

# **Competencies and Capability Development of Science Teacher in Japan's Teacher Training**

—The System and Concrete Image of Teacher  
Training for Science Teachers—

Yusuke ENDO, Ph.D & Yoko YAMAMOTO, Ph.D  
( Faculty of Human Science, University of Tsukuba )



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# 1. Professional Growth of Teachers throughout Their Careers

## ■ Establishment of an “Image of Teachers Who Continue Learning”

“It is indispensable for teachers to **continue learning** with inquiry competency in order to develop their practical teaching competency throughout their careers and continuously renovate their knowledge and skills to meet rapid progress of the society.”

(Report by the Central Council for Education, 2012)

Pre-service teacher education (at universities and graduate schools)



In-service teacher education (for beginning, mid-experienced, and experienced teachers)

***Continuity of education from pre-service to in-service periods is necessary for constant promotion of the professional growth of teachers.***



## 2. The competencies required science teachers

### What competencies are required of science teachers?

- ① **Pedagogical principle competency:** Principle for education, a sense of mission as a teacher, passion, etc.
- ② **Basic practice competency:** Basic competency to conduct educational practices as an independent teacher
- ③ **Skillful practice competency:** Competency to conduct advanced educational practices as an experienced teacher
- ④ **Pedagogical research competency:** Competency to conduct research directly targeting themes of educational reality (research into effective teaching and learning strategies, etc.)
- ⑤ **Pure science research competency:** Competency to conduct research into professional themes taught in lessons

(Ohtaka, 2008)



- Every one of these competencies is indispensable to desirable lesson practices.
- **What is important is balanced and integrated development of all the competencies through participation in teacher training programs.**



## 2. The competencies required science teachers

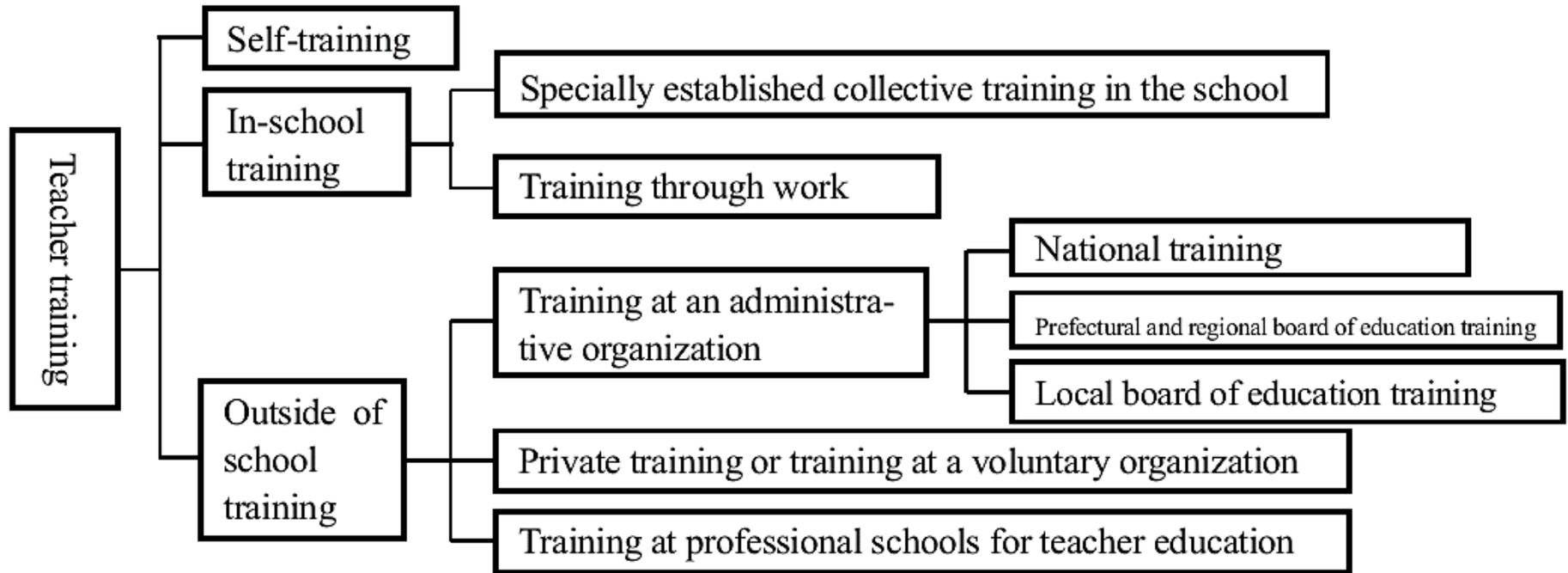
- Individual training programs are not intended for development of all the above competencies (1) - (5).
  - **Points of emphasis differ depending on intentions, positioning, and targets of individual training programs.**
- (ex.) Training programs for beginning teachers (targeting teachers in their first year of teaching) → emphasis is on (1) and (2).
  - ...These competencies are not emphasized in trainings targeting experienced teachers and teachers in administrative positions.



