# “Assembling units of information and formulating problems” Learning engineering: Designing new modes of learning for the AI era


4 Tsukasa Hirashima

Professor
School of Informatics and Data Science
Graduate School of Engineering

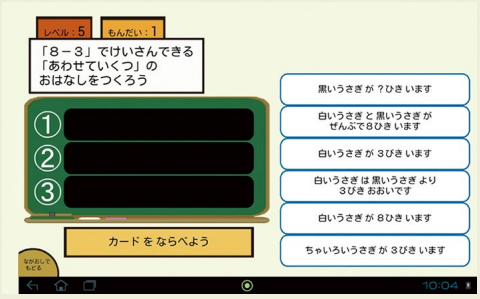

Prof. Hirashima obtained his doctorate in Engineering from the Department of Information Engineering of the Graduate School of Engineering Science at Osaka University. Before assuming his current post, he served as an assistant and lecturer attached to the Institute of Scientific and Industrial Research of Osaka University and as an associate professor at the Department of Intelligence and Information Engineering, Faculty of Information Engineering at Kyushu Institute of Technology. His main research theme is artificial intelligence, particularly knowledge engineering and its application for educational purposes. He is active in practical application in classroom settings, resulting in his being honored with the Gold Prize of the Japanese Society for Artificial Intelligence Field Innovation Award in 2017. He had served as President of the Asia-Pacific Society for Computers in Education (APSCE), as well as a board member of the Japanese Society for Artificial Intelligence, the Japan Society for Education Technology, and the Japanese Society for Information and Systems.

Artificial intelligence (AI) is in its third-wave boom at the moment. This is because the scope of its application has substantially expanded since it has become evident that AI produces far better results than humans principally in pattern recognition, thanks to advances in statistical AI technologies, as represented by deep learning. Because of this development, more and more people are wondering if AI will take away jobs from human workers in the future. This is a misleading idea. It is more accurate to say that AI will change the work that should be done by humans. In other words, we will leave what AI does better than us to AI, while focusing on what only humans can do.

What AI does better than us mainly comprises solving problems, whereas we can say that AI does not excel in formulating problems. So in the era of AI, humans must have the ability to do this. This leads us to a new challenge. Up to the present, we have taken tests to have our problem-solving ability evaluated. Also, the learning that we have done so far is often oriented toward those tests that measure our problem-solving ability. You might think that this challenge can be easily overcome by getting learners to learn how to make problems. This is not easier said than done. When a problem is fixed, its solution is usually found. This is why one teacher can handle many students at one time in problem-solving. If students were to learn how to make problems, it would mean each student making his or her problem, requiring instruction specific to each student. This necessitates the construction of a new learning mechanism.

This challenge becomes a research subject in the domain of information science with the following assumptions: “a problem is made up of information,” “formulating a problem involves assembling units of information,” and “solving a problem is handling information.” Learning engineering is a research area wherein new learning mechanisms are proposed and tools are developed to realize these mechanisms. These proposals and the development of tools are centered on information science but also require integrated and interdisciplinary research closely linked with education science and psychology, as well as the actual field of educational practice. Information science is sometimes defined as a meta-science that integrates various fields of science from the perspective of information, and learning engineering is a typical example of information science.

The 21st century is an age of information. People’s lives are determined by information, and not material objects. Information is not discovered or invented; it is designed. Information is designed through interdisciplinary integration of knowledge of various disciplines centering around information science. With the opening of the School of Informatics and Data Science in the academic year 2018, Hiroshima University is gradually establishing a system of training individuals who will take up information design in the age of information. I would like our students to “learn information to change society.”




The problem-formulating software Monsakun is based on a model that defines narrative arithmetic problems as combinations of concepts of quantities. Versions of the software from kindergarten to junior high school students are used in actual classrooms.

A scene from a school lesson in which Monsakun is used: students can use Monsakun on tablets, and data can be relayed from the students’ tablets to the teacher’s tablet via a server.