How to Prepare Students for the 4th Industrial Revolution Society

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Abstract

This paper aims to examine how universities prepare students for meeting the job needs in the 4th industrial revolution society and suggest a curriculum to meet the students' needs. In order to achieve the research goal, a survey method was used. According to Wikipedia, the 4th industrial revolution consists of various technological components such as mobile devices, Internet of things Platforms, big data, and augmented reality. This study attempted to determine whether the university's curriculum is designed to prepare students for obtaining the knowledge and skills necessary in society. It also examined how students perceive their abilities to handle technologies and get jobs in the changing society. Based on the data analysis, suggestions were made to adjust a curriculum design for future changes.

Keywords: *4th Industrial Revolution, Curriculum Design, Technology, The Job Market*

Introduction

Society changes rapidly. Using smart technology for everyday life becomes a social phenomenon. The World Economic Forum, held in 2016, pointed out that disruptive changes are taking place in current business models, and it will have a significant impact on the employment environment in the coming years. The business sectors stress that future technologies will influence changes in job contents and employment patterns, and thus, individuals must prepare themselves for rapidly evolving job requirements. It is already shown that many job positions will be replaced by artificial intelligence or network technology. According to the 2018 issue report from the career education centre in Korea, job markets' nature changes based on a human being's needs. Because artificial intelligence and robots have a significant impact on jobs, current employees are also

afraid of losing their jobs. It is not easy for college graduates to find new jobs in some areas. Van Dam (2017) predicted that job fields such as future industries, digital industries, and advanced manufacturing require individuals' different abilities since industry 4.0 keeps bringing faster innovation in producing and distributing new systems and technologies. The Fourth Industrial Revolution's new paradigm requires educational systems to have individuals who can survive in new environments. Therefore, educational organizations need to prepare students to achieve the necessary skills and knowledge in the curriculum. A curriculum is required to improve the ability to analyze logical thinking, prospects for the future, and problem-solving skills by connecting and understanding social phenomena' contents with students' academic areas to design the future. When looking at the current university curriculum, there are traditional courses offered but not many courses about evolving ideas or phenomena. However, researches about contemporary society are still limited and incomplete. Therefore, it is essential to continue to explore whether or not. The purposes of the study were to:

1. To determine whether students have experiences with the classes related to the industry 4.0 society.
2. To determine the degrees of students' knowledge about current society and abilities in using technologies
3. To explore students' preparations with their future jobs and perceptions of the jobs

Literature review

Studies about the 4th revolution deal with various aspects of society. Cowie, Townsend, & Salemink (2020) examined the directions of digitization in the rural areas and speculated the smart city in accordance with characteristics of rural areas. In rural areas, the levels of technology facilities are different from the cities, and there is a possibility for the rural areas to be ruled out from the innovation movement. Therefore, it is necessary to build a smart technology frame that is suitable for the regions. Oke & Fernandes (2020) claim that African society is not ready for the 4th revolution in society. The government needs significant attention to change the environments and curriculum of education for the future. Chala & Poplavska (2020) studied the social and sustainability requirements affected by the Fourth Industrial Revolution. In this study, the main conditions were structured by exploring the state's role in digitalization and the characteristics of public organizations.

Researches dealing with education and future jobs focus on the changes in the directions of training focus. Yoo (2017), the 4th Industrial Revolution has a large and rapid ripple effect that is incomparable with the previous industrial revolution. In particular, the core competencies required for jobs are changing as the environment of future employment, occupations, and positions are changed tremendously. Therefore, paradigm changes are inevitable in education. In particular, vocational training

organizations should make strategic choices for providing better programs. Since society changes rapidly, people need to develop new lifelong vocational skills. Yoo (2017) emphasized that people have to learn how to solve problems and make reasonable choices and vocational skills. Thus, education institutions have to develop programs focusing on current and future needs. Jagannathan, Ra, and Maclean (2019) indicate that future human resources' key attributes include necessary digital technology, literacy, learning ability, skills needed for green energy, skills required to engage in Industry 4.0 jobs. Next-generation infrastructure and service technologies; and extensive soft technologies to help improve the working environment's efficiency. Teamwork, problem-solving, creativity, and design thinking will have a significant and far-reaching impact on the future direction of technical and vocational education and training. Lavalle et al. (2017) stress that education's focus should be linked to facilitate the development and implementation of innovative technologies that are critical factors of growth in the present society. The Fourth Industrial Revolution's new paradigm requires an educational environment that can produce managers who can run future smart factories, workers who can use smart technologies, and talents who can access new cultures.

