EDUCATIONAL INNOVATION IN SOCIETY 5.0 ERA: CHALLENGES AND OPPORTUNITIES

Edited by
Yoppy Wahyu Purnomo & Herwin
EDUCATIONAL INNOVATION IN SOCIETY 5.0 ERA: CHALLENGES AND OPPORTUNITIES
Educational Innovation in Society 5.0 Era: Challenges and Opportunities

Edited by

Yoppy Wahyu Purnomo & Herwin
Faculty of Education, Universitas Negeri Yogyakarta, Indonesia
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Preface

Educational innovation in the era of Society 5.0 is directed to resolve various social challenges, issues, and problems relating to educators, students, the dynamics of the education system, and social dynamics. Era Society 5.0 is an answer to the challenges that arose due to problems resulting from the Industrial Revolution 4.0 era by utilizing innovations in technology that integrate cyberspace and the physical world. This is expected to balance economic development and solve social problems. Based on the background of the situation, there was a need for a forum that was able to explore and publish various results of studies and research related to educational innovations in the era of Society 5.0. The 4th International Conference on Current Issues in Education (ICCIE) 2020 took place in Yogyakarta on October 3-4, 2020. The conference was organized by Yogyakarta State University (UNY) in collaboration with Universiti Kebangsaan Malaysia (UKM).

There were 226 participants from countries all over the world attending the conference. The scientific program consisted of in total 92 talks, a big part of them presented in 10 mini-symposia. Five talks were invited plenary lectures given by Assoc. Prof. Dr. Hayashi Masami (Japan), Prof. Dr. Glykeria Fragkiadaki (Australia), Prof. Dr. Juliane Stude (Germany), Prof. Dato’ Dr. Abdul Razak Ahmad (Malaysia), and Prof. Dr. Siti Irene Astuti Dwiningrum (Indonesia).

We would like to express our appreciation to the many people who contributed to the success of the conference: the plenary and keynote speakers, the authors, the participants, the session chairs, and the members of the Committees who nominated plenary and keynote speakers. The editors are especially grateful to those who reviewed the manuscripts included in this book.

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Society 5.0 and education in Japan

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ABSTRACT: Japan calls the future, which is impossible to predict with precision, Society 5.0. Current occupations will be replaced by machines and human jobs will decrease. However, humans will have to do new jobs to make a living. Japan examined what kind of policies are needed for peace and sustainability for humanity. As a result, we decided that we need to master artificial intelligence (AI) and train people who cannot be replaced by AI. However, specific education is still being explored in all countries. In this paper, I have first identified the characteristics of Japan’s educational reform. Then, the future of education in Japan was discussed based on the OECD’s Learning Compass 2030.

1 INTRODUCTION

1.1 The purpose of the investigation
The purpose of this presentation is to introduce Japan’s Society 5.0 and relativize its advantages and challenges. In times of slow change, the future can be predicted by analyzing past data. However, at times, there is a significant disconnect between the past and the future. For example, the present and the future are not continuously connected, as exemplified by the pandemic of the new coronavirus disease. We live in these unpredictable times. First of all, we need to be able to analyze big data and choose the best option. On the other hand, we also need to be able to deal with unpredictable situations that differ from past trends and how best to deal with them. Society 5.0, as proposed by Japan, is the inevitable future. The decision on what kind of education is needed in Society 5.0 era will differ from country to country. This decision will probably change the future of each country.

1.2 The problem being investigated
I will clarify what kind of Society 5.0 is proposed by Japan, its advantages, and the direction in which it should be incorporated into education. It should be noted that Society 5.0 is not an ideal future, but a reality brought about by technological innovation. Technological innovation allows machines to fill in many parts of human activities. It could be said that machines will take away human jobs. This includes the question of how humans will live in a future where machines will replace many parts of human work. Education, as proposed by the OECD, may provide a hint of a solution. I believe that one of the answers is an education that allows students to exercise competency and agency towards well-being.

