# Online and on-demand teaching materials for science education

**openaccessgovernment.org**/article/online-and-on-demand-teaching-materials-for-science-education/193801

Emily Warrender

June 10, 2025

## Masatsugu Taneda, an Associate Professor at Osaka Kyoiku University, focuses on science education, in particular, the development of online and on-demand teaching materials, including chemistry

Post-COVID-19, the importance of non-face-to-face teaching is recognised, and demand for it is growing worldwide. In Japan, online and on-demand teaching materials development are progressing rapidly due to the <u>GIGA School programme</u>. This government policy prepared sufficient ICT equipment and set up school internet connections. Demand for on-demand teaching materials for schoolteacher training is also growing.

Today, it is a concern that teachers in Japan don't have enough time to study teaching material. On-demand materials suit teachers because they can learn what they want, when convenient. <u>Osaka Kyoiku University</u> is designed as a flagship teacher education university <sup>(1)</sup> by the <u>Ministry of Education, Culture, Sports, Science and Technology</u> (<u>MEXT</u>), and one of its special features is the development of on-demand teaching materials. The university has already established a platform for on-demand teaching materials for schoolteachers. <sup>(2)</sup>

#### Chemistry: Developing on-demand teaching materials

Concern exists regarding on-demand teaching materials for practical training subjects like physical education, music and science experiments. Chemistry experiments, in particular, have been considered too challenging to lecture non-face-to-face because glassware and reagents are used.

In 2020, when COVID-19 spread across Japan, our group successfully carried out simple chemistry experiments at a university lecture at home, using on-demand teaching materials. The simple experiments could be carried out with food and commercial agents such as gargles and cups, and students learned about redox reactions.

We have recently developed on-demand teaching materials for chemistry experiments to learn how to handle labware correctly. The subject of the on-demand experiments is measuring a volume change of an aqueous solution caused by salt dissolution. For the experiments, with a laboratory kit including a komagome pipette, dropper, graduated cylinder, test tube, test tube stand, beaker, measuring spoon, ruler (as slicing spatula), and a bottle containing salt prepared; digital teaching materials were created to carry out experiments. These labware are made of plastic, so there is no risk of breaking the laboratory kit, which can be sent by post. <sup>(3)</sup>

Students from Osaka Kyoiku University trialled the teaching materials. The students received a laboratory kit and conducted experiments at home using digital teaching materials. Following the experiments, a questionnaire survey was conducted to assess the effectiveness of the teaching materials in enhancing knowledge and skills. <sup>(4)</sup>

#### Schoolteacher training in Japan outcomes

We have successfully carried out lectures on chemistry experiments on demand at home. The system that enables chemistry experiment learning at home will revolutionise schoolteacher training in Japan. In Japan's elementary schools, few teachers majored in science. The lack of knowledge and skills for chemistry experiments sometimes resulted in accidents. In chemistry experiments, accidents mustn't occur.

Accidents sometimes cause injuries to students, but troublesome experiences may make students hesitate to study chemistry. To eliminate accidents, schoolteachers should be trained to learn how to carry out chemistry experiments safely as soon as possible. The correct knowledge and skills for handling labware to prevent accidents are crucial. However, in Japan, there are few opportunities to learn to handle labware correctly in school.

Furthermore, teachers often have insufficient time to study teaching materials. Therefore, a system allowing teachers to learn about chemical experiments at home at their convenience is important and can significantly contribute to science education development. In STEAM education, developing science skills from an early age is needed, and it is valuable to enhance science education in primary schools.

Introducing plastic labware into chemistry experiments can also reduce the burden on schoolteachers. The labware is lightweight and unbreakable; thus, pupils can use it safely. Hence, students can handle the instruments more freely, engage in experiments and learn chemistry more actively and deeply by eliminating the risk of using glassware. The low cost of plastic materials is also crucial for primary schools with little funds.

### Developing on-demand teaching materials research

Our research group consists of Taneda, the research supervisors, Dr. Asaka, the attached schools of Osaka Kyoiku University, and Kenis Limited. It is advantageous to obtain raw data from teachers and pupils. Kenis Limited manufactures science educational materials. Kenis education kits reach 99% of the schools in Japan. We have also been developing on-demand teaching materials for chemistry experiments for secondary education. We hope that the on-demand experiments will foster scientists of the future.

- A teacher education flagship university is designated by MEXT to lead the development of teachers who will form the basis of "Japanese-style school education in the Reiwa period" and to play a leading role in reforming the ideal way of teacher training courses.
- 2. https://o3edu.osaka-kyoiku.ac.jp/
- 3. M. Taneda, N. Asaka, R. Sakaguchi, A. Gung, Impact, 2025, 24-26.
- 4. M. Taneda, N. Asaka, R. Sakaguchi, A. Gung, R. Kamino, Y. Shimada, K. Kimura, Memoirs of Osaka Kyoiku University. Educational Science, 2025, 73, 181-198.

Primary Contributor

Masatsugu Taneda Osaka Kyoiku University

Creative Commons License

License: CC BY-NC-ND 4.0

This work is licensed under <u>Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International</u>.

#### What does this mean?

Share - Copy and redistribute the material in any medium or format.

The licensor cannot revoke these freedoms as long as you follow the license terms.