

THE DIRECTION OF ARTIFICIAL INTELLIGENCE EDUCATION IN THE SCHOOL EDUCATION FIELD INTRODUCTION

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This article is talking about the possibility that artificial intelligence development may cause various problems in the society. It is claiming about the necessity of focusing on AI-ethics in school curriculums, rather than its techniques. AI-ethics is completely different from practical ethics, but it is related and able to affect every people and technologies, hence AI ethics must be taught in schools. Although there are many tries to put AI-ethics classes in the curriculum, there is a problem; the uncertain definition of AI-ethics education; What is AI-ethics, what constituents are needed to be in the school curriculums, and what is the reason to teach it. This article divides the ethics – the ethics of AI, the ethics to treat AI, and the ethics about AI. And it clarify what AI ethics should be taught in schools and why. Also it insists the imperativeness of the staged AI-ethics education starting from elementary schools.

1. Introduction

Every year, the new technologies appears. AI is being used in almost everywhere. It has started to be used not only in the areas where the people easily spot, like robots or meta-verse, but also in everyday products and programs around; such as smartphones, computers, games, and refrigerators. If AI is in everyday life, school curriculum should contains the classes which teaches about AI. Then, what AI contents should be in the school curriculums? Many countries are introducing AI-related classes into school curriculums. Learning the use and technology of AI is important, but understanding how to use AI in a proper way is more important. If people abuse AI, the negative effect can reach to thousands of people. With current technology, it is not able to expect AI to have human's ethics. The more AI being used, the more people who use AI will be asked of the ethics to use AI. Therefore, AI-ethics education needs to be started from an early age, and educate people about the guide line of using AI morally.

2. Artificial intelligence ethics education in Korea

Korea stipulates coding & software education as the compulsory education since 2016. Korean government have provided AI-teaching training to the teachers, and have supplied tools and materials to schools for AI classes. Although exquisite AI computers or devices haven't been distributed or utilized at school sites yet, AI-related education is being conducted in diverse ways. However, in Korea's current national level curriculum, the 2015 revised curriculum, there are no specific AI-related content elements, AI-educational methods, or AI-learning achievement standards. Also in the curriculum, there is no system of AI-ethics education

contents (Hyeongbin Park, 2020, 307). The elementary school moral subject textbook, which is based on this curriculum, is not containing AI-related contents or AI-ethics contents(Hamin Kim, 2021, 2). The lack of the systematic AI-education caused improvisation at the school sites, and it linked to the result; the AI ethics classes focused on vocational contents.

In 『The Future of Jobs Report 2018』, released by the World Economic Forum (WEF) in 2018, says lots of jobs are disappearing and appearing at the moment, and the change is expected to be greater in the future (World Economic Forum, 2018). It also says that the careers and occupations will be changed – the jobs that were popular in the industrial and digital society may no longer be big, and completely new professions may appear, or the occupations that have been neglected may become huge. With these hypotheses, it is difficult to predict the future professions or students' career paths, which are expected to undergo rapid changes. Thus, the schools needed a new approach to the career education, different from the existing one. First, the coding and software education, which is considered as the basics of AI use, were introduced through the practical art subjects. However, the experts' opinions on the development level of future technology and occupations are not consensus. The experts overall believe that many jobs will disappear and lots of new jobs will emerge compared to the past. Although, they did not coincide in opinion about the jobs that appear as new or are treated better than the past. There are two representative arguments; whether AI will ultimately outperform humans in the workplace or not(Alex Ross, 2016, 53). The schools cannot immediately follow the changes described so far, so there is limitation in the curriculum. Current AI education in the school curriculums is for developing AI, based on computer science or technology, such as coding lessons or software education, and for vocational training (Taechang Kim, Soonyong Byun, 2021, 82).

3. The direction of artificial intelligence education needed in school education

What should we teach in the classroom when we teach AI? If AI is taught in the schools, it is because of the thought that it can help students' lives and lead to righteous lives. In the 2022 revised Korean curriculum, it will be revised to cultivate AI literacy by linking and operating the basic principles of AI and the use of AI (Ministry of Education, 2020, 30). However, in the current Korean curriculum, the ultimate purpose of the AI education is not clear – Is it 'for having the students become an AI inventor' or 'for raising the students to use AI effectively' or 'for letting the students utilize AI uprightly'? Furthermore, even though Korean schools have been established lots of classes in various way to strengthen AI education, the classes were struggled to set a target; learning specifically about AI, or learning how to handle AI. Thus at the current school sites, the students are focused on learning skills – understanding the use cases or the concepts of artificial intelligence, and the application of machine learning. The following table is an excerpt from Korea's data surveyed by the KFSC on AI curriculum according to the school levels(Korean Foundation for Science and Creativity 2020(a), 9) (Korea Foundation for Science and Creativity, 2020(Korea Foundation for Science and Creativity, 2020) b), 8).

