Keynote Speech

Transformation of Modern Society and Teacher Training to Develop Creative Teachers

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1. Transformation of Society and the Path for Education

Future forecasts and educational training are closely connected. It can be said that future forecasts and societal debates are fundamental parts of education for teachers. That's because children will become working adults in the future. First graders in the 2018 school year will become adults in 2032. They will turn 30 in 2042 and 40 in 2052. Even after 2050, they will be the backbone of society. What sort of society will we have 10, 20, or 30 years in the future? It is necessary to forecast the future as much as possible and teach people about the corresponding knowledge that will be required. From an education policy perspective, of course, we must think about what teachers should be learning to develop individual ideas about the future of society and how to teach our students.

In an age of comparatively slow societal change, we may be able to teach as we always did and managed without any real future forecasts. But as we've seen with the evolution of the smartphone in the 2010s, society is changing rapidly. Today, VR (virtual reality) and AR (augmented reality) are said to be on the next-generation platforms. University students have started showing interest in artificial intelligence (hereinafter abbreviated as AI), VR and AR. They have become hot topics. These trends are truly tied to the advent of the fourth industrial revolution. The first industrial revolution began in the end of the 18th century when hydraulic power and the steam engine mechanized factories (England, etc.). The second industrial revolution was in the beginning of the 20th century when electric power (internal combustion engines, electric motors) brought about mass manufacturing (USA, etc.). The third industrial revolution began in the 1970s when electronic engineering and information technology brought about precision equipment, high-performance electrical equipment, and automatic production of automobiles (Japan, etc.). The fourth industrial revolution is known as Industrie 4.0 in Germany. As industrial structures change, work also changes, and so do the needed capabilities of workers. If those capabilities are changing, then the things we should be teaching in school should also change. Children will change because of the influences of society, and teachers need new devices to reach them. In short,

the fourth industrial revolution and educational reform are related.

Up to now this has affected all countries in the same way. However, Japan faces additional serious problems such as shrinking birthrates, decreasing population, shrinking markets, unprecedented aging of society, caregiver shortages and large fiscal deficits. The aging of society is a common phenomenon in China and Europe, but the aging in Japan is outstanding. As the aging of society ramps up, the social-welfare-related budget increases, and there is worry that the money for education might decrease. Some Japanese have concerns that we are slipping behind in the fourth industrial revolution due to the Galapagos effect when it comes to our place in the global economy.

Japan has always been an "education nation". We need to continue to nurture education and scholarship. If we don't reform education and improve teacher professional capabilities, we may be left behind by the fourth industrial revolution. We cannot forget that the quality of school education and teacher training is supported ultimately by academic research. Education and research provide the foundation for the fourth industrial revolution. Isn't educational reform necessary for us to create prospects for the future society? At first, I would like to explain my thinking about the awareness of the issues I've just described.

○ After the fourth industrial revolution, human beings' central activity will be inquiry, which is the source of identity and self-efficacy. We will become tolerant of diversity, and our symbiotic relationship with others will be respected. This sort of society is called a "harmonious and inquisitive society." And this makes it the task of education to train for symbiotic qualities and the ability to inquire or research.

○ For a harmonious and inquisitive society, we need creative teachers. We need to redefine a teacher's specialty as being at its core a creative practice.

○ It will become important to have a philosophy of symbiosis and inquiry when training teachers at the university level.

In this keynote speech, I will advance my arguments based on this point of view. How will society change, and how should school education and teachers change with it? As AI advances, teachers must change. If we don't change, our profession will not survive. Of course, some things are immutable. What are the immutable parts of being a teacher? And what makes a creative teacher? To realize this, what sort of training is necessary?

2. The Development of Artificial Intelligence and Work in the Near Future

It is said that Japan's future will be one of decreasing population and an aging society. By 2030, those 65 and older will make up 36.1% of the population (Terada et al 2017, 16). At the same time, there will be a serious labor shortage. In China, due to their aging population, the working age population is in decline, and it has been pointed out that by 2025, its population will begin to decline (62). The same tendency can be seen in the ASEAN region although it depends on a country.

It is said that demographic changes will lead to the fourth industrial revolution in the 2020s. The further development of AI and robots is predicted. It has been forecast that the development of AI "is highly expected to end up replacing about 49% of Japan's working population with technological AI and robots" (96).

Thus, how will the quality of work change? As AI takes center stage, new work related to it will be born. It may be enough for people to find specialized work in the field of supporting AI. It could be through sharing and collaborating with AI. For example, doctors have begun collaborating with AI at the University of Tokyo and Jichi (Collaboration with Japan's prefectures) Medical University. There is an enormous amount of medical literature on AI to read about methods for diagnosing through images and setting up treatment based on those diagnoses. The final judgment is by the doctor. If this sort of thing advances, a doctor's work won't disappear, but a doctor's identity and status may change.

