Being a Professional Teacher in the Era of Industrial Revolution 4.0: Opportunities, Challenges and Strategies for Innovative Classroom Practices

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Abstract

This paper discusses how professional teachers in Indonesia can maintain their professionalism in a rapidly developing world due to the developments caused by the information technology revolution in relation to the industrial world which has led to the rise of so-called industrial revolution 4.0 (IR 4.0). Some characteristics of the IR 4.0 era are *digitalization, internets of things, internet of people, big data, iCloud data, and artificial intelligence*. All of these new developments have brought about disruption in various sectors of life, including education. The IR 4.0 can be negative, as it can threaten the existence of schools and teachers. Yet, it can also be positive because it brings many opportunities for innovative research and classroom practices which can subsequently accelerate and optimize teachers' productivity and students' learning outcomes. Therefore, professional teachers must be aware of and adapt themselves to this development. Teachers of this digital age, for instance, should be teachers with the 21st-century learning mindset, possess digital literacy, keep learning new things, and should able to make use of opportunities provided by the IR 4.0 for their better teaching. Integrating classroom activities with some online platforms through blended/hybrid learning is a highly recommended teaching strategy for today's teachers. In short, if they are carried out consciously and systematically, all developments in the IR 4.0 will certainly have a positive impact on the achievement of our national education goals in the future.

Keywords: professional teacher, disruption era, industrial revolution 4.0, blended learning, classroom practices

1. Introduction

A teacher is the key and the main player in carrying out the education process in the field. A perfect curriculum content, complete educational facilities, detailed rules of the game or sophisticated legal instruments will not have much effect on the success of education they are not supported by the readiness of teachers in the frontline (Palmer, 1998). For this reason, the

1

Indonesian government has been on the right track to paying special attention to the professionalization of educators in the past ten years, especially after the enactment of Law 14/2005 on teachers and lecturers. Being a professional teacher then becomes an important issue for all stakeholders of Indonesian education.

As written in the law of teachers and lecturers, in the context of Indonesian education professional teachers are required to have four competencies: professional competence, pedagogic competence, social competence, and personal competence. Over the past 12 years, the government has been very concerned in the effort to prepare professional teachers with these four competencies. Various programs have been carried out by the government in order to professionalize more than 2.7 million Indonesian teachers. The programs start from conducting the teacher certification program for the in-service teachers, facilitating thousands of teachers to get their undergraduates degrees, conducting Teacher Competency Test (UKG) which is then followed by a *guru pembelajar* (the learning teacher) program, providing various kinds of trainings and workshops, to reforming the teacher education curriculum in the university by extending the teacher education program to be one year Teacher Education Program (PPG) in addition to the four years undergraduate program. All of these endeavours are certainly intended to improve the professionalism and educational competence of both existing teachers and teachers candidates in order to achieve the goals of national education.

Although the government has made various efforts to improve teachers' professionalism, the challenges of becoming a professional teacher in Indonesia cannot be said to be easier, let alone finished. Time keeps moving and brings new era with its own challenges. Therefore, professional teachers are teachers who can keep up with the times and changes. They should be ones who can see the opportunities that are brought to each era and can face all the challenges that accompany them.

This paper will discuss the current changes in human life in the modern century known as the industrial revolution era 4.0 which gave birth to an era of disruption and how this era has affected our education process in Indonesia. This paper will specifically address three questions: a) What is and how did the IR 4.0 era occur? b) What are the challenges and opportunities brought by the IR 4.0 era towards national education? c) What should Indonesian teachers do to

make use of the opportunities and challenges brought about by this 4.0 era to make a better classroom teaching and learning?