Table 1. AI curriculum and educational materials by school level in Korea

	Elementary School	Middle School	High school
Korea	[Grades 3-4] ·Use cases of AI (Voice recognition, etc.) [Grades 5-6] ·Understanding the concept of AI ·Utilization of AI (Machine learning, etc.)	[Grade 1] ·Understanding AI knowledge expression (If then, Tree) ·Understanding the machine learning [Grade 2] ·Understanding AI inference methods ·Understanding machine learning approaches (Supervised, Unsupervised, Reinforcement, etc.) [Grade 3] ·Inference of knowledge in various fields ·AI learning in various fields (Domain)	[Grade 1] · Machine learning concepts and algorithms ·Data analysis method of machine learning (Probability, Statistics) [Grade 2] ·Concept and program of artificial neural network ·Application of artificial neural network to real life problems

As shown in the table above, AI education in the curriculum exists only to develop computational thinking ability, and to raise AI developers through coding education and software education. Namely, the curriculum only concentrates on having the students enable computational thinking through teaching computer languages and programming, just as the industrial society raises students to be able to use computers. The current AI education in Korea can be said as a vocational education that teaches the skills to build AI, and by extension, it is drawn to the expectation that all students will become AI experts (Kim Tae-Chang, Soonyong Byun, 2021, 83).

Here, I insist of the necessity of AI-ethics training, just as the importance of the AI-skill training. In the future society, AI will be essential. However, that doesn't mean that everyone has to be an AI expert who can create AI and code programs. Even when the digital society first started, it was difficult to run a computer without an operating system. As the technology advanced, the GUI operating system is generalized. The web browsers and the application programs also became popularized, the most people can handle the computers without understanding the computer languages or the operating system of the CUI system. Likewise, people will be able to use AI easier and more convenient someday. Even in the digital age, it has become more important to the ordinary citizens, except experts, to use the program correctly and not harm people with digital technology rather than how to make the program. Because the digital-ethics education was delayed in the digital society, numerous side effects appeared in the digital world. A similar thing could happen in a future society where AI becomes commonplace. Therefore, although the official AI-education has not occurred yet, I agree with the argument that ethical education is necessary before the side effects able to be caused by AI appearance (Soon-yong Byun, 2020, 428), and I also assert that we need to find out what and how AI-ethics should be taught in the curriculum.

4. The direction of AI ethics education

As mentioned in the previous chapter, if AI education is focus on the technology parts, then the purpose will be having the students be able to create and develop AI or the software, without considering the students' aptitude. Perhaps in the future, lots of jobs will be related to AI, but that doesn't mean everyone will be involved with building AI. Through the industrial and digital

revolution era, scientific technology developed rapidly and became the center of the society, but not everyone was required to become a scientist or an engineer. In the industrial age, not everyone had to be able to invent machines. In the information era, not everyone had to make programs. Inventing was only important for specific professionals and related workers, not for the normal people. Likewise, when the AI society comes, creating or designing AI won't be asked for everyone. However, as the impact of the technology abuse was bigger in the digital era than the industrial times, the misuse of the technology will cause even worse side effects in the AI society. Therefore, we need to provide proper AI-ethics education to the students from the early days of elementary school. Then, we will have to decide what ethics to teach for the right direction. For AI-ethics education to handle AI rightly, first we need to clear the definition of the AI-ethics. For example, the following chart is the MIT Media Lab's AI-ethics learning goals among AI-ethics education in the United States.