- **Participants are expected to reflect on their individual teaching practices, to know the degree of development of their own competencies from a metaphysical viewpoint.**
- **Based on this knowledge, participants are expected to have a vision of their future career as a teacher, and to choose and participate in training programs suitable for their own ambitions, in order to ensure professional growth as a teacher.**



### 3. Institutional framework for science teacher training



**Figure 1 Types of Teacher Training in Japan**

(Source: National Institute for School Teachers and Staff Development's, *Teacher Training Guide 2018*, p.3)



## 3. Institutional framework for science teacher training

### ( 1 ) Self-training

...Voluntary training by individual teachers based on their individual themes.

(ex.) Daily review and brush-up of science lessons, research into teaching materials, subscriptions to science education-related journals and articles, participation in academic societies, study meetings and circles, etc.



### 3. Institutional framework for science teacher training

#### (2) In-school training

...Training programs planned and organized by all teaching members of a school, for the purpose of solving a problem at the school.

##### ( i ) Specially established collective training in the school

(ex.) Science lesson study conference (both in-school programs and those open to other schools)

##### ( ii ) Training through work: “On-the-Job Training(OJT)”



## 3. Institutional framework for science teacher training

### (3) Outside of school training

...Training programs implemented in a field outside the school

#### (i) Training at an administrative organization

(Responsible entity: the state, prefectural boards of education, local boards of education)

(ex.) ■ Mandatory training programs

→ training programs for beginning teachers, and for teachers with 10 years' experience

■ Training programs for teachers with respective years of experience

→ training programs for teachers with five years' experience, for teachers with 20 years' experience

■ Training programs for specific functions

→ training programs for student guidance supervisors, for principals and vice-principals



### 3. Institutional framework for science teacher training

#### (ii) Private training or training at a voluntary organization

(ex.) ■ “Chemistry experiment workshops” co-provided by Toho University and the Chemical Society of Japan

■ Workshops for safe science experiments provided by science teaching material companies as a part of CSR activities, etc.

#### (iii) Training at professional schools for teacher education

○ “Professional Schools for Teacher Education”: Specialized graduate schools for pre-service teacher education, a framework established in 2008 to train highly-skilled professionals. After completing the course, which usually takes two years, a professional degree of “Master of Education” is granted.