On the other hands, there is a study to stress human value as well. Lee (2020) suggested designing a socio-technical research database system for professionals to get better research results when developing a research database. For society's sustainability, the research focus should not be just on digitalization. The social aspects, such as ethics, team, and value, should be treated as important as the successful implementation's technical aspect.

Winterton et al. (2019) present the concept of "work preparation after graduation," and cooperation between universities, governments, and the vocational world is required so that learners who graduate from college can be ready for the vocational world. In order to produce the talent needed in reality, universities need to examine their relationship with graduates and labour markets. Universities can conceptualize "graduate work readiness" (GWR) so that graduates can measure their employment potential. Yoo (2017) claims that the TML model can explain the Fourth Industrial Revolution's impact on the labour market. TML Model is a systematic description of the labour market developed by European researchers in the late 1990s. TLM is more about employment security than job security. An employment security strategy pursues and protects jobs themselves. It emphasizes empowering people with job competencies and adaptability to environmental changes rather than employment capacity. TLM suggests lifetime-level training. To ensure employment stability, continuing to strengthen job competency and adaptability through career development are necessary. The model emphasizes promoting an individual's activeness and responsibility. It claims that the nature of the digital economy has led to a drop in the employment rate in recent decades and has also affected labour market trends. While the increase in labour productivity has not had a negative impact on employment, technological development and automation have led to a significant drop in

the middle class's jobs in recent decades, bringing about a change in employment composition. These changes in employment structure have resulted in changes in polarization patterns.

The Korean Research Institute of Vocational Education and Training (KRIVET, 2017) surveyed the employees in natural science, engineering, and manufacturing about the perspectives of their jobs in 2017. The KRIEVET survey report (2017) revealed that many of the employees perceived that the development of science and technology, such as artificial intelligence, robots, and the Internet of Things, will be in full charge in their work field five to 10 years. Technicians, devices, machine operators, and simple labor workers are more optimistic about future jobs than experts. It also showed that women, employees with high educational background, experts in their field had more pressures that they are required to perform their duties in accordance with the development of science and technology. People who have ICT-related jobs expressed that the job fields will be changed a lot in 10 years. The KRIVIET (2017) reported that vocational organizations provide information on job problems following the Fourth Industrial Revolution, including artificial intelligence and intelligent robots the educational organizations, and provide customized vocational training based on the needs. At the government level, reliable job information on future job changes should be developed online and offline and distribute it to people. Besides, training and education to improve employees' job performance should be provided to actively cope with changes in work due to the development of science and technology. Training should be expanded to all the fields. Since labour workers will face changes and have great possibilities to be replaced by artificial intelligence, robots, and the Internet of Things, they need to acquire new skills in response. It is essential to provide them with opportunities to prepare for future changes in society.

Methodology
Research methods
In order to achieve the study goals, a survey method was used. Two kinds of surveys (survey A, Survey B) were conducted with the two groups of students (A University and B university) who currently attend the two universities. University A does not require any specific graduation classes, while university B requires students to take six credit classes related to industry 4.0 for graduation in the liberal arts areas. Thus, most students have experiences with the knowledge and concepts about the changing society.

Research instrument
Two survey instruments were designed to collect the data. Survey A was to collect quantitative data, and survey B was to collect qualitative data. Survey A consisted of30 questions. It has four sections, asking about the experiences with the industry 4.0 classes, knowledge about current technologies and changes, perspectives of the future job market, and evolving and diminishing job areas. Survey B was consisted of 2 open-end questions,

asking about their future job plan and perspectives of changes in their job areas in the industry 4.0 society. The survey questionnaires were developed by the researcher and reviewed by three experts in the field of education. Detailed information about the survey instruments is as Table 1 below.

Table 1. Survey instrument

	Section	Number of Items	Question type
Survey A conducted with University A	Experiences with the Industry 4.0 related classes	15	5 Likert scale
	Knowledge about the industry 4.0 related technologies and abilities to use them		
	Career Plan	10	
	Evolving and diminishing	2	Open-end
Survey conducted with University B	Perspectives of changes in the job areas in their study areas	2	Open-end

Participants

A total of 131 students participated in this study. Fifty-six students from A university participated in survey A, and 80 students from B University participated in survey B. The participants were students who enrolled in the two different Universities in the spring semester of 2020. For the data collection, two courses were randomly selected from each university. Group A participants consisted of 21 food science major students and 30 science education major students. Group B students vary in their study areas because the selected courses were liberal art classes designed to teach concepts and technologies in using information. The students' participation was voluntary, and the anonymity of students' responses and their confidentiality as participants were explained by the researcher before conducting the survey.

