C
- Mathematics II
- Mathematics B
- Mathematics I
- Mathematics A

Science

	Advanced Physics	Advanced Chemistry	Advanced Biology	Advanced Earth Science
Science and Our Daily Life	Basic Physics	Basic Chemistry	Basic Biology	Basic Earth Science

The direction of revisions to the subject of mathematics in the high school government curriculum guidelines

High school mathematics course

Current subject

Mathematics I (required)
Mathematics II
Mathematics III
Mathematics A
Mathematics B
Applied Mathematics

After revision

Mathematics I (required)
Mathematics II
Mathematics III
Mathematics A
Mathematics B
Mathematics C (new)

Scientific and Mathematical Inquiry (new)

Fundamental Scientific and Mathematical Inquiry (new)

*Positioned as a high school science and mathematics course.

- With the introduction of Scientific and Mathematical Inquiry and Fundamental Scientific and Mathematical Inquiry, Applied Mathematics is abolished.
- Mathematics C is established and the content of Applied Mathematics is transferred to Mathematics A, Mathematics B and Mathematics C.
- Mathematics C comprises “utilization of data” and other content.
- Regarding statistical content, emphasis is placed on cooperation with the IT course in particular.

Image of education in investigative subjects spanning mathematics and science at high school

*Comprising the following two subjects

Implementation stage

"Scientific and Mathematical Inquiry"

Stage of further inquiry

- Students use the qualities and abilities gained in the foundation to set their own problems and conduct the entire process of inquiry.
- Students independently obtain the individual skills and knowledge necessary to conduct investigation according to their problem and aim for deeper inquiry.
- In the inquiry, actively utilize external institutions such as universities and companies to enhance quality.
- From the success or failure of the experiment and the analysis themselves, emphasize the process of proactively conducting trial and error while accepting the risk of failure.

Basic stage

"Fundamental scientific and mathematical inquiry"

Stage of basic learning

- Students must acquire the basic qualities and abilities to conduct the entire process of inquiry themselves.
- Students must acquire an attitude of engaging in self-led inquiry through deepening their understanding of the significance of striving in the creation of new value etc.
- Students must obtain a basic understanding of research ethics etc.

Support from universities and businesses etc.

Students use what they have learned in the foundation to set their own problems and conduct the entire process of inquiry.

Students present the results of inquiry inside and outside the school.

Example of the learning process

Learn about methods of inquiry

Under the guidance of teachers, students consider how to move forward with the experiment/observations and methods of analysis, and conduct an inquiry into the selected problem etc.

Learning for a basic understanding of research ethics

Present results in school etc.

Development of Next-Generation in STEM

In order for Japan to lead the world in science, technology, engineering and mathematics (STEM) in the future, it is necessary to continuously and systematically foster talented children who will lead the next generation. For that, Japanese government uncovers children with exceptional abilities and carries out efforts to foster and develop those talents.

Elementary school → Junior high school → High school → University → Society

Fostering top-class children (future global leaders)

Expanding base (encouraging interest in STEM)

(4) Promotion of STEM contests

(3) Fostering next-generation Scientists Program

(2) Global Science Campus (GSC)

(1) Super Science High Schools (SSH) Program

Promotion of practical science research activities for junior and senior high school students