**(Others) “Training programs as a part of the teacher license renewal system”**

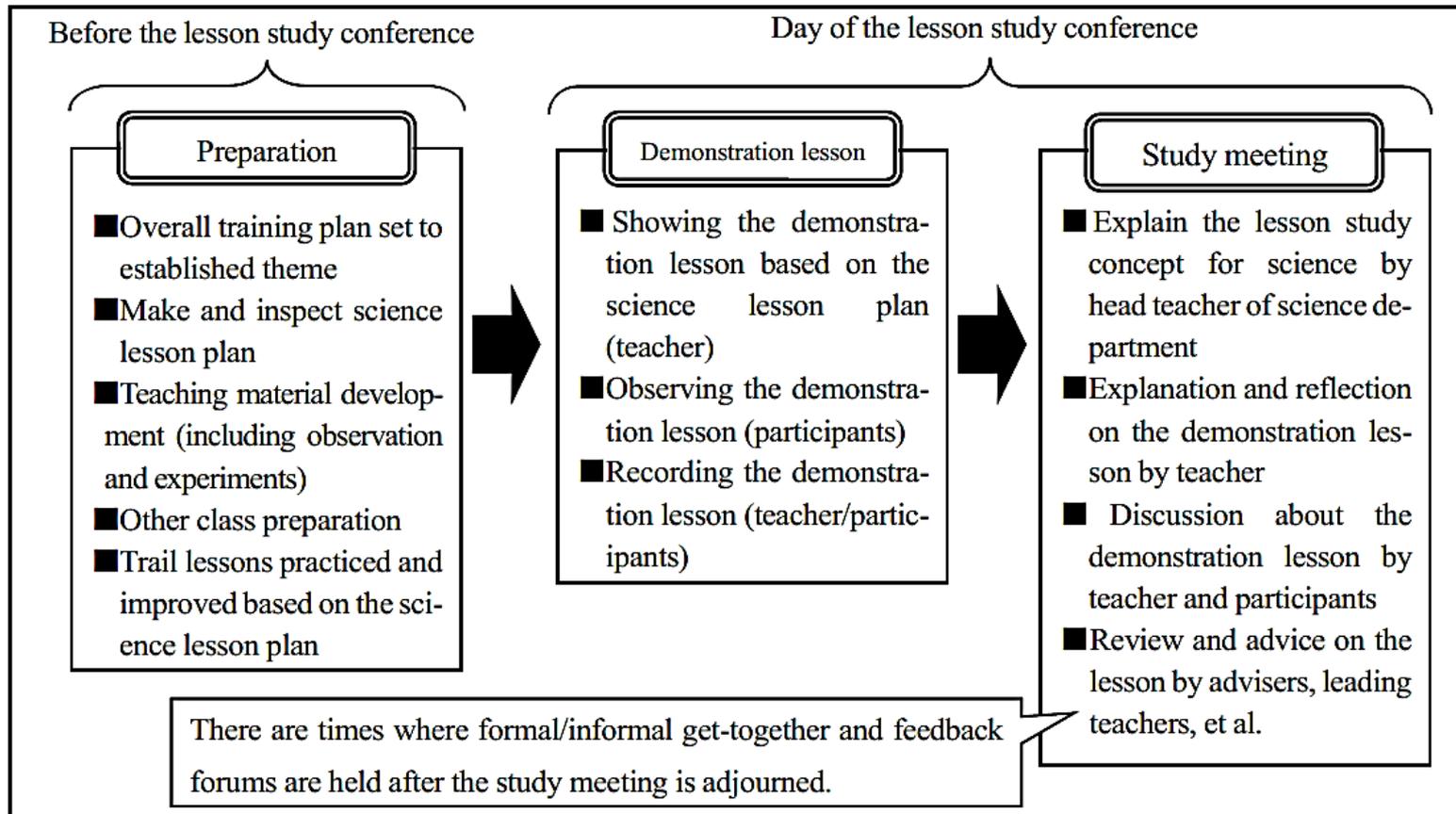


**The science teacher training system in Japan is multilayered and provides extremely abundant opportunities for training.**



# 4. A concrete image of science teacher training

## (1) Science lesson study



**Figure 2 The Basic Structure of a Science Lesson Study Conference**

(Source: created based on Ohtaka, 2012; 6-7, Isozaki, 2014; 27-29)



## 4. A concrete image of science teacher training

### Preparation

- Planning and examination of the science lesson plan, mainly by the provider of the lesson to be demonstrated (demonstration lesson).
- \* **Science lesson plan** → The plan includes the goal of the overall unit, lesson schedule, positioning of the demonstration lesson, teaching materials, learning situations of the students, the goal of the demonstration lesson, the teacher's questions and the students' expected answers, details of learning activities (including observations and experiments), the guidance and assistance method, the methods and viewpoints used in assessing learning by students, etc.
- Development of teaching materials (including how to conduct observation and experiments)
  - ※ The lesson provider may receive advice from colleagues or university teachers.



## 4. A concrete image of science teacher training

### **Demonstration lesson**

- Lesson provider (Teacher) → Conducts a lesson based on a prepared lesson plan.
  - Participants → Observe the lesson with reference to the lesson plan distributed beforehand.
- \* *In some cases, the lesson provider or colleagues record the lesson scene on video.*



## 4. A concrete image of science teacher training

### ***Study meeting***

- Explanation of the lesson study concept (by head of teacher of science department)
  - Explanation of the aim of the lesson, points of emphasis, review, etc. (by the lesson provider)
  - Discussion (by all participants)
    - Open exchanges of questions and answers between the participants and the lesson provider about preparation of teaching materials (materials, time required, etc.), lesson development, etc.
    - Group discussions → Presentations by the respective group representatives and sharing what was discussed
  - Comments and advice (by university teachers and supervisors) on the lesson
- \* *Sometimes a formal or informal review meeting or convivial gathering is held after the study meeting, though these have become rarer in recent years.*



## 4. A concrete image of science teacher training

### (2) Training courses for science teachers as a part of the teacher license renewal system

#### ○ “The teacher license renewal system”

- Started in 2009.
- The period of validity of a teacher’s license was limited to 10 years. Participation in and completion of ***training courses for license renewal***, of 30 hours or more, have become mandatory before license renewal.
  - • The training courses are provided by universities or their equivalents certified by the Ministry of Education, Culture, Sports, Science and Technology.
  - The training courses consist of “compulsory areas (6 hours or over),” “elective compulsory areas (6 hours or over)” and “elective areas (18 hours or over).” Most of the training courses relevant to science are included in the elective areas.

In the fiscal year 2018, the number of training courses in the elective areas provided by the University of Tsukuba **totaled 100**.