2. The Industrial Revolution 4.0: What is it?

The term *industrial revolution* is related to some fundamental changes that occur in the field of industry, starting from the industry 1.0, 2.0, 3.0, to industry 4.0. Industry 1.0 was characterized by the emergence of production mechanization in order to support the effectiveness and efficiency of human activities. This phase occurred around the end of the 18th century which was marked by the discovery of the first railways and steam engine in 1784. At that time, the industry was introduced to mechanical production facilities using hydropower and steam. The work equipment that initially relied on human and animal power was eventually replaced by the machine. Industry 2.0 occurred in the early 20th century characterized by mass production and quality standardization. This development was followed by the birth of the 3.0 industrial era around 1970 which was marked by mass adjustments and flexibility of automation and robot-based manufacturing. Industry Revolution 4.0 then comes to replace the industry 3.0 which is characterized by physical cyber and manufacturing collaboration (Hermann et al, 2016).

The term IR 4.0 itself originally came from a project initiated by the German government to promote computerization of manufacturing. Lee et al (2013, in Yahya, 2018) explained, IR 4.0 is characterized by an increase in manufacturing digitalization that is driven by four factors: 1) increased data volume, computing power, and connectivity; 2) the emergence of analysis, ability and business intelligence; 3) the occurrence of new forms of interaction between humans and machines; and 4) digital transfer instructions to the physical world, such as robotics and 3D printing.

Similarly, Hermann et al (2016) explained that there were four industrial principle designs of IR 4.0. First, an interconnection between the capabilities of machines, devices, sensors, and people to connect and communicate with each other through the Internet of Things (IoT) or the Internet of People (IoP). Second, information transparency is the result of the ability of information systems to create virtual copies of the physical world by enriching digital models with sensor data including data analysis and information provision. Third, the availability of various technical assistance from information technology which includes; (a) the ability to support

3

humans by consciously combining and evaluating information to make the right decisions and solve urgent problems in a short time; (b) the ability of the system to support humans by carrying out various heavy and dangerous tasks. Fourth, decentralized decisions which are the ability of the virtual physical system to make their own decisions and carry out tasks as effectively as possible. In practice, the use of the new IR 4.0 features makes it possible for workers (humans) to collaborate with machines and/or robots, control and remote control over the work they do, manage digital-based performance, and automate work knowledge.

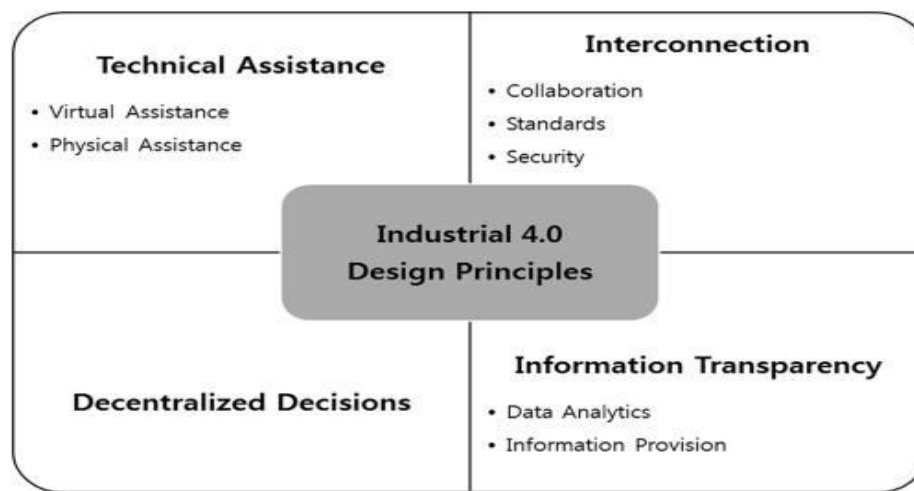The principle of IR 4.0 can be described as follows.

Figure 1. Principles of IR 4.0 (Hermann et al, 2016)

The four Industry 4.0 design principles are further elaborated on below:

Interconnection: Machines, devices and sensors will use wireless communication technologies to communicate with each other over the Internet of Things. Communication standards play an important role in enabling communication. Also, 6 cyber-security issues will be of increasing importance since the number of harmful attacks will increase when valuable information is transferred in the network and stored in the cloud.