1.3 The background
In today’s world of the Internet, new future strategies are becoming an important issue for the industry as well. In conjunction with this, education strategies need to be reoriented for optimization. Governments need to examine their education policies for the sake of peace and a sustainable future for humanity. Here, I would like to show how Society 5.0, which is being considered and implemented by the Japanese government, is changing the educational sector in Japan. Society 5.0 will serve as a reference point for education policy in other countries and for teacher training in universities in other countries, and this will contribute to educational reform.

1.4 General approach
This report describes how the Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) and the educational community in Japan have responded to the Japanese government’s policy of Society 5.0 and how they are putting it into practice. One common approach is to develop indicators and case studies to test their effectiveness. Since we have yet to measure effectiveness, I will adopt the case study method of the MEXT. I believe that many countries can take a number of cues from Japan’s education reforms, which may or may not be positive.

1.5 The criteria for my study’s success
The goal of the study is to be able to interpret and explain the development of Japan’s Society 5.0 strategy in the education world based on OECD’s Education 2030 competencies and agencies. Japanese education up to now has tried to work on the individual to make him or her into the desired condition. As
a result, students have become more knowledgeable, skilled, and nurtured in their humanity. The Japanese educational community emphasizes the merits of individual education. However, less attention has been paid to how students live in a world of technological innovation and globalization. This is a point of reflection. Therefore, I decided to use the OECD project, which is examining educational models that respond to technological innovation and globalization, to clarify the characteristics of Japan. Tokyo Gakugei University, to which I belong, is conducting a project to provide evidence for educational reform in collaboration with the OECD and MEXT.

2 RESULTS

For predicting the future of employment, a study by Michael A. Osborne of the University of Oxford was the catalyst. There, it was published that many of the jobs that currently exist will be replaced by machines (AI) in the near future (Freya & Osborn 2017).

Influenced by research in this direction, Japan’s Nomura Research Institute released a report that said 49% of current jobs in Japan will disappear in the next 15 years. In 2015, Japan’s Nomura Research Institute estimated the establishment of computer technology replacements in the next 10-20 years for each of Japan’s 601 occupations. It found that about 49% of Japan’s working population could be technologically replaced by artificial intelligence (AI). On the other hand, occupations that require knowledge to organize and create abstract concepts, such as art, history, archaeology, philosophy, and theology, were found to be difficult to replace with AI. It was also found that professions that require cooperation with others, understanding of others, persuasion, negotiation, and service orientation are also difficult to replace with AI. Comparing Japan, the United Kingdom, and the United States, it was also found that Japan’s workforce is more replaceable by robots and other technologies (Nomura Research Institute 2015). The Nomura Research Institute’s comparison of the UK and the US is based on the work of Dr. Osborne and Dr. Frey, among others (Figure 1).

In the case of Japan, education policy has been developed around the concept of Society 5.0. Society 5.0 is defined by the Japanese government as follows. “A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space” It follows the hunting society (Society 1.0), agricultural society (Society 2.0), industrial society (Society 3.0), and information society (Society 4.0). Today’s complex society is Society 5.0 (see Figure 2).

The difference between Society 4.0 and Society 5.0 is as follows: in Society 4.0, the Cloud is used, but not yet as big data. This is a society where AI does the analysis (Figure 3).

However, we are not yet at the stage where AI can analyze big data and use it consciously and creatively. Therefore, the MEXT, with an eye on society 5.0 vision of a society, is trying to increase the number of people who can engage in research and development related to AI, and to train people with human strengths that cannot be replaced by AI.

The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) is currently working on three leading projects: Leading Project 1, which aims to optimize learning through the accumulation of student study logs. At present, the results are still to be determined, but support strategies have been initiated for the GIGA (Global and Innovation Gateway for All) school initiative.

