AI Teacher Education in Korea

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Introduction

The 4th Industrial Revolution is a period when the productivity of work is dramatically improved as the whole process of production, distribution and consumption of goods or services is intelligent through the use of core technology like big data, IOT, robotics, autonomous driving vehicles, virtual reality and 3D printing which are all centered on AI. AI is one of the most very important key concept in our current society for educated people to develop sustainably the new intellectual society based on the highly sophisticated technologies. This paper introduces new challenges of Korean education for training "AI teachers" and shows three initiative efforts the Korea National University of Education has provided recently.

Why AI learning in school is important?

AI has a human attribute in that it implements a variety of recognition, thinking, and learning activities which have been performed by only human intelligence. However AI is a technology that models human intelligence through algorithms so that computers or robot can execute them. These algorisms are performed by humans and eventually should be trained through schools. The reasons why various AI techniques should be taught in schools can be discussed from the following four perspectives:

- Humanistic perspective: AI is a human heritage. Research on AI began in the 1950s by and many kinds of AI skills have been developed. Students need to understand the key skills that guides the rapidly change of the modern period.

- Ordinary life perspective: AI is closely related to our daily lives. AI which provides various information to help human activities in their daily lives already exists next to us. Students need to learn about benefits and limitations of AI in our lives and ethical aspects that arise from the use of AI.

- Developmental perspective: AI is like a problem solver. Students can develop their own thinking power by exploring basic knowledge and procedure to operate AI.

- Social developmental perspective: AI is changing the current society as well as will change our future society. Students have to learn the AI technology to speed up the development of workstation where they will contribute as workers after graduation from school.

New challenges in education

In the new society where AI machine or robots are in charge of many things that human beings have done so far, education demands new challenges that are quite different from what we have seen so far. In addition to teaching students how to understand and utilize AI itself, schools need to teach the connection between AI and the various curricula, and the complex relationship between "AI and human" in which technology changes the human ways of thinking and living. For example, school needs to emphasize new

kind of statistics using big data rather than "fossilized" knowledge and calculations for a given table and figure. Furthermore, as AI technology changes, education should develop soft skills for super-intelligent society, such as sociality, sensitivity, empathy, challenge to adventure, and networking, as well as the ability of critical thinking and problem solving related to the use of technology.

As the importance of AI technology being emphasized, the Korean government announced the "software education" policy to secure national competitiveness in a software-driven society in which software is central to innovation, growth, and value creation by preparing for a future society through software education (Ministry of Education, 2016).

Meanwhile, in order to develop the new high-tech society continuously, it has long been argued in South Korea that elementary and high school education including all aspects of curriculum, teaching and learning methodology should become selective, integrative, and custom-made education, which is "SMART" abbreviated as "self-directed, motivated, adaptive, resource-enriched, and technology-embedded" (Ministry of Education, 2012, 2015). However, there has had no serious debate on how to train teachers with the interdisciplinary approach rather than with the isolated viewpoint under the compartmented department system (Lew, 2019).

New challenge of teacher education

In 2016, the South Korean MOE announced that from 2018, all elementary school pre-service teachers at 11 teacher education universities were required to provide "software education" focusing on coding education with interdisciplinary approach in order to prepare for mandatory software education in elementary schools which started in 2019 (Ministry of Education, 2016.12.1).

Furthermore, in 2019 the South Korean government has decided to train the so called "AI teachers" who are responsible for fostering new human resources to lead the new era of the fourth industrial revolution. Each year for 5 years, 1,000 AI teachers will receive master's degrees through three years of in-service training at the universities of their choice from the second semester of 2020. Government will support half of the tuition for in-service teachers during three-year master's course. Convergence will be emphasized for educational methods.

New challenge of Korea National University of Education

As only comprehensive teacher training institution in Korea, Korea National University of Education trains all teachers from kindergarten to high school and provides almost all kinds of job training programs, and is responsible for the nation's new principal training and new senior teacher qualification programs except for Seoul area.

Located near the Se-Jong city, the new administrative capital, the university is accessible within 2 hours from anywhere in the country. It coordinates perfectly not only with the Korea Institute Curriculum and Evaluation, the Korean Educational Development Institute, 17 city and provincial education offices and the Ministry of Education, but also the Korean Teachers' Associations Federation and the Korean Senior

Teachers' Association. To present a new paradigm of convergence education for the cultivation of human resources required by future society and to nurture teachers capable of cultivating convergent talents, Convergence Education Research Institute was established in 2016.

The university is also in charge of active leading roles in new kinds of AI teacher education and software education for teachers, recently proposed by the South Korean Ministry of Education. Below are three innovative programs run by the university: AI Master degree programs, Drone Flight Club with Python Coding, Entry Block Coding Course for Pre-service Elementary Teachers.