## 4. A concrete image of science teacher training

**Table 1** Example of Science Related Teacher License Renewal Training at University of Tsukuba in 2018 Fiscal Year

Training name
A lesson for children who like science
Understanding radiation ~The basics and principles of radiation~
Bouncy ball lecture
Energy sources and new technology
Technology that supports AI and Big Data
Playful experiments, interesting work
Discovered! Mt. Tsukuba area geopark
Talking about rice plants and rice
Moving earth ~earthquakes•tsunami•eruptions•landslides~
The Satoyama expedition
Aiming for durable and delicious vegetables ~Field trip to the Institute for Horticultural Plant Breeding~
Outdoor observations at a museum park ~Let's look up the names of the nearby plants and moss~
Animal observations ~Observing daphnia and a story about bears~
University affiliated elementary school training
University affiliated middle school training
University affiliated high school training



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**Table 1** Example of Science Related Teacher License Renewal Training at University of Tsukuba in 2018 Fiscal Year

Training name
A lesson for children who like science
Understanding radiation ~The basics and principles of radiation~
Bouncy ball lecture
Energy sources and new technology
Technology that supports AI and Big Data
Plan for experiments to interest students
<b>The training courses deal with a variety of themes, including tips for organizing science lessons, teaching methods, development of teaching materials, observations and experiments and fieldworks, the latest scientific research, and practical exercises at affiliated schools.</b>
Animal observations ~Observing daphnia and a story about bears~
University affiliated elementary school training
University affiliated middle school training
University affiliated high school training



## 4. A concrete image of science teacher training

### Course title: *"A lesson for children who like science"*

→ Based on international comparison surveys, the problems of Japanese students in academic ability in science, points to note in the new science curriculums, points of view in lesson planning based on the latest teaching and learning theories, evaluation methods to assess learning outcomes in science, etc. are explained.

- **Teachers from different types of schools and with different experiences participate in the same training courses.**

→ ○ Through exchanges of opinions, participants rethink education practices with fresh eyes, which may lead to new discoveries.  
(Participants)

△ In order to meet the needs of diverse participants, there may be conflicts in choosing case examples from various types of schools, and in deciding which age group should be most focused upon.  
(Instructors)



## 5. Conclusion

- The training system for teachers in Japan is highly multilayered and provides abundant training opportunities, including for science teachers.
  - It is important for teachers to examine and choose training programs to participate in, taking into account their respective level of competency along with the competency level required at their respective stage of life.
- While teachers in Japan show strong willingness to participate in training programs, their busy work schedules impose a major barrier, hampering them from doing so.
  - In addition to efforts to improve training programs in terms of opportunities and contents, active discussions are expected on the issue of creating an environment where teachers can participate in those programs with ease, and the issue of work style reforms, an item of heated debate among teachers.



## 6. Reference

- The Central Education Council (2015): *About the improvement of qualification and ability of teachers who are responsible for school education in the future – toward building the teacher training community for mutual learning and encouragement (Report)*.
- The Central Education Council (2012): *About the comprehensive improvement measure of teacher's qualification and ability throughout his/her professional life (Report)*.
- The National Institute for School Teachers and Staff Development (2018): *Teacher Training Guide 2018 – The Knowledge and Technique for Effective Management*.
- Tetsuo Isozaki (2014): "Theory of Education for Science Teachers" by Tetsuo Isozaki, *Teacher Training Vol.15 – For Science Education at Middle Schools*, Kyodoshuppan, pp.7-31.
- The National Institute for Educational Policy Research (2015): *International Comparison of Teaching Environment, OECD Teaching and Learning International Survey (TALIS), The survey report for 2013*, Akashishoten.
- The National Association for the Study of Educational methods (NASEM) (2009): *Lesson Study in Japan (first volume) – The History of Lesson Study and Teacher Training*, Gakushisha
- Ohtaka Izumi (2012): "Development of the Professional Competency of Science Teachers through Lesson Study", *4 East Asian Nations International Conference on Improving Mathematics and Science Teachers' Teaching Competency by Lesson Study - A critical analysis of lessons for improving students' PISA Mathematical and Scientific Literacy- The Collection of The International Symposium Research Papers*, pp.1-23.
- Ohtaka Izumi (2008): "What Do You Study at Graduate School of Education? – Its Originality and Advantage as Teacher Training", *Teachers Training Course*, vol.34, No.12, Kyodoshuppan, pp.24-27.
- Ohyama Mitsuharu (2014): "Evaluation of Teacher Training Programs for Teaching Skills in Science", *Journal of Research in Science Education*, vol.54, No.3, pp.307-316.

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