For the GIGA school concept, a package of measures for the realization of “one computer per student” was created by MEXT. (December 2020) MEXT’s roadmap for the realization of the GIGA school concept calls for organizing digital devices for all classes, from elementary school to high school, by the end of 2022 as a start. And it is planned to implement online education through the use of digital textbooks. The plan is to install wireless LANs in all public high schools by the end of the 2020 school year. The plan is to install wireless LANs in 80% of public schools in elementary and junior high schools by the end of the 2020 school year. The government’s budget for this is 231.8 billion for the fiscal year 2019. The purpose of this project is to achieve individualized learning without leaving any of the diverse students behind by using a learning log. In the past, Japanese education has offered a choice of subjects, but the degree of individual optimization was not sufficient. From now on, we will be able to provide more customized learning in the future.

Leading project 2 is a reform of the high school entrance examination. In Japan, high school entrance examinations and university entrance examinations are regarded as important, and the subjects on the Common Entrance Examination will be especially focused on. It has been decided to add “information” to the list of subjects to be included in the university entrance examination from 2024. Related to this, data science and statistics education are also being emphasized in the elementary, middle, and high school curricula.

Figure 1. Percentage of the workforce likely to be replaced by AI and robots, compared to Japan, the UK, and the US (Nomura Research Institute 2015).
MEXT emphasizes the promotion of information utilization skills and the enhancement of information morality education as a way to promote the informatization of education. A 2016 survey on information utilization skills is the basis of the policy. It had the following results (Table 1).

The results of the survey show that there are challenges in the ability to use information. In particular, collecting the necessary data (10) and doing numerical processing (11) has a very low percentage of correct answers. Besides, MEXT also gives students a message about moral education: do not give out passwords, do not open email links or files immediately, always keep your computer updated, and talk to adults if you need help. There have also been changes in university education, with the creation of the faculty of data science in Japan’s national universities (Figure 4).

Along with the emphasis on data science in Japan’s high schools and universities, a different kind of teaching is being sought at the compulsory education level as well. At Tokyo Gakugei University, we have been
Table 1. Implementing entity MEXT.

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<th>Practical skills in the use of information</th>
<th>Correct answer rate</th>
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<tr>
<td>1 Reading the current situation from the text including figures and tables</td>
<td>77.7%</td>
</tr>
<tr>
<td>2 Question about organizing based on web pages</td>
<td>73.6%</td>
</tr>
<tr>
<td>3 Question about solutions based on evidence</td>
<td>37.2%</td>
</tr>
<tr>
<td>4 Suggesting reasons from multiple charts of variance</td>
<td>Perfectly correct answer 9.8%. Proper Answer 32.1% *There is a problem in organizing and expressing multiple statistical information. Scientific understanding of information and attitude to participate in society</td>
</tr>
<tr>
<td>5 The question to be able to complete a flowchart</td>
<td>46.2%</td>
</tr>
<tr>
<td>6 Question about being against information morality</td>
<td>80.0%</td>
</tr>
<tr>
<td>7 This is a question about processing with attention to portrait rights</td>
<td>40.6%</td>
</tr>
<tr>
<td>8 Questions about sources and citations</td>
<td>Perfectly correct answer 3.8%. Proper Answer 54.4%</td>
</tr>
<tr>
<td>9 Problems related to fraudulent billing on web pages</td>
<td>54.7%. *There is a problem in dealing with sources, citation, and portrait rights. Newly identified issues</td>
</tr>
<tr>
<td>10 What kind of data should I obtain?</td>
<td>14.9%</td>
</tr>
<tr>
<td>11 A question about calculating with a spreadsheet software</td>
<td>16.3%. *There is a problem in determining what information is needed and processing the data numerically.</td>
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</tbody>
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Note: Subjects 10th grade, 135 schools, 4,552 students surveyed. Time period 2015-2016. Number of characters entered per minute (24.7).


Figure 4. An example from the Faculty of Data Science at Shiga University. https://www.ds.shiga-u.ac.jp/en/ (July 24, 2020)

conducting research on competency and agency in the classroom, as proposed by the OECD.

