Impact Objectives

- Research learning methods which encourage learners to create quizzes
- Design a learning model and support system in which learners cooperate with each other and create quizzes

Collaborative learning through problem-posing

__Associate Professor Masanori Takagi__ heads a laboratory that is dedicated to promoting collaborative learning through an initiative called CollabTest, which enables learners to independently create problems and to review them among group members using information and communications technology

How did you come to be involved in the field of educational technology and information system engineering?

I was assigned to a laboratory specialising in computer networks when I was in the third year of university. As I was interested in education, especially collaborative learning, I began researching the use of computer networks to support education and learning in that laboratory. At the beginning of the research, I started developing e-learning teaching materials (digital teaching materials) on my own, which took me a lot of time and effort. But during the process of the development of teaching materials, I arrived at a better understanding of myself which has aided my research ever since.

These experiences inspired me to focus on learning methods which encourage learners to create quizzes. In addition, by applying the idea of collaborative learning, instead of creating quizzes alone, we formed a group and designed a learning model and support system in which learners cooperated with each other and created quizzes. This was the background of the development of the CollabTest.

Can you briefly explain what CollabTest is?

The CollabTest we have developed supports learners to create quizzes, and also enables teachers to construct confirmation tests using the quizzes created by the learners, which the learners can then answer the tests online. The current aim is to build a learning environment which will help learners independently improve their thinking, judgement and expressiveness.

You are a member of a number of key associations and organisations in this field. Can you briefly talk about how this can add value to your research?

I am a member and in charge of several relevant associations. I think by being a member of these associations, I can acquire the latest research results and knowledge, which is helpful for considering new research themes and coming out with new ideas. In addition, by presenting my research results, I can get the feedback and points of views that collaborators and myself are not necessarily aware of. Knowing other people's research can be a reference point for thinking of how best to proceed with my research. Furthermore, by looking at other people's research results, it can often motivate me to start conducting my own research into a similar field.

What are the next steps you have planned?

In the near future, I would like to put effort into the development and design of education and learning environments in Personalised Learning, which will be integrated with human input and Artificial Intelligence (AI). Currently, in my class, chatbots and learners communicate with each other to diagnose inadequately understood units and recommend teaching materials that are useful for understanding. In addition, teachers and assistants individually assist with the parts that cannot be supported by chatbots during class. I want to expand the scope of this by incorporating different technologies.

In the future, we will develop a chatbot that implements AI functions so that learners can engage in learning while communicating with the chatbot. We are considering producing supporting guides of learning processes to encourage self-regulated learning, such as guiding learning methods that deepen understanding, supporting the creation of learning plans and facilitating reflection. ▶

Proving the effectiveness of problem-posing learning for students

*A team of researchers based within the **Takagi Lab** at **Iwate Prefectural University** is conducting research on next-generation learning support systems in the hopes of developing an improved education method and changing the future of education*

There is a wealth of evidence that points to the effectiveness of adaptiveness - which is relevant if we consider the pitfalls of a teacher explaining the next level of a subject before their student has reached a level of understanding of the previous level. Technology is now evolving to manage these concepts better. For example, computerised adaptive testing (CAT) is a computer-based test that is able to automatically adapt to the testee's ability level.

In this regard, the technology can be thought of as tailored testing, in that each question that is asked is based on the preceding answer. It is designed to coax the best, most effective forms of learning for an individual and is often better than a generalised test where every person is asked the same list of questions irrespective of the extent of their understanding. CAT is designed to maximise exam precision by gaining a highly accurate picture of the testee's abilities.

PROBLEM-POSING LEARNING

A team of researchers is expanding the ideas that are central to CAT to improve education methods, and perhaps even help shape the future of education in Japan and beyond. Associate Professor Masanori Takagi is the head of a laboratory based within the Faculty of Software and Information Science at Iwate Prefectural University in Japan. He leads a team which is focused on using the methods of learners to create quizzes that aid their learning. Takagi has been working in this field for almost two decades which has culminated in the development of the CollabTest. This is a system which supports learning by allowing students to create quizzes on the Internet and evaluate quizzes from other people within a group.

Since 2002, the practice of quiz learning through the CollabTest has been used in a wide range of different subjects, including maths, English, chemistry and information technology, at various education institutions such as elementary schools, high schools and universities. Across a staggering 200 different subjects, more than 23,000 quizzes have been collected from learners. Of course, managing such a large number of quizzes is a challenge, but it is known that by analysing them, researchers can gain more of an idea about problem-posing learning and maximise its effectiveness. It is with that in mind that Takagi and his team have begun conducting research on quiz learning support systems of the next generation. 'The ultimate aim is to promote autonomous learning by giving individuals the tools they need to enhance their knowledge,' observes Takagi.

THE EFFECTIVENESS OF CAT

To achieve the aims of the project, Takagi is using CAT to present problems that are aligned with the test taker's ability. 'CAT has an advantage of being able to measure the examinees' abilities in a short time with a high accuracy,' he explains. 'However, it is not simply enough to use CAT - in order to use it effectively, it is necessary to accumulate a large number of quizzes for which item parameters can be recognised by item response theory (IRT) analysis. The main problem then, is that it takes an enormous amount of time to create quizzes and assume parameters.'

Put simply, IRT refers to a set of mathematical models that are used to explain the relationship between unobservable characteristics and how they manifest themselves in an individual, such as responses or performance. IRT performs calculations that can be an effective means of determining the ability and attitude of an individual, as well as other qualities. The key realisation that Takagi made was that there was already a wealth of quizzes available for his research using CAT - 18 years' worth of quizzes generated from the CollabTest. So, he decided to utilise the quizzes. However, it is possible that the quizzes created by the learners are inadequately expressed, so he is currently in the process of analysing whether the quizzes are suitable for measuring performance and ability.

VERIFICATION AND TESTING

Somewhat remarkably, Takagi was still a student when he conceived the CollabTest project and, as such, had no funding to conduct his investigations. This meant he needed to develop the entire system on his own. Fortunately, he made great strides which has resulted in him now securing a research fund and he has been able to outsource some of the more challenging aspects of building the system. 'During my time as a student from 2002 to 2007, I bought books myself to study and essentially taught myself what I needed to know to begin this research,' observes Takagi. 'Other members of my laboratory were able to assist me which proved invaluable to the ongoing success of my studies.'

It now remains for Takagi and his team to verify the learning effect of problem-posing learning. As it stands, they have analysed the learning effect by using pre- and post-test analysis, as well as giving learners questionnaires to complete. However, they are still unable to completely prove the effect of problem-posing learning. 'I believe it will be shown to be effective at improving thinking, judgement and expression ability, which the Japanese Ministry of Education, Culture, Sports, Science and Technology is currently focusing on,' concludes Takagi. 'I hope to determine the effectiveness of problem-posing learning soon and shape the future of education in Japan and beyond.' ●

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The campus of Iwate Prefectural University

Project Insights

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BIO

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