A Look at IR 4.0 in Education

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Abstract. This article describes about industrial revolution 4.0 in education. IR 4.0 stands for fourth industrial revolution. And which is a new level of life. The industrial revolution 4.0 had positive and negative impacts on all aspects of life, including education. The industrial revolution 4.0 can provide many benefits for the achievement of educational goals, with the use of sophisticated machinery which is the implementation of the industrial revolution 4.0.

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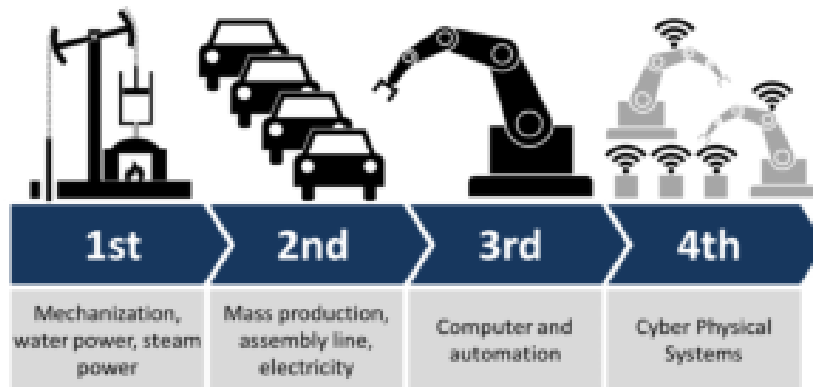
1. Introduction

The industrial revolution 4.0 is an era in which human work is facilitated by the use of sophisticated machinery and technology that is connected and controlled with internet network systems. The industrial revolution is a change that affects all aspects of life. In the beginning, all activities were done traditionally and using animal assistance, now new innovations have emerged with the use of machines, the internet and computers that are more optimal. This certainly affects the way of thinking and lifestyle of the people, which have changed along with the development of this industrial revolution.

The world has experienced four industrial revolutions. Starting from the first industrial revolution, which was marked by the revolution of the manufacturing sector. And the discovery of steam engines and manufacturing machines, which took place in the mid-18th century. The emergence of the first industrial revolution can reduce dependence on workers who are less productive. Then change the agricultural sector into the industrial sector.

In the 19th century, the world entered the second industrial revolution, this was seen from a big breakthrough, namely with the discovery of electricity which was then utilized for large-scale production. So that goods that are produced can usually only be produced in limited quantities, when it can be produced in greater quantities than usual and in a short time.

Then the third industrial revolution occurred around the 1970s with the use of computers. As well as the use of machinery, also began to be used in production sites, such as factories that produce goods in large quantities.

And today is the fourth industrial revolution marked by the emergence of automation systems, intelligence engineering and the use of the internet (internet of things), where computers and sophisticated technology are emerging with new ways of working. This fourth industrial revolution took place around 2011 [1]. The change of industrial revolustion from 1.0 to 4.0 is shown below [2]

Picture 1. The Change of Indutrial Revolution from 1.0 to 4.0

Industrial Revolution 1.0 is characterized by production mechanization to support the effectiveness and efficiency of human activities, Industrial Revolution 2.0 is characterized by mass production and quality standardization, Industrial Revolution 3.0 is characterized by mass customization and flexibility in automation and robot-based manufacturing. Industrial Revolution 4.0 then comes to replace industry 3.0 which is marked by cyber-physical and manufacturing collaboration [2].

Utilization of sophistication in the era of the industrial revolution, will bring something better in the economic, social, cultural and even educational fields. This time the focus of the discussion will discuss the 4.0 industrial revolution in education. Because of seeing the phenomena that occur, there are still many walks of life that do not understand what the industrial revolution 4.0 is, and its users are good, especially in the world of education.

As we know with the presence of the industrial revolution 4.0 has provided benefits for daily life. But in spite of all that frees, present the industrial revolution 4.0 also gives a negative. As will be widely accepted. Because the work that was once done by humans is now done using machines. And as is currently rife is the hoax distribution or known as hoaxes. This is related to internet access that is easily obtained and there are no restrictions in its use. Successful environmental damage has occurred due to environmental exploitation, due to factory activities that operate almost every meeting. In addition to technological advances, special gadgets will move direct interaction with people around, addicted and not independent, [3].

Therefore, the need for educational participation that will generate new thinking to minimize the negative impact of the industrial revolution 4.0. Inevitably the implementation of the 4.0 revolution in education. And the nature of education for the advancement of life.

2. Research Method

This article uses systematic methods and steps, called the SLR (Systematic Literature Review) method. Namely by collecting material from books, articles and journals that are collected and read and understood, so that the writer can analyze the subject matter that is presented in this article. This literary method aims to assist the writer in gathering information and insights related to the discussion of the article. Making it easier for writers to be able to analyze and conclude the issues to be discussed.