While having this sort of discussion, it's important to think about what sort of AI will advance and to what level. AI has two types; specialized and general. The AI used by doctors is the specialized type. This type is famous for the computerized Shogi (Japanese chess) playing and the Google search algorithms, which show their strengths in specific fields. But the general type of AI is being developed today. Even with general AI, knowledge based on completing tasks in a certain field stays in that field and can't be transferred. Put in pedagogical terms, there is no formal discipline (thinking power and transfer of learning). However, there is one form of high-performance general AI that is being developed, so that it can transfer knowledge on its own. It works similarly to how the human brain handles formal disciplines, so when it takes on work in a different field it makes educated guesses. If a machine or robot with eyes is developed, we are getting close to realizing Astro Boy from Osamu Tezuka's manga.

3. What will Become of Teachers?

When we look at all the information related to development of the fourth industrial revolution, the most often heard conclusion is that teachers won't be replaced by AI (The Economist, UK, 2017, 311). AI Researcher Maki Sakamoto writes, "The weakness of AI is in work that requires

high capabilities and is so-called 'deep-responsibility work" (Sakamoto 2017, 39) such as a doctor or an elementary school teacher. The argument that AI will never become a teacher generally goes that AI can only adhere to a specialized field. It could support a teacher, but a teacher needs to be a human who can gauge the reactions of children and understand them emotionally.

So how will the quality of a teacher's work change as specialized AI or first-generation general AI spreads? This question connects to how a teacher's specialization will be redefined. AI Researcher, Yutaka Matsuo predicts that AI will enter the education field deeply around 2030 (Matsuo 2015, 51). If so, the relationship between AI and teachers should be debated in education research.

Famous big data players such as Recruit, Microsoft, Pearson, and IBM have already entered into businesses of educational practices. Strategies can be devised for measures and countermeasures related to group learning by grade and school through access to a database. In the UK and Australia, schools have large discretionary budgets, so they use it to hire private education consultants (former principals who open businesses) for proposals and analysis. The principal needs to use the consultant's knowledge and data and also exercise leadership.

What will the teacher's work be? I'd like you to envision teachers teaching students in various classrooms and overseeing a homeroom. Each student has his or her own individuality, and their guardians probably hold a variety of opinions. And their feelings change day to day. Teachers must read the students' expressions, understand them, form a trusting bond, and teach a lesson. However, the students are children, and they are not always in touch with their own emotions. Human relations in a classroom have many variables. From a group perspective, the classroom teacher needs to be observant. I don't think AI can handle that sort of work.

However, beyond the compulsory education that is so important for the structure of society and the building of human relationships, high-school level classes may have spread to online classrooms. Will that reduce the number of teachers? It may be necessary for teachers and AI to share, but is the idea of sharing enough? AI Researcher, Noriyuki Yanagawa and team posit that "if you think of education in a straightforward way, AI or robots can't keep up. Human strength is in our pliable ability to handle problems with many individual variables. Tools and education that furthers those strengths will become even more necessary." (Yanagawa et al 2016) "The pliable ability to handle problems with many individual variables" is a creative ability. For teachers to be able to teach symbiosis and inquisitiveness as the fourth industrial revolution develops, they will need to be creative.

4. The New Teacher's Specialty: The Creative Teacher

According to The Economist of the UK, "In the long term, the market for medical, education

and legal affairs will expand along with employment opportunities. Monotonous work that no one wants to do like making algorithms will be taken up, and the quality of people's employment will trend in a positive direction." (The Economist, UK, 2017, 317). "Education may become quickly customized to each individual's need for material and instruction" (316). However, at the same time, "if the students are put to sleep by a monotone and meandering lecture, the teachers will just end up getting fired. Teachers will be like sports coaches … and help up students who fail. We can expect a sense of balance to be exerted." (312)

With the appearance of AI, teachers need to be more coach-like. There will be fewer teachers who have exclusive knowledge and impart that knowledge from above (traditional teachers). So what will the new specialty of teachers be? In one phrase, they will be "creative teachers". A creative teacher has an outlook about the future, a pliancy and a responsiveness to develop the possibilities for children as much as possible, gather resources, develop or acquire through colleagues' new viewpoints, and be a specialist who creates a comfortable learning environment for lessons, classroom management, school events, etc.