In this study, we analyzed the classes at Oizumi Elementary School affiliated with Tokyo Gakugei University. A professor at Tokyo Gakugei University visited the elementary school as a guest teacher and gave a lesson using a robot. The content of the class was to think about the future of Japan and humanity as students interacted with the robot. The students thought about the alternative possibilities for robots and the unique missions of humans (Figure 5).

Figure 5. The robot class at Oizumi Elementary School, Tokyo Gakugei University.

Leading project 3 is the reform of upper secondary schools. The World Wide Learning Consortium was established in the high school to promote research on global social issues, and so forth. Specifically, they plan to set up one administrative school per 60,000
high school students. At present, they plan to establish one administrative school and about 10 additional schools in total.

The WWL has a new budget of 167 million yen planned for FY 2019. And it is trying to train global innovators. The WWL will break away from the traditional and poorly functioning high school system, which is divided between the humanities and the sciences and will be characterized by a high school-university connection. There are about 10 designated schools, and the maximum amount of annual financial support per school is 15 million yen. WWL has been actively promoting cooperation with other countries, including fieldwork in a rural village and a national park in Indonesia (Figure 6).

3 DISCUSSION

What AI can do and how it can be used is currently being explored. However, in Japan, we are trying to get students to think about the professions that AI will replace and equip them with the ability to use AI. It is not clear what and how these skills can be measured for non-AI alternative creative occupations. It is a challenge that we face. For the part about what forces cannot be replaced by AI, I believe that the OECD’s Learning Compass 2030 (Figure 6) can be used. This is the same direction as the OECD competencies and agencies.

The OECD’s Education 2030 project Learning Compass 2030 aims to be a state of well-being in 2030. Well-being here includes both personal well-being and social well-being. It is very good to set a period time, for example, 2030 as a goal in education reform. It makes the timeline easier to create.

The OECD’s Learning Compass 2030 has a three-layered structure. The core competencies are knowledge, skills, attitudes and values, which have been consistently emphasized in the past. And the second layer is the core foundations, which include data literacy, and so on. The transformative competencies are located in the outer layer. It is Creating New Value, Taking Responsibility and Reconciling Tensions & Dilemmas.

In Japan, curricula are often considered in parallel with other subjects, so the OECD model of a three-layered approach is refreshing. The need to Reconciling Tensions & Dilemmas has not been deliberately incorporated into education in Japan, and this is a new need that has been focused on. In Japan, reconciling tensions and dilemmas have been taught unintentionally as part of special activities such as classroom activities, club activities, student council activities, and school events. From now on, this is the part that needs to be taught more intentionally. And this part is also a human-specific activity that is difficult for AI to replace.

The OECD’s Learning Compass also modeled the learning cycle. It is an AAR cycle model of anticipation, action and reflection. It is similar to the three-step model of introduction, expansion and summation that often appears in the Japanese lesson plan for school education. In Japan, the teacher has the students go through the whole lesson at the introduction and the students are made to reflect on the whole lesson at the summary.

Traditionally, the OECD has taken the stance of making the OECD key competencies clear. However, the OECD’s Learning Compass 2030 focuses on not just having a compass of competencies, but using the OECD’s Learning Compass. It is called student agency and co-agency; the OECD learning model expects students to gain competency and move proactively toward 2030 well-being. It is not just an individual activity. Students are also intended to work collaboratively with peers, teachers, parents, and community members to increase their agency (Figure 7).
Figure 7. The same direction as the OECD competencies and agencies. https://www.oecd.org/education/2030-project/teaching-and-learning/learning/ (July 24, 2020).

4 CONCLUSION

In Japan, as in the United States and the United Kingdom, about half the jobs will be replaceable by AI and robots by 2030. For this reason, Japan is emphasizing both education to develop the ability to use AI and robots and education to develop competencies and agencies that cannot be replaced by AI and robots.

The Cabinet Office of Japan aims to train leaders who are capable of technological innovation by using AI. The Japanese Ministry of Education is looking for ways to educate all students, including those from the local community, to support society 5.0. I hope that each student will be able to achieve well-being both personally and socially.

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