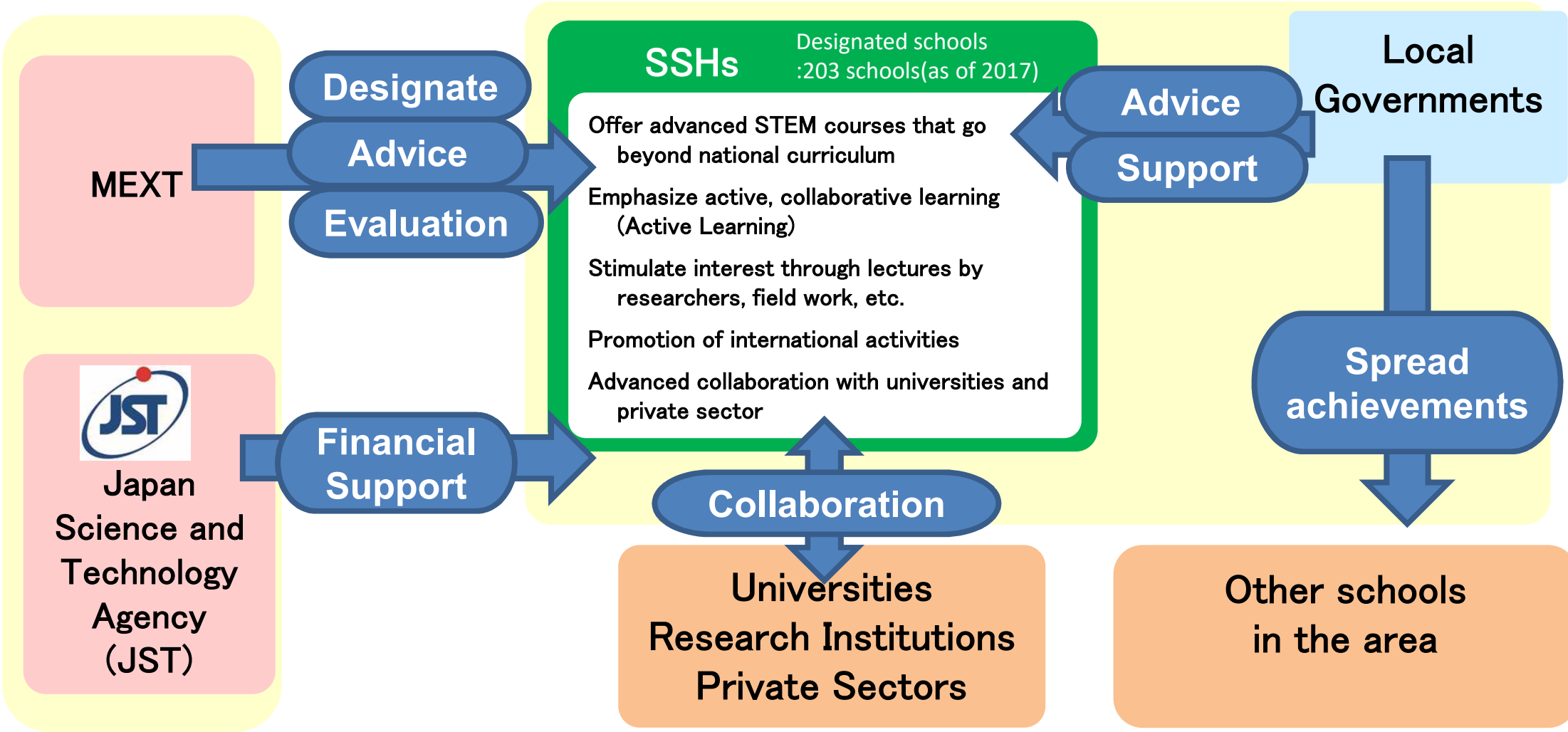
Supporting Female Junior, Senior High School Students to Choose STEM careers

▪ Strategic, systematic fostering, securing of S&T human resources

Creation of next-generation human resources for diverse S&T innovation

(1) Super Science High Schools (SSH) Program ①

MEXT has designated high schools that provide advanced STEM education as “Super Science High Schools” (SSH)
SSHs will serve as bases for the fostering of human resources that will be able to play important roles globally in the future.



(1) Super Science High Schools (SSH) Program ②

《Examples of advanced efforts at SSHs》

Advanced Research (topic at 2016 SSH Research Presentation Awards Meeting)

Winner of MEXT Minister award: Fukuoka Prefectural Kasumigaoka HS

"Improving Flight Performance of Horizontal-Axis Airborne Objects – Applying Wind Power Generators"

Japan Science and Technology Agency Prize:

- Hyogo Prefectural Kakogawa Higashi High School: "Design of New Small-Winged Wind Mills"
- Hyogo Prefectural Kobe High School: "Memory and Rebirth of Planaria"

⇒ "Research" (setting scientific problem, research through observation, testing)
It is characteristic activities of SSHs compared to other high schools. Independent, collaborative study and research.