AI master degree program

KNUE will train about 160 in-service teachers every year. This is one-six of the nation's whole quota of 1000. The university will urgently hire two AI professors this semester and secure facilities and space for teachers to practice in weekends and will get support of professors from the University of Science and Technology, which is one of the top universities in science area and located near KNUE campus. And, the development of a graduate curriculum for AI teacher education will take place during the spring semester of 2020.

There will be at least four tracks students choose by their majors:

- Humanities and Social Study track for elementary and humanity subject teachers.

- Science & Engineering track for normal high school teachers

- Science & engineering track for gifted and vocational high school teachers.

- Art and culture track for music and art teachers

The students will take 27 credits for the following eight subjects:

- An Introduction to AI (3 credits): The definition of AI; the society change as a result of the development of high technology like AI; the importance and value of AI in the future society; ethical problems caused by the use of AI; and skills on how to express knowledge and inference etc.

- AI and Data (3 credits): Skills on how to collect and process data to solve problems related with big data; skills on how to visualize and to analyze data to close up the features of data well; the basic concepts of machine leaning; the mathematical concepts underlying the machine learning algorithm.

- The Realization of AI (3 credits): Implementing machine learning algorithm to predict the future phenomena using Python as coding language; AI algorithms such as understanding problems, collecting and pre-processing data, learning and evaluating models, writing programs, testing and improving programs; the basic concepts of deep learning; artificial neural network; computer vision; natural language processing

- AI for problem solving (3 credits): Carrying out various projects in various social

and academic fields. Sharing the AI models in community and high schools

- ☐ Mathematics for AI (3 credits): Fundamental level of mathematics for understanding, implementing and designing AI models including calculus, statistics, linear algebra, discrete mathematics

- ☐ Python for AI (3 credits): Python programming language to design AI models.

- ☐ Projects for Master Thesis (3 credit): Prepare various projects for dissertations for master's courses. At least 3 hour meeting a week during the course is mandatory.

- ☐ Independent Study to relate AI and subject matters (6 credits)

Drone Flight Club with "Python" Coding

The drone is recognized as one of the AI related technologies driving the fourth industrial revolution. There were various attempts to secure the capabilities needed in the era of the fourth industrial revolution by introducing drones control skills such as simple manipulation by radio, but it was difficult to expect educational effects as their competency. Therefore, KNUE decided to foster the problem-solving capabilities of its pre-service teachers by providing drone experience controlled though programming.

As the first step, KNUE made Drone Club for pre-service teacher to enjoy Drone flying experience through coding of Python. However, most of all of the first members of the club was students of Department of Computer education. It is because many students thought that learning Python is not easy. We expect more students come from various subjects. It might be possible now because we teach Python in high school under that current curriculum.

"Entry" Block Coding Course for Pre-service Elementary Teachers

ENTRY is South Korea's programming language platform developed by the Entry Education Research Institute. It is a main block-based language used officially in Korea for elementary and junior high school students. It is similar to Scratch developed by Mitchel Resnick, MIT Media Lab, but much easier. Visit play-entry.org to provide English version for learning, creating, and sharing.

Securing the software education leadership capacity of elementary school teachers in preparation for the mandatory software education of the 2015 revised curriculum Reinforcement of the teaching ability of elementary school teachers to foster creative and interdisciplinary talents of students pursued by the 2015 revision of the curriculum. Strengthening creative and logical thinking power of elementary school teachers by improving their computing power

Mandatory Courses for All Elementary Students

- ☐ Elementary Software Education and Computational Thinking *(Basic level coding)*: grade 1

- ☐ Software Education in Elementary Education *(Middle level coding):* grade 2

Mandatory Courses for Elementary Computer Education Major (High level coding)

☐ S/W and Problem Solving: grade 3

☐ Creative Computing Thinking: grade 3

☐ S/W and Ordinary life: grade 4

☐ Multimedia and S/W: grade 4

Mandatory Courses for Elementary Subjects Major (High level coding)

Choosing only one course with 3 credits during grade 3 and 4 according to their major: Elementary Korean Language, Elementary Mathematics, Elementary Social Study, Elementary Technology, Elementary Art, Elementary Music, and Elementary Science

Conclusion

The 4th industrial revolution is a current industrial change based on a "virtual physical system" like AI that can connect machine or robot and human intelligently through a high speed network 5G. AI is the core technology in the system. The most important key competencies for operating the system are to understand AI itself and computational thinking to make human to communicate with machine. It is a hot issue in Korean educational community like in the many countries. It is essential for a sustainable development of the 4th industrial revolution.

Korea decided to introduce it to the national curriculum from the 5th and 6th grades as compulsory from 2018 and then, launch a software teacher education and an AI teacher program. These new attempts are posing enormous challenges to the nation's educational society and teacher training institutions. Many people worry that it might be a reckless decision made without a curriculum or faculty and facilities, but many others believe that it is an understandable decision because they believe AI teacher education is too urgent to take place after sufficient preparations are made.

No one can predict success, but I think Korea's new attempt will serve as a good touchstone for SEAMEO countries regardless of whether it is successful or not.

References

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