

# Trial of a New University Curriculum for Mathematics, Data Science, and AI Education

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**Abstract.** Japan's AI strategy requires higher education institutions to train data scientists based on mathematical science. We have developed and implemented a new curriculum for "Mathematics, Data Science, and AI" education at Kagawa University. This curriculum consists of a literacy level, an applied basic level, and an advanced program. Student testing and evaluation results confirm that the program is generally successful.

## Introduction

In Japan, we are lagging behind global trends in several areas of academia and industry, and we have a great sense of urgency. In particular, the absolute number of data scientists based on mathematical sciences is low compared to other countries [1]. In this environment, the Japanese government has put together the "AI Strategy 2019" [2] and set goals in the field of education with numerical values.

The AI Strategy 2019 has a wide range of content, but "Mathematical, Data Science, and AI education" is located at the center of it. We have a population of approximately 1 million 18-year-olds, half of whom go on to university or other higher education. The first goal is to ensure that 500,000 students who enter all those colleges and universities have a literacy level knowledge of data science by 2025. So, the specific goal is to strengthen efforts at each educational institution to build educational programs and create an environment where all students can take courses. Second, the upper-level goal is to have a system at each university and other institutions to provide applied basic level knowledge skills, including programming skills, mainly for students majoring in the natural sciences, and to establish a program that can be offered to 250,000 students. The goal is to train approximately 2,000 highly skilled PhDs, 100 of whom will become top specialists.

Each university designs its curriculum to follow a standard curriculum in creating its program. And The Ministry of Education, Culture, Sports, Science and Technology (MEXT) ensures quality assurance through an accreditation system that evaluates and certifies the educational programs of each university.

## New Curriculum of Kagawa University

We have established programs at Kagawa University at the literacy level, the applied basic level, and the advanced level, and we present an overview of these programs.

First, let us introduce the literacy level. The required 2-credit Information Literacy course that we originally had included a lot of data science content, so we reorganized and integrated the content and created Information Literacy A and B in 2020, each with 1 credit. Literacy B is a mathematical and information science e-Learning course that includes basic statistics and programming and is taken by all 1,300 students in the first grade. Together with Information Literacy A, which includes exercises, the program was approved to meet the literacy level of the national accreditation system by MEXT. This means that all students belonging to Kagawa University have reached a literacy level of education.

The evaluation of this course by students for four years is positive as shown figure 1 (left). We asked whether knowledge was gained through the course by being able to explain key words. Figure 1 (right) shows generally good results, with particularly high gains in key words of “data science” and “big data”.

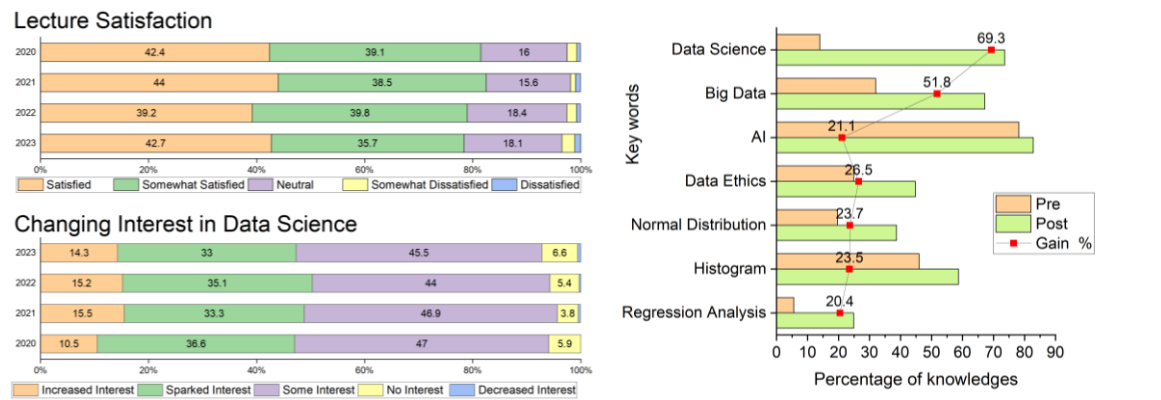


Fig. 1. Results from class evaluation survey 2020-2023 (left) and changes in pre- and post-test knowledge (right).

The next is the applied basic level. The educational programs at this level, as mentioned above, aim to create an environment in which about half of the students can take the course, but it is objectively desirable for all students at the national universities in our country to be able to take the course. We therefore reorganized our existing information minor program and restructured it for mathematics, data science, and AI education in 2021. It is based on a minor framework that was originally open to all students and is therefore open to the entire university. This program was also accredited by the government as fulfilling the applied basic level. Some students have already completed the program. These students have gone on to work in industry with their expertise or to graduate school for more in-depth study. The details of the results at the applied basic level will be left for another time due to the limitation of the amount of text.

On top of that, the advanced level program was built in 2023 and began accepting students for the entire university in 2024. Kagawa University has crisis management studies as a distinctive feature of the university and has data on many crisis management issues. The program is designed to provide education in Mathematics, Data Science, and AI by utilizing such data. In addition, Kagawa University is also educating specialists in a graduate course for training data scientists.

## Summary

We have tackled this nationwide challenge and established three levels of educational programs for the entire university. These programs have been realized by successfully reorganizing individual courses that had been disparate and adopting them as minors. Results from student evaluations and testing indicated that our curriculum is successfully in motion.

## References

- [1] World Digital Competitiveness Ranking, IMD (<https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-digital-competitiveness-ranking/>)
- [2] AI Strategy 2019 - AI for Everyone: People, Industries, Regions and Governments. (<https://www8.cao.go.jp/cstp/ai/aistrategy2019en.pdf>)