Overseas collaboration

(Kyoto Pref. Sagano HS)

- Systematic promotion of overseas collaboration
- Asia Science WS, Singapore, Kyoto
- Joint experiments using "science English"

Raising interest in STEM

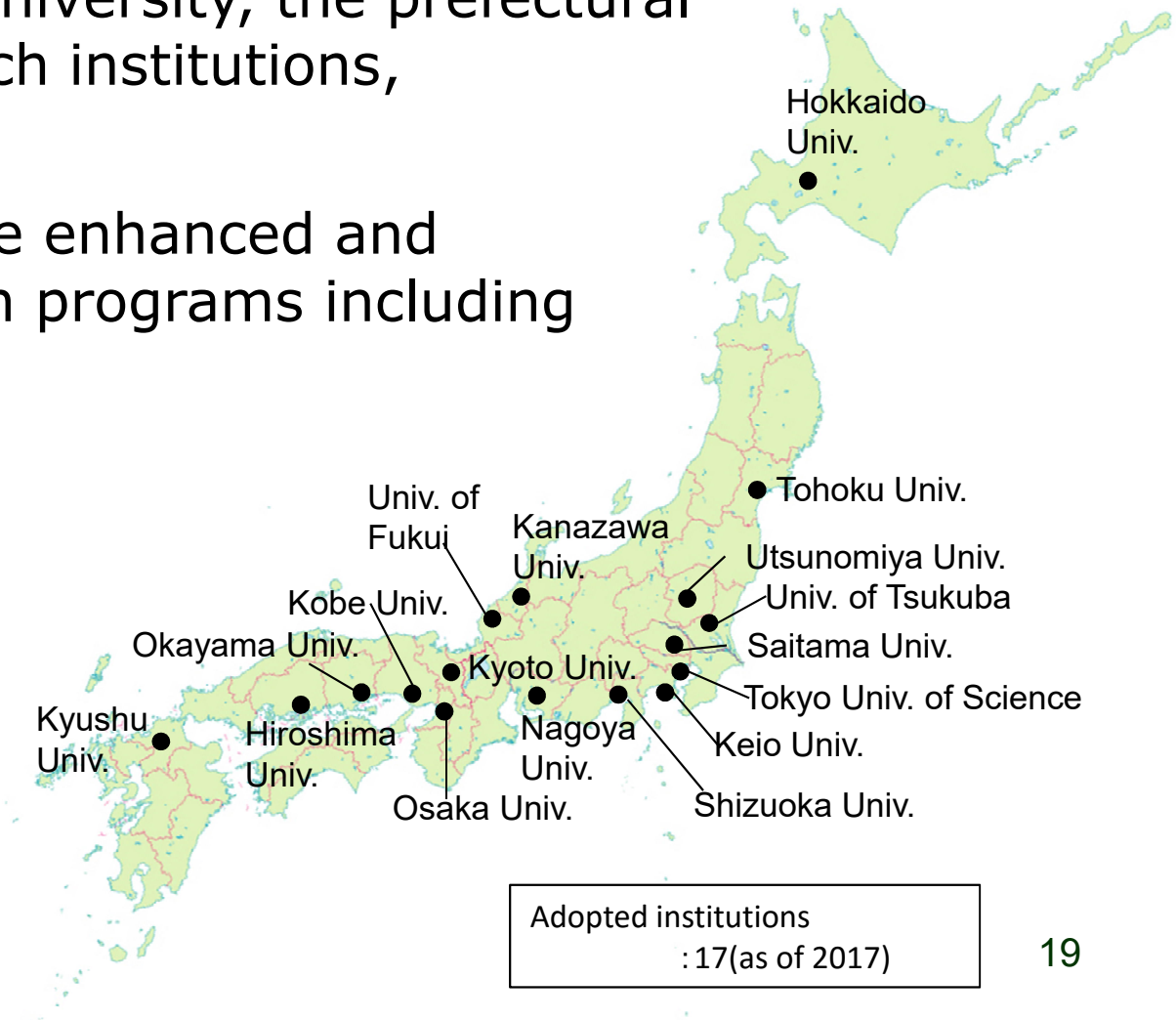
(Chiba Pref. HS)