When we speak of being creative, we're not talking about designers or scientists, for example. Teachers don't have to force a uniqueness or originality. Instead, what is needed is the ability to see the actual situation with the children and understand and analyze the change, variety, societal features (for example, change in play, friendships, communication), and family environment of the students. Then, the teacher will shape the classroom experience and the lessons to encourage a child to grow into an adult who can enjoy a comfortable life. In this process, the questions will be how much originality and ingenuity can be shown, how pliant they can be, how much they can wait for children to develop, and whether they can talk to and help children on their own level. A teacher can become creative if he or she acts with the fundamental human right principle, makes comfortable class lessons, and uses intuition to structure the students' experience.

Based on the basic ideas I have just mentioned, the qualities of a creative teacher, or the core specialties that a new teacher in the fourth industrial revolution should have are as follows.

○ The teacher should use AI to support individual learning and the advance of collaborative learning. The three elements of school management are said to be people, things, and money, but we've come to an age where time and AI should be added making it five elements of school management. In other words, the teacher use AI to sometimes divide work, and teaching groups use AI to organize high-quality class lessons.

○ Consider the children and their guardian's ideas, books, educational material, regional society's educational resources, and global topics to develop and put into action a curriculum that stresses

symbiosis and inquiry. To do this, teachers need a wide range of knowledge and training, analytical skills, problem-solving skills, a strong structure, good planning skills, and an imagination. This is the kind of research ability that can be acquired in a graduate thesis or master's thesis. Research is the source of creativity. In other words, teachers need practical research skills.

○ Teachers should not just reply on AI; they should think about what AI cannot do. AI cannot cooperate with others, negotiate, network, support (for example, helping a child expand his or her narrow horizons. Help with difficulties faced with development.), meaningfully change curriculum direction to reflect environment and context, motivate, encourage, build a child's confidence (inspire, influence, encourage, fire up, help feel alive and vital). This is a teacher's work.

○ "People can find themselves in an unprecedented situation, but apply past experience to a different field and extend and apply their knowledge to make an effort to solve the current problem." (Sakamoto 2017, 39) Abilities unique to humans include "implicit understanding" and "being able to refine communication to be suitable to different groups and exert leadership." (39) This ability for teachers will continue to be important, as it is now.

○ There is no fear or anxiety in AI. But there is fear and anxiety in humans. To avoid fear and anxiety, humans have developed an aesthetic sense. An aesthetic sense avoids fear and anxiety and brings about a feeling of calmness (Habu 2017, 39-41, 80-83, 97-98). When seeking an aesthetic sense, a feeling of tension and seriousness intersect. Also, an aesthetic sense can impress people through athletic competitions, artwork, singing etc. A teacher needs an aesthetic sense as he or she teaches and manages the class. This will make the classes and events impressive. However, to avoid being authoritarian or prescriptive, we remember that our aesthetic sense is not immutable.

○ A teacher must grasp a student's needs and create needs. By developing an attractive curriculum, the teacher will create new learning needs for the students. In this process, AI can be made good use of because of its expanded intelligence. The essence of a creative teacher is to create high-quality curricula and lessons. It is desirable to apply the approach (educational method) toward symbiosis and inquiry in a pliant and variable way, reflecting on the context of the school, and the conditions of the class or child. An effective means of protecting the quality is through lesson study.

○ In lesson studies, the class observer does not offer one-sided opinions. If there is criticism, there should be practical advice on how to change. When criticizing a certain aspect, the observer should put themselves in the teacher's shoes and think what they would do in a similar situation. "What sort of question would I pose to get the child to speak further?" Through this detailed vision, the observer can exchange ideas from the same stance as the teacher. It is safe to say that this sort of lesson study is a creative activity for teachers.

○ The fourth industrial revolution's advance means our society will be structured on our actual world, a mix of our world and the virtual world, and the virtual world alone. If a school or teacher uses virtual material and AI, he or she should keep a pivot foot in the actual world, bring up ethics, and support the children's societal and realistic development.

5. Teacher Training from Now - The Tsukuba University Example

To develop new teacher specialties in universities and graduate schools, we need ideas for how to use inquiry as an axis for developing and using our knowledge. I will offer one detailed example. From April 2017, the Master's Program in Education at the University of Tsukuba offered an international baccalaureate degree through an accredited program. It is called the MA in Education, International Education Program. The objectives of the specialization are to develop internationally minded inquirers with a sound understanding of innovative thinking in education and the skills necessary to plan and conduct research on issues in International Education. Students will investigate pedagogy, curriculum and assessment in the context of the International Baccalaureate (IB) and other international curricula. The student profile is described thus: "This specialization welcomes open-minded thinkers with an active interest in educational innovation who want to make a contribution to the field of international education." Obtainable certificates are the IB certificate in teaching and learning (IBCTL), PYP/MYP/DP, and IB advanced certificate in teaching and learning research（IBACTLR）.