3. Result and Discussion

Understanding Era IR 4.0

IR 4.0 is an abbreviation of industrial revolution 4.0 or more familiarly heard as the fourth industrial revolution. The industrial revolution 4.0 is defined as a new level of organization and has control over the entire life cycle chain, towards more individual and specific needs [4]. So that it can affect lifestyles and have an effect on life throughout the world. Changes in consumption patterns are seen in communism, and make lifestyles as imaging and pretense [5]. The concept of the industrial revolution 4.0 first appeared in 2011, at a manufacturing industry exhibition held by an association from Germany. And then developed because of support from the German government [6].

The fourth industrial revolution is a concept of automation, where work is easier to do with the help of sophisticated tools or applications. And get more efficient and effective results in achieving an industry target and other fields in everyday life. The manufacturing used is flexible and is intended for mass production which will increase productivity, [7]. The characteristics of the industrial revolution 4.0, is the CPS (cyber physical system), which is the integration of computers, networks and physical activities [2].

The biggest thing that can be felt from the fourth industrial revolution is the use of the internet which greatly facilitates the search for data, information and creates many opportunities for those who can make good use of it. So that the term internet of things appears. And many more advanced technologies resulting from the fourth industrial revolution, such as the widespread use of machines and robots to facilitate human work, with automation and digitization. This is marked by the emergence of super computers, smart robots, vehicle without a driver, genetic editing neuro technology and many others.

There are four factors that have led to an increase in manufacturing digitalization in the industrial revolution 4.0, including:
a. Improved data volume, connectivity and computing power
b. The emergence of analysis, ability, and business intelligence
c. New forms of interaction between humans and machines occur
d. Changes from digital to the physical world, like robotics.

In the industrial revolution 4.0 era, computer technology and automation worked in new ways. Machines, the internet, computers, and humans, are interconnected to solve problems. Starting from doing automation, simulation, system integrity, and system analysis. The industrial revolution 4.0 is a combination of physical, digital and biological aspects. Sometimes there is almost no difference between these three things, because of increasingly sophisticated technology and the existence of the implementation of engineering intelligence or artificial intelligence. Here are some of the advantages of the 4.0 industrial revolution [8], including:
a. Operational efficiency,
b. Saving time,
c. Reduced operational costs,
d. The emergence of new innovations,
e. It will be easy for everyone to access the information needed.

But the question is whether the mentality of the people, especially the people of Indonesia are able to face the era of the industrial revolution 4.0. According to [9], the mentality of the people is not sufficient to face the implementation of the fourth industrial revolution and the need for further studies on this matter. Because there are still many people who are left behind from the development of the times and abuse the existing facilities for

things that are not good. There are at least four things done to be able to adjust and keep abreast of the times [10], namely:

    a. Improve self competence
    b. Improve technology capabilities
    c. Improve communication
    d. Can see and capture the opportunities that exist.

There are four principles in industrial revolution 4.0. The first principle is interconnection, which is the ability 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). This principle requires collaboration, security and standards. The second principle is transparency of information. What is meant by information transparency is the ability of information systems to create virtual copies of the physical world by enriching digital models with sensor data including data analysis and provision of information. The third principle is technical assistance which includes: (a) the ability of the assistance system to support humans by combining and evaluating information consciously to make informed decisions and solve urgent problems in a short time; (b) the system's ability to support humans by performing various tasks that are unpleasant, too tiring, or unsafe; (c) includes visual and physical aids. Whereas the fourth principle is decentralized decisions, which is the ability of virtual physical systems to make their own decisions and carry out tasks as effectively as possible. With the changes in the industrial era 4.0, the world of education needs to make learning innovations, namely integrating learning with technology and information (IT). [2]

Because the industrial revolution was born in developed countries that are already mature about automation and the use of advanced technology, this will be inversely proportional to developing countries that are still in the stage of adjustment and there is often a gap. Because of the lack of adoption of the fourth industrial revolution [11].

The Fourth Industrial Revolution in Education

The fourth industrial revolution had a great impact on all walks of life. No exception in the world of education. Which is the essence of education is an effort to develop the potential of self from theory and practice. Education itself is a container for the emergence of new ideas and innovations that support the development of human life. Improving the standard of living towards a better and bring progress in all fields.

This proves that the industrial revolution and education have a very close relationship and are bound to one another. Without education, the fourth industrial revolution would never have existed. Because the concept of the fourth industrial revolution, is the result of thinking which is a process in education. Likewise the opposite of the fourth industrial revolution, also had an influence on education.

In the world of education there are terms of input, the process of education itself, and output. The role of the fourth industrial revolution was strongly felt in the education process. In the teaching and learning process today, certainly not escape from the role of technology and all the conveniences offered by the presence of the fourth industrial revolution. Because in practice the learning and teaching process uses a lot of machines or tools that can facilitate the process.