- Collaboration among pref. elementary, junior and senior high schools
- Prefecture-wide "Chiba Science School Festival"
- High school-university linkage seminar

(2) Global Science Campaus

- targets the motivated and talented high school students in the region,
- is led by a university and promoted through a consortium including the university, the prefectural education committee research institutions, private enterprises etc.,
- develops and implements the enhanced and systematic science education programs including international activities.

Students' poster presentation



Adopted institutions
: 17(as of 2017)

(3) Fostering next-generation Scientists Program (NEW)

Targeting elementary and junior school students who are especially eager and motivated to study science, math, ICT.
Universities and other institutions provide special educational programs to foster their capabilities.

students selected based on reports, interviews, attendance, tests etc.

Special spports by univ. faculty, grad students

Layer2
Assignments to appropriate labs
Individualized guidance on conducting research activities
Making presentations at various opportunities

Particularly motivated, highly capable children

Layer1
Learn basics of science through wide-ranging lectures, lessons, small-group experiments, observation of advanced facilities, understanding of role of science in society, ethics.
Students will discover areas they are particularly interested in.

Eager elementary and junior high school students in regions nationwide

Nationwide events
Excellent elementary, JHS students

Examples:
Lectures by Nobel laureates, presentations of research results, etc.

Adopted institutions
: 10(as of 2017)

Recruitment

- Self-recommendation (parents' recommendation)
- Recommendation by BOE, school
- Participation in Science Olympiads, Science Koshien other events
- Recommendation through science museum, etc.
- Others (recruitment by individual method of organization)

(4) Promotion of STEM Contests

MEXT is making opportunities for junior and senior high school students with strong interest and ability in STEM to test their skills against each other.
It is important to foster excellent students in STEM who will be able to play active roles internationally and increase the number of students who want to study these fields.

Example : International Science Olympiad

Trends in number of participants in National Olympics (unit: 1 person)

2004	…	2010	2011	2012	2013	2014	2015
3,257	…	10,845	12,855	14,764	16,388	18,089	19,016

*No. of participants: No. of contestants in domestic contests targeting mainly high school students leading to participation in international contests next fiscal year.

International Science Olympiads to be held in Japan
⇒Earth sciences (2016), Information (2018), Biology (2020), Chemistry (2021), Physics (2022), Math (2023)

Record at 2016 International Science Olympiad)

	Gold	Silver	Bronze
Math	1	4	1
Chem.	1	3	0
Biology	1	3	0
Physics	3	1	1
Info	2	2	0
Earth sciences	3	1	0
Geography	0	2	1
Total	11	16	3

Analysis of Saitama's New Assessment for Skills

Research assumes that the implementation of Active Learning leads to an improvement in Non-cognitive Skills and Learning Strategies which have an effect on Cognitive Skills.

(1) Active Learning is positively correlated with Learning Strategies (three categories*)