Information transparency: By having interconnected objects and people, more information will be available. By having access to all the information, a virtual copy of the physical world can be created. Equally important as having the information, is to provide the information to the right people or objects.

4

Decentralized decisions: When objects and people are interconnected and the information is transparent, decentralized decisions can be made by utilizing both local and global information. Only in certain cases, the decision must be delegated to a higher level.

Technical assistance: Due to the increased complexity of production, technical assistance will be of major importance. There are two main types of assistance systems. First, decision support systems that will support people in decision making by aggregating and visualizing information for people. The second main type is physical assistance. Advances in robotic technology will enable new types of physical assistance on the factory floor.

Having seen the characteristics of the industrial revolution, it can be said that one of the central points of IR 4.0 is the emphasis on the digital revolution. It is called the *digital revolution* because of the proliferation of computers and the automation of records in all fields. The logical derivative impact of this development is the occurrence of what is called the era of technological disruption. IR 4.0 is also said to be an era of technological disruption because automation and connectivity in the field will make the movement of the industrial world and job competition become non-linear.

One of the unique characteristics of industry IR 4.0 is the application of artificial intelligence (Tjandrawinata, 2016 in Yahya, 2018). This aplication can be seen in the use of smart robots that can work quickly, effectively and efficiently in replacing human labour. On the one hand, the use of this smart robot in replacing human work is a great achievement of the modern century of human civilization. But on the other hand, it also brings new problems and challenges to humans and humanity, as will be discussed in the following section.

3. Challenges and Opportunities

Among the biggest challenges of the IR 4.0 is that this era will bring major changes to the structure, model and type of work needed. As a result, many old jobs are threatened with loss and death. Futurist such as Gerd Leonhard estimates that globally the era of digitalization in the IR 4.0 era will eliminate around 1 - 1.5 billion jobs throughout 2015-2025 as the human positions will be replaced by automatic machines. The United States Department of Labor estimates that in the future, 65% of elementary school students in the world will work on jobs that have never existed today (Naim, 2017).

In the context of Indonesia, this threat has also been voiced by many parties, including Prof. Rhenald Kasali, an expert in human resource development teaching at the University of Indonesia. He has warned people that there are many jobs that would be lost when the muscles were replaced by robots and machines in this era of digitalization. But, at the same time, he also mentioned the good thing of digitalisation. That the change can make us more human. Kasali, for example, mentioned port transporters who have now been replaced by cranes and forklifts. Not only at the port, even in supermarkets young people are now turning from pelvis to guards in the control room.

Another good news is that technology is not only replacing muscles or replacing jobs that have been more physically dependent, but humans also use technology to replace dangerous jobs. The use of smart robots, for example, is now used by police to enter homes that are controlled by terrorists and put out fires. In another place, we now see that the labourers on duty at the toll gate have begun to be replaced with machines. According to Kasali, this is a positive thing, because working at toll booths is getting more dangerous, both for health (vehicle carbon fumes), security and comfort (not equipped with toilets). This is not to mention that technology is also replacing distance so that crowded and jammed shopping centres are suddenly lonely because consumers choose to shop from their hands and the goods come alone.

In short, Prof. Rhenald Kasali reminds that the rapid changes due to the digitization of this industry have caused many existing jobs 20 years ago to gradually fade away. After the postal officer, the translator and librarian are predicted to also follow the lost and replaced machines. Even the lecturer and teacher professions are predicted to disappear because the campus will turn into a kind of event organiser (EO) that organizes lectures from world-class scientists. Cashiers at supermarkets, taxi drivers, newspaper delivery, insurance agents, and a large number of accountants are also predicted to decrease. Therefore, we certainly need to rethink the work that we are engaged in today. Will it still survive in the coming years?