Table 2. Participants

Participants' school	Number	Major	Gender
University A	56	Food Science 26, Science education 30	41 Male, 15 Female
University B	80	Diverse	64 Male, 16 Female

Data analysis

The survey results were analyzed using t SPSS 26 to examine the tendencies of responses, and themes of each sentence analyzed open-end questions. Even though 80 students responded to the open-end questions, many responses are out of the theme of unfinished responses. The response which is not applicable were eliminated from the analysis.

Findings

(1) Students experiences with the classes related to the industry 4.0

in order to find out students' experiences with the industry 4.0 classes, questions number one (experiences with taking software or coding classes) and two (experiences with classes about industry 4.0) were analyzed. Interestingly, students responded the same to both questions. A total of 77% (43 students) of the students responded that they did not have any experience with the coding or software classes, and they do have experience with taking any industry 4.0 related classes. Students do not know what kinds of classes are related to the industry 4.0 concepts and technologies except for coding or software classes. When asking about the types of courses they have taken, all the respondents answer, "Computing thought and problem-solving class." Detailed information about the students' experiences is presented below.

Table 3. Students' experiences with taking classes related to the industry 4.0

Questions	Yes	No	Total
Experiences with Software of Coding classes	23% (13)	77% (43)	100% (56)
Experiences with the classes about the industry 4.0	23% (13)	77% (43)	100% (56)

(2) Students' knowledge about the knowledge about industry 4.0 and abilities in using technologies

In order to find out their knowledge about industry 4.0, six survey questions from survey A were analyzed. As table 4 indicates, students were not aware of the concepts about industry 4.0(m=. Students who were comfortable using computer technology tended to have positive attitudes toward online education, and they are more likely to select online education as their preferred instructional mode. T-Test was conducted to determine if there is a difference in their answers according to the experiences with taking industry 4.0 classes. However, there were not any statistical differences found.

Table 4. Students' knowledge about industry 4.0

Statements	Mean	S.D
1. I know what industry 4.0 is.	2.86	1.10
2. I know the five key technologies of industry 4.0.	2.14	1.10
3. I know well about the role of artificial intelligence plays in our lives.	3.29	1.04
4. I can use the statistics program to handle big data.	2.11	1.12
5. I can explain what augmented reality is.	2.41	1.22
6. I know well about the types and roles of the Internet of Things (IoT).	2.27	1.17
Total mean	2.51	1.13

Note: The higher the mean score, the more positive the response. Note: Maximum score is 5 (strongly agree); the minimum score is 1 (strongly disagree); Note: The mean score above 3 is regarded as a positive response.

When analyzing students' skills in using technologies, it shows that their technology skills are very poor (M=2.49). In particular, the students do not know how to use 3D printers and do not have any coding skills. Also, they do not have any skills in using

technologies used in their classrooms. They do not know how to use the database and how to analyze data using statistical software. Respondent also does not feel comfortable with communicating with a chatbot or artificial intelligence in real-life environments.

Table 5. Students' skills in using technologies

Statements	Mean	S.D
I know how to print using a 3D printer.	1.66	0.88
I have the computer skills necessary for my classes.	2.70	1.09
I can freely use basic computer software or statistical tools such as Word, Excel, and PowerPoint.	2.89	1.20
I can use basic coding software such as Scratch.	1.86	0.88
I can know to use and analyze big data to make decisions.	1.93	0.95
I know that driverless cars are running.	3.27	1.21
I know that cars made by 3D printers are available to buy.	1.86	0.98
I know the name of the IoT that currently exists or is in use around me.	2.16	1.04
I feel comfortable to talk to Artificial intelligence on the phone or communicate with a chatbot.	3.29	1.32
Total means	2.49	1.09

Note: The higher the mean score, the more positive the response. Note: Maximum score is 5 (strongly agree); the minimum score is 1 (strongly disagree); Note: The mean score above 3 is regarded as a positive response.

(3) Students' preparations for plan and perceptions of the job markets
When analyzing the job preparation, they do not seem to know about job markets in their fields and do not have concrete job plans yet. They perceived that changing environments will somehow affect their job markets, but they did not know how specifically it impacted their job areas.