Table 2. AI Ethics Learning Goals of MIT Media Lab (Soonyong Byun, 2020, 159)

1. Understand the basic operating principles of artificial intelligence systems.	a. Recognize various algorithms in the world, and can give examples of algorithms and computer algorithms in everyday life. b. Able to tell the three stages (input, processing, output) of the algorithm. c. Knowing that AI is a specific type of algorithm, it can be seen that it consists of a dataset, a learning algorithm, and a prediction. d. It is possible to understand AI systems in everyday life and infer what AI systems predict and potential datasets used by AI systems.
2. Recognize that all technological systems are socio-technical systems. It is understandable that socio-technological systems are not value-neutral and have political issues.	a. Understand the term optimization and recognize that the goals of man-made socio-technical systems are human-determinable. b. Be aware of social-technical systems in everyday life, and be able to distinguish between extrinsic and practical goals of social-technological systems. c. You can see the term algorithm bias that can occur in the classification process.
3. It can be recognized that there are many stakeholders in a socio-technological system and that the system can affect stakeholders in different ways.	a. Stakeholders related to the socio-technical system can be identified. b. Can reasonably explain why each stakeholder is interested in the outcome of a socio-technological system. c. It is possible to identify the value of each stakeholder in the socio-technical system. d. An ethics matrix can be built around a socio-technical system.
4. Able to apply technical understanding of artificial intelligence and knowledge of stakeholders to determine the correct goals of socio-technological systems.	a. Ethical matrices can be analyzed and the results of the analysis can be used for new goals of socio-technological systems. b. You can identify the datasets you need to train your AI system to achieve your goals. c. Functions can be designed to reflect the identified goals of a socio-technological system or to reflect stakeholder values.
5. Consider the impact of technology on the world.	a. It is possible to understand the secondary and tertiary influences caused by technology, and to know that technology is made for various stakeholders.

The MIT Media Lab focused on the ethics applied to the society and systems through the AI principles and technologies. AI cannot be ethically neutral, it can have multiple issues. Each socio-technical system is intertwined with many interests, so it can trigger the ethical or value issues. The countries and the institutions in the world are announcing various measures for AI-ethics standards or AI-ethics education. However, it hasn't been clearly set which of these should be the centered of AI-ethics education.

General AI-ethics can be divided into the ethics of AI, to treat AI, and about AI. The ethics of AI is the ethics that AI should have. That is, AI itself becomes an artificial moral actor based on semi-morality, which is the design and the application of algorithms that simulate human moral behavior (Kim Kook-hyun, 2020, 78). It relates to a question – Can AI take the responsibility or obligations when the accidents happened due to the AI's decision or malfunction. In other words, it touches the ethical field which includes the contention whether AI can become an ethical actor. It matters to the experts who develop AI, the scholars who present ethical standards, and the countries that legislate and announce the ethical standards.

This ethics needs to be formed by experts and scholars, so it will not be the central contents of the AI ethics in the school curriculums.

Next is the ethics to treat AI. The devices with AI are showing actions and reactions in a similar form to humans by learning through the technologies; machine learning, deep learning, and artificial neural networks. And the techniques, including AI's words, actions, expression methods, and avatar shape design, make AI like a human or a living creature. And because of it, humans feel more psychological bond to AI(Eunbyul Yang, Yeonju Tak, Jihun Ryu, 2021 , 2028). If AI have people feel intimate to them, they can call empathy just as animals or something people care about. In this case, AI becomes a bit different from the existing technologies or tools, and it calls some questions; Can AI be treated same as general technologies or tools? How should human act towards to AI? The answer of those questions could be the ethics to treat AI. This ethics can directly affect people's lives more than the ethic of AI(discussed in previous paragraph), and is an ethical rule that everyone should follow. For example, when people see the video of the robot dog who is kicked to check its balancing function, if there is a demand to stop harassing or abusing of the robot dog for its right, that is the part of this ethics. There is no doubt that this ethics should be in the school curriculums, but if the technology is not improved enough to make AI be considered as a new species or an individual person, it won't make a huge difference from the existing ethical rules. Even in the past, there is the ethics that tells us not to abuse machines or tools, especially if those resemble humans or animals. Furthermore, the ethics has been existed to treat animals because of their right. For the ethics to treat AI, the most important thing is the point of the view to see AI – Is AI be able to considered as intellectual being having dignity, so it should be discussed in the school classes. However, it can't be the main directions of the school AI-ethics curriculums.