In the context of education, the challenge is not only the threat of the existence of teacher-replaceable teacher jobs but also in terms of how educators face new genes (Y genes and Z genes) which have their own characteristics. Today's teachers, for example, will face children who are very close to gadgets and or smart devices since they were from babies. They are usually referred to as *digital natives*. While many teachers know gadgets and other devices as *digital*

immigrants. It is a challenge for teachers to anticipate this condition in their learning process in the classroom. Teachers, therefore, must continue to think about how they can utilize the closeness of students with technology, such as gadgets, in the learning process in the classroom. Otherwise, our classes will be boring. Students will be more interested in playing with their gadgets (if they are allowed to bring into class), rather than listening to teacher's lectures that may be monotonous in the classroom. Students can even assume that they no longer need teachers because they can find out the various contents of the lessons they need by themselves. They can even know the contents of the lesson long before being delivered in class.

Apart from bringing challenges, this era of digitalization also brings many opportunities. The World Economic Forum, for example, estimates that digitalization of manufacturing in the IR 4.0 era has the potential to provide a net increase in employment to 2.1 million new jobs by 2025. There is a potential for carbon emission reduction of approximately 26 billion metric tons from three industries: electronics (15.8 billion), logistics (9.9 billion) and automotive (540 billion) from 2015-2025 (Naim, 2017).

Likewise, Kasali (2017) expressed optimism that when many types of jobs were lost in an era of technological disruption, at the same time we witnessed the emergence of new jobs that we never knew 10-20 years ago. Some of the new emerging professions are such as a barista, blogger, web developer, apps creator/developer, smart chief listener, smart manager, big data analyst, cyber troops, cyber psychologist, cyber patrol, forensic cybercrime specialist, smart animator, game developer, smart control room operator, medical sonographer, prosthodontist, crowdfunding specialist, social entrepreneur, fashionista and ambassador, BIM Developer, Cloud computing services, cloud service specialist, Dog Whisperer, Drone operator and so on.

Specific in the world of education, the IR 4.0 era brings enormous opportunities for educational practitioners to make a large-scale expansion in targeting prospective students who are no longer confined to physical classrooms. Therefore, it is now beginning to mushroom a variety of virtual lectures that are carried out systematically, such as the phenomenon of mushrooming Massive Open Online Courses (MOOCs) in various parts of the world. Today we don't need to fly to the United States to study at Harvard University, for example. Thus, education is also experiencing a tremendous revolution, both in terms of effectiveness and efficiency, and in terms of the model

and approach. In short, the 4.0 era has brought new hopes to the world of education, in addition to other areas of life.

4. Educator's Strategy: Adapt or "Die"

Given the fast and fundamental disruption that occurs, teachers and all educational practitioners should do any necessary adjustments as soon as possible. The key word to survive in this rapidly changing world is the ability to adapt to change or be left behind and then die. This can be preceded by the awareness of all relevant parties, such as the government as the education provider, curriculum developers, teachers, and even parents about this changing world. They must have a new mindset about education and learning.

Teachers, for example, must have new awareness and views that educators today cannot play a full role as agents of knowledge transferer. Not only because of machines ability can store and even transfer various knowledge sophisticatedly, but also because today's students can easily get the knowledge they want quickly. Furthermore, the new mindset must challenge the teacher to keep looking for new approaches to learning, and also rewrite the focus of learning in the classroom. Today's teachers, for example, can focus on developing students' soft skills and characters, such as empathic communication skills, developing tolerant attitudes, being responsible, thinking openly, being able to cooperate, and others.