Table 6. Students' perceptions of jobs in the future

Statements	Means	S.D
I have an accurate plan for my career after graduation.	2.78	0.94
I know what I am good at for my job.	2.80	0.93
Social changes do not influence the job I am planning to have.	2.45	1.02
I am well aware of the job positions newly created because of the 4th Industrial Revolution.	2.35	1.04
I am well aware of the job positions that are being extinguished due to the 4th Industrial Revolution.	2.73	1.08
The job I am planning to have will exist in 10 years.	3.31	0.92
Information about future changes is strongly related to my career decisions	3.51	0.96
It is necessary to have the ability to use software or big data in my job area.	2.91	1.01
I believe that colleges must offer courses related to the 4th Industrial Revolution.	3.24	1.19
The Fourth Industrial Revolution will have a great influence on my career path.	3.29	1.05
Total mean	2.94	1.01

Note: The higher the mean score, the more positive the response. Note: Maximum score is 5 (strongly agree); the minimum score is 1 (strongly disagree); Note: The mean score above 3 is regarded as a positive response.

When analyzing the survey Regarding future jobs, the students responded that engineers working in developing AI, robots, and computer-related technologies would be needed more while jobs such as interpreters, teachers, doctors, pharmacists, bankers, and accountants will be diminished. When analyzing the responses about perceptions of industry 4.0, they seem to accept the changes but believe that there are still many areas that machines cannot take place. Students' responses are as follows.

The Fourth Industrial Revolution will cause many people to lose their jobs. The number of people engaged in jobs where there are many different opinions, but machines cannot, and where people have to work together will rather will increase. For example, the art and sports industry is expected to have a bigger market without art and sports as machines lack many parts to imitate human emotions. (Student A)

In the future, the society in which we live will see many cases of job loss due to machines. I think we need to develop the power to keep our position. Or, I think it's best for us to deal with it in advance so that there's no difficulty getting things done even in jobs that can't be replaced by machines.

Currently, many conveniences have been created due to the fourth industrial revolution, but many jobs have been created and disappeared, so it would be good to avoid jobs that are disappearing as much as possible, and to get a job in all industries or manufacturing, which are currently being newly created or have a lot of old companies by industry.

Due to the rapid change, society is now making many changes. At the national level, we should also help the people, and the people should choose according to the changes and continue to study in order to live a more advanced life by abandoning the sense of naturalization of their jobs. Also, I will make efforts to have a future-oriented job in order to make a quick leap forward for the present generation, not a life that is struggling with the industrial revolution and living with it.

Due to the development of information technology in the wake of the fourth industrial revolution, the quality of human life is expected to improve significantly. However, this will increase the unemployment rate of some professions due to automation, such as the spread of smart factories due to AI and robots' development. To cope with this employment structure, it is necessary to focus education on having judgment and problem-solving skills that are difficult to replace with AI.

When analyzing students' responses regarding their future jobs, they expressed positive expectations about the job market in their study areas. In particular, students majoring in social welfare, disaster protection, engineering, nursing majoring seemed to be sure that their job areas exist in the future and need more people working in the field. In the case of photography, major students and major cosmetic students expressed that since their job areas need creative abilities, their jobs that cannot be replaced by a robot or AI may continuously exist. Nursing major students strongly believe that there are

always people in need in the case of medical care. They perceived that a nursing job would be secure in the future as well.

On the contrary, a student majoring in architecture showed concerns about the future of their field. It will be difficult for them to find a job and remain in a job position for a long time. Therefore, they need to study more to get expertise in other areas simultaneously, such as food science, sports, or factory workers.

> *I am in the construction sector, and in the construction sector, it was not easy to find jobs with similar wages after losing jobs in 2011. However, in 2017, the construction industry was still able to find jobs with similar wages compared to 2011. I think the construction industry will be easier to find later than it is now with this outlook. The results showed that the economy would not be out of work for the next six months, and economic development prospects are good. (Construction major student)*

> *My major and future hope job is beauty. All in all, anything that can replace a beauty-related robot or hairdresser is a product that cannot come out. Therefore, the future job of beauty is expected to continue to be high in employment. From now on, I think the job prospects of beauty will be higher and higher as a job of hope, and since it is a job of finding artistic sense using hands, it will require sufficient practice and experience. (Beauty care major student)*

> *I'm going to get a job in the health field. In the health sector, statistics suggest that people's perception is a recent prospect. However, due to the fourth industrial revolution, the health sector can also change jobs as AI, and artificial intelligence are introduced. In order to cope with these changes, it is necessary to learn some IT skills, in addition to simple health skills, to have an interest in other areas and to have a broader view of the profession. This investigation has led me to believe my major in nursing seems to have a good outlook. This appears to be the reason why many students want to study nursing in these days of high unemployment and job shortages. (Nursing major student)*