Finally, there is the ethics about AI. It is an ethic of how should we use AI and what we must keep in mind when using AI. Also, it considers the consequences of using AI. In the future, AI will be more used in every aspect of our lives– from controlling the simple machines to the parts closely related to life, such as autonomous vehicles and smart home appliances. Through the technology improvement, people will be able to do unimaginable things with AI. It is too early to say the era of AI arrived, but we must prepare for coming up AI society. Because of the AI's peculiarity; widely used, convenient to invent something new, and simplify the existing progress to do something, it can cause even greater problems socially or ethically than the digital society times. Therefore, the ethics for handling AI uprightly has to be essential in school education. It will be needed for everyone regardless of class, age, occupation, etc. It must contains from the small things like writing commenting in the Internet, or SNS usage ethics, towards to the a bit more serious factors like the education for preventing the AI crimes. This ethics is also related what kind of AI or technology we should invent and develop. Thus, it is also relevant to professionals, business executives, and social leaders. That is, this ethics is necessary for all the general public who live in a AI-prevalent society, including the office workers who use AI, the experts who build AI, the businessmen who sell AI products, and the social leaders who make decisions on AI-related policies. The required level of AI-ethics could be different for each people, but the ethics about AI is an ethic to help people using AI uprightly, to prevent abusing AI to harm others, and to let the world move forward through AI.

AI-ethics for the school curriculums needs to meet several necessary and sufficient conditions. First, it should be relevant to everyone, not just some experts or limited individuals. The ethics of AI and the ethics to treat AI cannot be the center of AI ethics education, because those are more leaning towards to AI experts, academics, and social leaders. However, the ethics about AI affects the people in all classes, and could be a foundation of all ethics– the civic ethics,

the professional ethics, the business ethics, and the social ethics. Therefore, the ethics about AI should form a main content of the curriculums.

Second, it should be able to expand in many directions without being limited to a certain field. As AI develops, the ethics of AI will be a very important in the future. If the singularity of AI comes as suggested by Ray Kurzweil (Kurzweil, 2007), it will be treated more crucially. Even if the singularity does not come, it will become more important the more AI does. Although, it should be defined by the AI experts, researchers, businessmen, and social leaders through the social discussion. It is not scalable to all people, so it is more suitable ethics for higher education institutions. The ethics to treat AI will also be crucial to the society after the singularity, in the sense of establishing the relationship between AI and human beings. However, until the singularity coming, it's not so different from the human-tools relations, so it doesn't have enough extensity. On the contrary, the ethics about AI as mentioned above, is more suitable for the school curriculums because of the trait to cover broader areas; from the simple using methods to even designing and improving AI.

Lastly, it need to be useful to everyone. The ethics of AI or the ethics to treat AI are the important ethics to human, technically and socially. But it's not for use to people's daily life situations. However, the ethics about AI is linked to make decisions in everyday life. In conclusion, the main contents of the AI ethic education should be the ethics applicable and useful to the public, inclusive for new and broad fields, i.e. the ethics about AI.

5. Conclusion

There is no doubt that AI will be more prevalently used in the future. Already, lots of electronic devices with AI, such as AlphaGo and Watson, are becoming more and more common in our life. These rapid development of AI causes the social, technological, and occupational changes, and it has brought confusion and renovation of the education. The students being taught in the present curriculum will live in a new society which is completely different from the one we have been through so far, will experience new changes. When they become adults, the society may become a fantastic society alike SF movies or novels. The human lives and the ethics will be changed even more than it had. Therefore, the preemptive education of the AI-ethics is demanded in schools.

Just like the social problems appeared, such as anomie phenomenon, because of the ethic education couldn't keep up with the speed of the digital era technology-development, if the AI-ethics education waits the transition towards AI society, human will not only follow the bad methods and problems before, but also welcome the new problems that we can't even imagine. Hence, we need to realize the necessity of the proper AI-ethics education and set the center of the curriculum contents. There are discussions about AI-ethics definitions in various directions, but the AI-ethics for the school curriculums should satisfy several conditions. It need to be relevant for everyone, useful for daily life decisions regardless of people's occupation or status, and expandable to the new field as the social situations changes. Therefore, the most inclusive AI ethics, namely the ethics about AI, need to be a core of the school AI ethics curriculum.

The present time cannot be said to be the era of AI. However, considering the impact that AI will bring to us and the society, the AI-ethics to use AI uprightly must be educated from the schools. Human will not be able to block the changes in the social structure caused by AI's technological advances and innovations, and also will not be able to prevent side effects

completely. Thus, the importance of the AI-ethics education can't be overemphasized. The essential contents and right directions of the AI-ethics education should be set in the school curriculums, and the AI-ethics education should be started from now that the AI era hasn't come in a full scale.

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