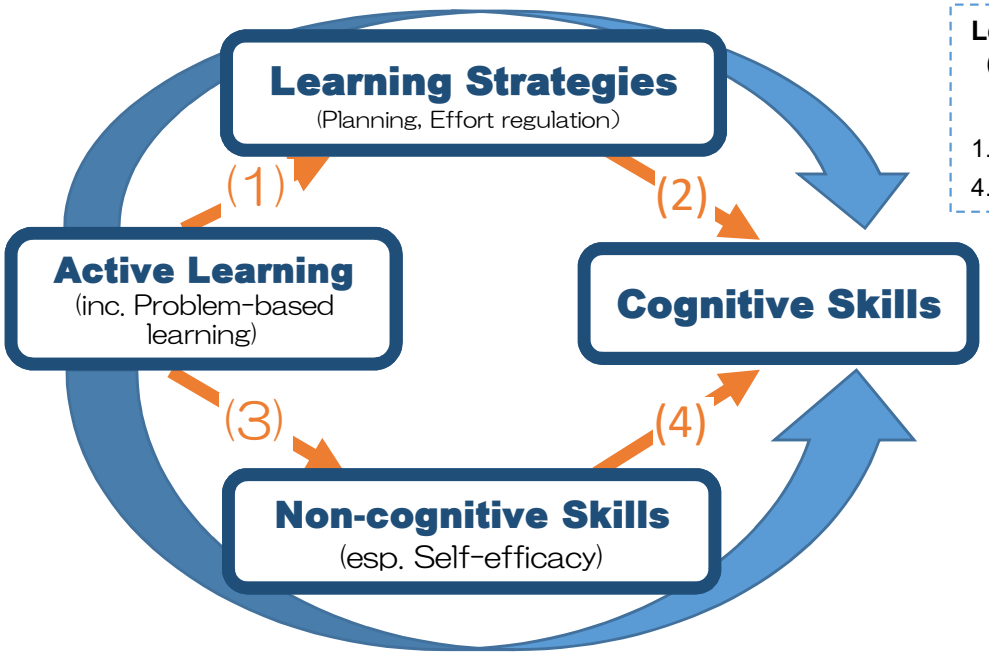
*planning, operation, effort regulation

(2) Learning Strategies (three categories*) **have positive correlations with Cognitive Skills.**

*planning, critical thinking, effort regulation

(3) Active Learning is strongly correlated with Non-cognitive Skills.

(4) Non-cognitive Skills have a positive correlation with Cognitive Skills.



Learning Strategies
(Strategies students consciously/ intentionally use to improve learning)

1. Flexibility 2. Planning 3. Operation
4. Human resources 5. Meta-Cognition 6. Effort regulation

• Perspective/direction for administrative advice to improve cognitive/non-cognitive skills based on analyses

1. Analyses suggest that improvements in learning strategies/non-cognitive skills lead to an improvement in cognitive skills.(2)(4)

2. Active learning (inc. problem-based learning) improves learning strategies/non-cognitive skills and leads to more effective teaching.(1)(3)

Analysis of Saitama's New Assessment for Skills

Only Survey in the world to consecutively and accurately evaluate changes in skills

1 IRT (Item Response Theory): used to accurately assess skills. (This method is also used for TOEFL.)
2. Panel Data : used to consecutively track the same student.

● Saitama's New Assessment for Skills (2015-)