> *Jobs that require creativity rather than manufacturing or construction are expected to have a good outlook and are likely to survive in the future. Artificial intelligence, robot-related education, or jobs will likely increase, so I think it would be better to receive an education based on changes in society. In the future, the food industry will have a hard time because the cooking process will decrease a lot. From now on, you should study the calculation of food microorganisms. (Food science major students)*

Conclusion

This study revealed that students have limited knowledge about current society and abilities to handle technologies necessary. It also showed that students do not have ideas about how to prepare for the changes. Students foresee the ambiguity that there will be changes in the job markets because of artificial intelligence and robots. Nevertheless, there were no concrete ideas about the kinds of changes in the job market in their study

areas. Some students in the field of health care and social welfare predict that their job areas will be secure in the future. Students in art areas perceive that jobs that require creativity and human empathy will be secure. Changes are not limited to certain fields. Even though students expressed that since their job areas need creative abilities, those jobs which cannot be replaced by a robot or AI may continuously exist. However, there are still many opportunities that machines take place in their jobs. AI analyzes people and accumulates personalized information in the database. Based on the database information, AI might better serve better for each individual accurately.

AI can replace any job position. The only matter will be if it is entirely taken or partially taken. Therefore, educational institutions must prepare students for changing society with a proper curriculum. According to the study results, students do not have understandings of current society and do not know their study areas such as research trends, job markets, and related technologies. It is because of a lack of opportunities to share ideas about the trends and issues and deal with innovations and technologies in the curriculum. Students need to be exposed to the studies in their field more often. In addition, they need more changes to have discussions and using merging technologies. Students need to learn to survive in this dynamically changing society, and the focus of education should be on helping students become compatible individuals to society. Through the years, a variety of teaching strategies have been introduced, and the curriculum has gone through significant changes based on the needs. However, students still do not know how to prepare themselves after they graduate. Looking at the current curriculum, most universities provide the same courses for years, and there are many lectures, only classrooms. In order to empower students' competencies to be ready for the real world, courses for nourishing high-thinking abilities and problem-solving abilities should be implemented as mandatory. Curriculum, including teaching methods, should be changed in a way for students to be involved in real-world situations. Every course does not need to be a project-based class, but a project-based class should increase in the curriculum. In that way, students will have more opportunities to be exposed to the knowledge and skills needed in real life. Also, courses for understanding current trends and issues should be widely implemented in a seminar for discussion. Each university has its own educational goals and strategies. The curriculum plays a vital role in achieving the goals. Universities have to develop new courses and new educational environments for students to compatible with the 4th industrial revolution society.

References

Chala, N. D., & Poplavska, O. M. (2020). Transforming the Relations between State and Society in the Context of the 4th Industrial Revolution: Ukraine's Experience. *Public Policy and Administration*, *19*(1), 89-98.

Cowie, P., Townsend, L., & Salemink, K. (2020). Smart rural futures: Will rural areas be left behind in the 4th industrial revolution?. *Journal of rural studies*, *79*, 169-176.

Jagannathan, S., Ra, S., & Maclean, R. (2019). Dominant Recent trends impacting on jobs and labor

markets*, International Journal of Training Research, 17*(S1), 1-11.

Korea Research Institute of Vocational Education and Training (2017). Job index research for customized employment support. KRIVET: Seoul.

Lavalle, A, Schumann, C. A., Pucher, R., Forkel, E., & Kauper, J. (2017). Move forward Industry 4.0 training needs. *FormaMente, 12*, 27-46.

Lee, J. Y. (2020). A Study on Socio-technical System for Sustainability of the 4th Industrial Revolution: Machine Learning-based Analysis. *International Journal of Internet, Broadcasting and Communication*, *12*(4), 204-211.

Menon, K., & Castrillón, G. (2019). Reimagining curricula for the Fourth Industrial Revolution. *The Independent Journal of Teaching and Learning, 14*(2), 6-19.

Oke, A., & Fernandes, F. A. P. (2020). Innovations in Teaching and Learning: Exploring the Perceptions of the Education Sector on the 4th Industrial Revolution (4IR). *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(2), 31.

Winterton, J., Turner, J. J. (2019). Preparing graduates for work readiness: an overview and agenda. *Education Training*, *61*(5), 536-551.

Yeyati, E. L., & Sartorio, S. (2018). Technology and the Future of Work: Why Do We Care?. *Latin America Policy Journal*, 7, 38-46.

Yoo, K. S. (2017). Job competency development policy in the era of the 4th Industrial Revolution. *Journal of Practical Engineering Education, 9*(2), 162-174.

Van Dam N. (2017). *The 4th industrial revolution & the future jobs*. Bookboon: London.

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