The derivative of the educator's new mindset is the emergence of an effort to adjust their teaching and learning approaches. In other words, today's teachers are expected to come up with some novelty and or innovation in their teaching. In this context, one of the movements proclaimed by the government, for example, is that the new literacy movement as an amplifier of shifting the old literacy movement. The new literacy movement is intended to focus on three main literacies namely, 1) digital literacy, 2) technology literacy and 3) human literacy (Aoun, 2017 in Yahya, 2018). These three skills are predicted to be skills that are badly needed in the future or in the IR 4.0 era. Digital literacy is aimed at increasing the ability to read, analyze, and use information in the digital world (Big Data), technology literacy aims to provide an understanding of the workings of machinery and technology applications, and human literacy directed at improving communication skills and mastery of design science (Aoun , 2017 in Yahya, 2018). The new literacy provided is expected to create competitive graduates by

8

perfecting the old literacy movement which only focuses on improving the ability to read, write and mathematics.

Adaptation of new literacy movements can be integrated and adjusted to the curriculum and learning system. This is in line with the 21st-century learning principles and approaches presented by Trillling and Fadel (2009), as shown in the following figure:
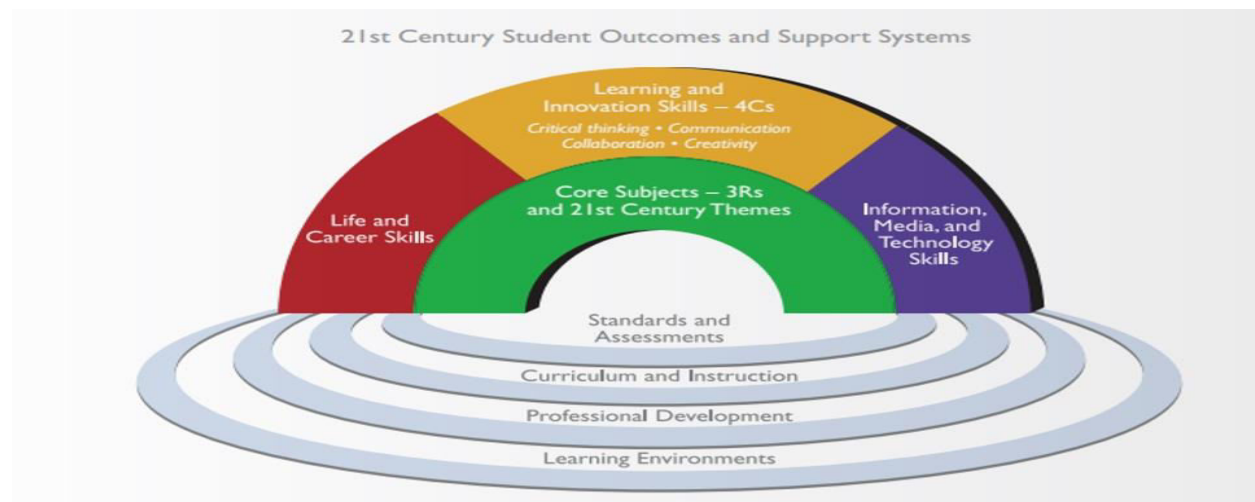

Figure 2. 21st Century Student Outcomes and Support System

According to Trillling and Fadel (2009), 21st-century learning focuses on the formation of an ICT-based digital lifestyle, learning ability and innovation, and the development of life skills. More specifically, the learning done by the teacher must be oriented to the development of four core skills: critical thinking and problem-solving skills, communication skills, collaboration skills, and the ability to create new things (creativity).

Furthermore, Irianto (2017) explained that the World Economic Forum warns structural changes in skills in the 21st century. In 2015, the structure of skills needed by the workforce is as follows; 1) complex problem solving; 2) cooperation with others; 3) people management; 4) critical thinking; 5) negotiation; 6) quality control; 7) service orientation; 8) assessment and decision making; 9) active listening ; and 10); creativity. In 2020 the work structure changes to; 1) complex problem solving; 2) critical thinking; 3) creativity; 4) people management; 5) cooperation with others 6) emotional intelligence; 7) assessment and decision making; 8) service orientation; 9) negotiation; and 10) cognitive flexibility.