The fourth industrial revolution must be utilized as well as possible. Educational progress has not escaped the effective and efficient use of the fourth industrial revolution. Education must also provide a good response to the fourth industrial revolution. The expected result is that sustainability in the industrial revolution will bring more rapid progress in the world of education [12].

Education in the fourth industrial revolution era combines information in the real and virtual world [13]. This can be seen from the rise of learning applications that present interesting learning videos and can be easily accessed anywhere and anytime. Not only that, the fourth industrial revolution can also be a big challenge and the need for mental readiness and learning methods that are able to keep up with the times [14].

Therefore, in the era of the industrial revolution 4.0, in the world of education, it requires us to be able to apply HOTS (Higher Order Thinking Skill), which is the ability to create and is the highest level of knowledge. Because in this era people are racing to bring out the latest ideas and innovations, and can create something more than before. Therefore the education in the era of the industrial revolution 4.0, must lead to patterns of thought and learning based on HOTS. And education will be adjusted to the jobs that will be faced later. So that students after graduating from their education, they will not be awkward with developments in the world of work later. It is even hoped that they will be able to become the pioneers for the progress of the next industrial revolution, by developing existing ideas and skills.

But there is also education in it, still teaching how to think and learn by means of Low Order Thinking Skills, which is the lowest level of learning. Namely students are only able to memorize and understand it. Without being able to analyze, evaluate even to create something new. Usually this happens in developing countries, so from now on developing countries are still crawling slowly in following the existing developments.

Then the way of critical thinking, collaboration, communication, and creativity are the basic things or characteristics that must be taught in education in the era of the industrial revolution 4.0. Given the rapid advances in technology, education also inevitably has to update its system, curriculum, and everything that can help in following this development.

3.3 Implementation of the Industrial Revolution 4.0 in the World of Education

Before discussing the implementation of the fourth industrial revolution in the world of education, the first thing to do is to determine strategies and methods in education, so that educational goals can be achieved by utilizing existing facilities. It aims to have readiness in implementing the 4.0 industrial revolution in education. According to [1] the method of teaching and learning in the era of the industrial revolution 4.0 is based on technology called education 4.0 which aims to improve the ability of digital technology in learning and for other purposes.

For this reason, the first thing that needs to be done is to integrate existing technology with education. Where the role of humans and machines is balanced to achieve educational goals. Therefore, it is necessary to develop the quality of human resources in order to be able to manage existing technology for the achievement of educational goals. Furthermore, what is equally important is the role of the government to support and provide adequate facilities for the utilization of technology in the world of education. Then to integrate education with technology, curriculum changes are needed [16]. After this can be achieved, the implementation of the industrial revolution can be carried out properly. Here are some of the implementations of the industrial revolution 4.0 in education:

a. The use of technology in learning media, such as computers and laptops that function to display, search and process learning material.
b. Utilization of the internet to access information needed in the world of education quickly and accurately.

c. Bring up new innovations in the student admission system or students, namely by using an online registration system.
d. Using technology in the management of educational data.
e. Creating online learning applications, which are interesting and easy to understand and can be accessed anywhere and anytime. Like virtual learning where the teacher explains to students not face to face in a class. But by using learning videos that have been created by the teacher and then shared with students to learn on their own. So students can access the closed video anywhere and anytime by connecting to the internet network.
f. Then even during exams students do not need to come and sit in class and fill in the exam questions with the paper answer sheets provided, now the exams can also utilize the online system. Students can fill in the answers with a predetermined time, and they can also see the results of the exam directly. And get a discussion about the problem if their answers are wrong. And from that students can immediately find out their mistakes and learn them again by looking at the discussion of problems that appear automatically.
g. Interactive learning media, namely learning media based on information and communication technology which is a web application used for quis and simple games but contains elements of learning [17]
h. Using video-based learning videos that are uploaded to video player services such as YouTube and others that can be accessed whenever and wherever they are. So students can repeat the video many times until they understand what is explained. [18]
i. Some examples of online learning media innovations for remote interaction that were widely used in the industial revolution 4.0 are Kahoot [2], Zoom, Google Meet, Youtube Live and E Learning Moodle.

Picture 2. Icon images of some learning media that are often used in the industrial revolution 4.0

4. Conclusion

The 4.0 industrial revolution was an era in which everything was sophisticated and automatic. Machines, the internet, humans, become an integrity to run lives. The effect of the industrial revolution 4.0 is also felt in the world of education. Education in the industrial revolution era 4.0 also experienced a lot of development and renewal that was adapted to rapid development. Students and teachers are required to be able to enrich themselves with knowledge of technology in education. By implementing all the conveniences offered by technology and the internet. And it is hoped to be able to create new discoveries that are even better for the advancement of human life, through education in harmony with the times.

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