As part of this educational training curriculum, the required courses for the IBCTL are: "Pedagogy for a Changing World II"; "Assessment for Learning I"; "Assessment for Learning II"; "Curriculum as Process I"; "Curriculum as Process II"; "The IB Primary Years Programme"; "The IB Middle Years Programme"; "The IB Diploma Programme"; "Professional Learning and Reflective Practice." (There are many other subjects to choose from; a master's thesis is also required.)

Associate Professor Akiko Taira, who has had some outstanding experience teaching at an international school in Hawaii, has introduced mindfulness and discussions of a person's

identity seen through cultural and societal lenses into Curriculum as Process II. The class plan is as follows: "Topic 1 -- Overview and Review of CAP (Curriculum as Process) I"; "Topic 2 -- Planning Processes"; "Topic 3 -- Planning for Transdisciplinary and Interdisciplinary Learning"; "Topic 4 -- Experiential Learning"; "Topic 5 -- Planning for Interdisciplinary, Transdiciplinary or Experiential Learning"; "Topic 6 -- Collaborative Planning and Reflection"; "Topic 7 -- Curriculum Mapping: Accountability and Communication."

One piece of educational material is called "Shadow a student challenge." Students are asked: "What would the school leaders see in your country's average school if they shadowed a student? Think, Group (of three), Pair. In your ideal/dream school, what would you see if you shadowed a student? Think, Pair, Share. Think, Group (of three)/Pair, Share. Through these questions, students see the school in a new light. This also introduces the following questions: "What do we want the students to understand? Concepts. What do we want students to be able to do? Skills. What do we want students to learn about? Knowledge. What do we want students to feel, value, demonstrate? Attitude. How do we want students to act? Action." This introduces the five principles of the IB's PYP curriculum.

Normally, the method for introducing and expounding on the principles of a curriculum happens during lectures in teacher training. But in this class, the principles aren't taught first; they are acquired through inquiry and arrived at last through this process.[1] "With humanism as a basis, we respect symbiosis and inquiry," Akiko Taira told me when we talked on January 17, 2019. "To conduct human-centric teacher training, we put ICT to work. As the fourth industrial revolution progresses, humanity and students' feelings of accomplishment become important, and at the same time, the trend is to use ICT. The IB program is changing in this direction too."

The IB teacher training program at the graduate school of the University of Tsukuba is cooperating with schools. In the future, the university will cooperate with the Senior High School at Sakado, a University of Tsukuba affiliate that employs the DP program. Moreover, on December 11, 2018, the University of Tsukuba entered into a partnership agreement with the Saitama City Board of Education. The main objective is to cooperate with the Omiya International Secondary School that opens in April 2019. Through this cooperation, a mutual exchange between the school (lessons) and the university (research) will take place, and both the quality of the lessons and the academic research is expected to improve.

Omiya International Secondary School has organized a consistent 6-year middle school curriculum. First- through 4th-year students learn in IB MYP (middle years programme). Fifth-year students (similar to 2nd-year high school students in Japan) and 6th-year students (3rd year of high school in Japan) divide the students into three paths: the global course (IB DP), liberal arts, and STEM. In MYP, morning is used for All English time. Saturday morning is called Learner

Directed Time. One unit a week is on English Inquiry, and another weekly unit is spent on the 3G Project (Grit, Growth, Global).

The graduate school at the University of Tsukuba is cooperating with more than just Omiya International Secondary School. As these efforts progress, through the use of IT, we can respond to the fourth industrial revolution through creative, inquisitive ideas, and the tolerance of symbiotic minds. This is a teacher training for a new era and one example of teacher training curriculum. The spread of this type of effort is connected to creative educational training and contributes to the realization of a comfortable learning environment for students.

Because of the fourth industrial revolution, humanity becomes more important than ever for our society. Inquiry is the core activity of human beings. At the same time, we need to become tolerant of diversity and respect our symbiosis with others. To create this symbiotic, inquisitive society, we need creative teachers. To activate the training of creative teachers, we will need even more effort and tools from here on out.

Note: This paper is a revised edition of "Become a Creative Teacher" (Hiroshi Sato, Gakubunsya, 2018, Language: Japanese) for SEAMEO international conference.

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[1] At the end of this class, these questions come out: Essential Question: How is the IB programme curriculum structured and what principles of learning underpin it? Essential Question: What processes are involved in designing effective programmes of learning within the context of the programme? How are they combined to create authentic learning activities? The students reflect and write 250 words explaining their view to hand in. Furthermore, to describe this event in Akiko Taira's classes, she gave me authorization to use the material and the presentation. I thank her for her cooperation.