Thus, another adaptation that we have to do is to continue to evaluate and update the learning content in our curriculum, so that our classes can always adjust to the needs and changing times, including in the IR 4.0 era. In this case, the learning content is expected to be able to fulfil 21st-century skills as mentioned above, and then with renewable learning content, it is expected to equip our students to be someone who is ready to take advantage of the opportunities that emerged in this era.

5. Classroom Practices

Purnomo (2017) describes several approaches that teachers should do in the era of the era of digitalization in the RI 4.0 as follows:

a. Student-centred

The development of learning in class should use a student-centred learning approach. While the teacher has more roles as a learning facilitator. Students are placed as learning subjects who actively develop their interests and potential. Students are no longer required to listen and memorize the subject matter provided by the teacher, but try to construct their knowledge and skills, according to their capacity and level of development, while being invited to contribute to solving real problems that occur in the community. Some learning models such as *inquiry learning, project-based learning, scientific approach,* or *problem-based learning* are among the learning models that teachers can use in the context of implementing student-centered learning.

b. Contextual learning.

Learning material needs to be linked to students' daily lives. The teacher develops learning methods that enable students to connect with the real world. Learning should be directed at formulating existing problems rather than just answering problems. The teacher helps students to find values, meaning and confidence in what they are learning and can apply in their daily lives. The teacher conducts student performance appraisals that are associated with the real world. Problems based learning and contextual learning are among the approaches that can be used in this case.

c. Community integrated learning

Similar to contextual learning, the teacher must try to prepare students to be responsible citizens. Therefore, learning should be able to facilitate students to be involved in their social environment. For example, holding community service activities, where students can learn to take roles and perform certain activities in a social environment and can do specialist works. Learning is directed to train analytical thinking (decision making) rather than mechanistic thinking (routine).

d. Collaborative learning

Students must be taught to be able to collaborate with others. Collaborate with people who differ in their cultural setting and values. In exploring information and building meaning, students need to be encouraged to be able to collaborate with friends in their classrooms. In working on a project, students need to be taught how to appreciate the strengths and talents of each person and how to take roles and adapt themselves appropriately. In this context, teachers must apply the principles of cooperative learning more during the learning process.

e. Technology-based learning

As the characteristic of IR 4.0 learning that is synonymous with the internet of things, the internet of people, icloud, big data, connectivity, and digitalization, it is highly important for teachers now to integrate their learning and teaching activities with the latest information technology developments. They, for example, need to combine offline learning mode with online (*blended learning/hybrid learning*). They can make use of several online learning applications, such as Google Classroom, *ruangguru*, *quipper, zenius*, and other similar applications to enhance students' learning. They can also plan to make use of social media platforms such as Youtube, Instagram, Line, and many others as one of learning media. In this context, teachers also need to maximize the use of sophisticated devices such as smartphones in the classroom for learning. In short, the integration of learning with the internet and/or network will greatly affect the effectiveness and acceleration of the achievement of learning outcomes in this digital era.

6. Concluding Remark

The Industrial Revolution 4.0 has brought many significant changes in human life. It has fundamentally changed the way people move and has a big influence on many aspects of human

11

life, including in economy, security systems, politics, and education. The IR 4.0 has brought positive influences on the effectiveness and efficiency of resources and production costs in many industries. Yet, it also has an impact on reducing employment, and the emergence of a number of new challenges which are not necessarily easier. In the education sector, in particular, today's educator is obliged to make self-adaptation and certain changes to successfully utilize all the potential benefits brought by the IR 4.0 era. Otherwise, they will be left behind, and it's not impossible 'die'. Among the adaptations and changes that the teacher must do is shifting the mind about the role of the teacher and the learning process. They also need to conduct adaptation programs, such as adjusting curriculum content with content that will prepare students with 21st-century abilities, and also choose and apply various current learning models suitable for millennial generation students. This includes to practice blended learning and make use of social media for teaching and learning. In this way, hopefully, we can take maximum advantage of the opportunities brought by the RI 4.0 era for the future of our national education.

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