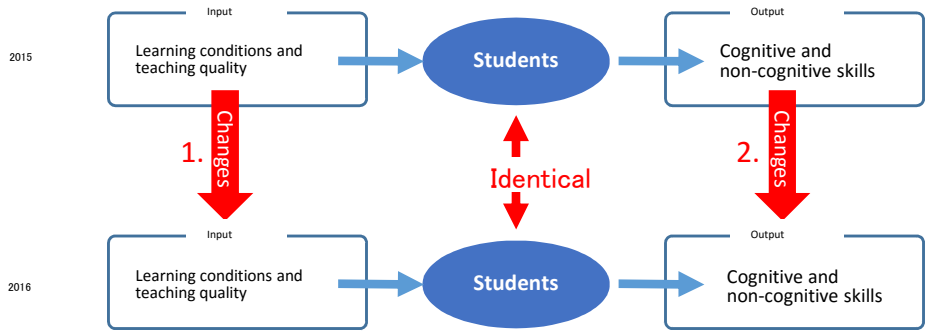
Purpose	To develop each student's skills through improvement in educational policy and teaching based on data showing changes in both cognitive and non-cognitive skills
Date	1st Test: 16 April 2015 2nd Test: 14 April 2016 3rd Test: 13 April 2017
Target	Exhaustive survey (All students from 4th grade elementary school through 7th-9th grade junior high school in Saitama Prefecture) 2015: 708 elementary schools, 150,310 students 360 junior high schools, 148,013 students 2016: 708 elementary schools, 149,227 students 356 junior high schools, 146,323 students
Outline	(1) Survey for students a. Questions about subjects 4th grade elementary school through 7th grade junior high school: Japanese, Mathematics 8th and 9th grades junior high school: Japanese, Mathematics and English b. Questions for Questionnaire Learning Strategies and Non-cognitive Skills (self-assessment) (2) Survey for schools and municipalities (3) (Only in Toda City) Survey for teachers (Priority issues for teaching)
Research Team	(1) A research team commissioned to statistically analyse 2015 and 2016 data (2) Research team : Keio University, Shonan Fujisawa Campus (3) Main researchers: Keio University, Dr. Nakamura, Professor Shizuoka University, Dr. Masukawa, Vice Professor (4) Analysis approach 1. Correlative analysis between changes in Cognitive Skills and answers about Non-cognitive Skills and Learning Strategies 2. Subject-oriented field work research

Analysis of Saitama's New Assessment for Skills

To identify causes for an improvement in cognitive skills, We need :

1. Input: consecutive data about changes in learning conditions and teaching quality

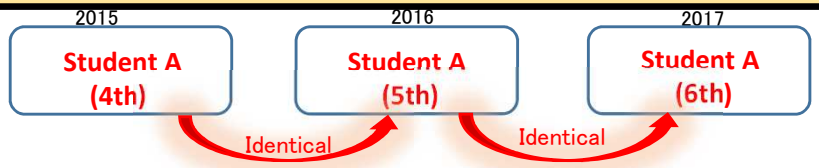
2. Output: consecutive data about changes in cognitive and non-cognitive skills



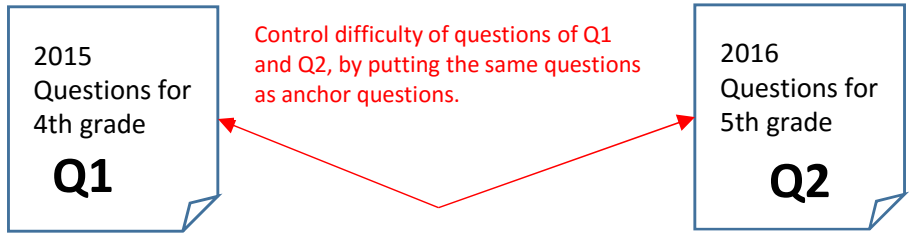
Data of 1 and 2 make it possible to analyze which input leads to an improvement in cognitive and non-cognitive skills.

Saitama's New Assessment

1. Panel Data:
Possible to collect consecutive data to trace changes in input and output of same students



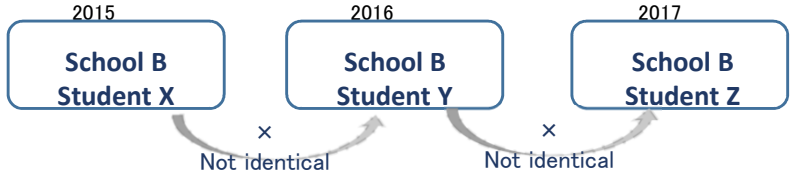
2. Item Response Theory:
Possible to compare the scores between different questions consecutively by using maximum-likelihood estimation



Saitama New Assessment can analyse the decisive issues for an improvement in cognitive and non-cognitive skills

Usual assessment

Impossible to collect consecutive data , as only taking non-consecutive data to focus on a specific grade
(Cross-sectional Data)



Impossible to trace changes in cognitive skills, as each year students answer different questions
(Impossible to conclude the reasons for changes in student scores, such as whether questions are easier than the previous assessment or if students have acquired higher skills.)