The Innovation and the Role of Educational Technology in the 4.0 Industrial Revolution Era

Darmansyah
Educational Technology Department, Faculty of Education
Universitas Negeri Padang
Email: darmansyah2013tp@gmail.com

Abstract-*The industrial revolution 4.0 has triggered the emergence of innovation in the field of educational technology. Various types of future needs of digital and virtual-based jobs will color the lives of future communities. The World Economic Forum report estimates that 65% of children entering primary school today will find a different work environment in the future. Mastery of intelligence-oriented and digital skills-oriented information technology is the best solution to avoid shocks in facing future big challenges. Educational Technology has a very strategic role in improving the quality of human resources through virtual-based learning innovation based on big data and online systems. What are the latest innovations and how the role of educational technology in learning in the digital age, this is the focus in the discussion of this paper*.

Keywords: Innovation, Learning, Role, Educational Technology, Industrial Revolution

I. INTRODUCTION

By 2020 it is estimated that there will be 1.5 million new digital jobs worldwide. At the same time, 90% of organizations currently have a lack of information technology skills, while 75% of educators and students feel there is a gap in their ability to meet the skills needs of the workforce in the information technology field. Efforts to meet the needs of the digital-oriented economy-oriented workforce, education must be able to adapt as quickly as the growth and development of demand for information technology skills is far more powerful in the coming years.

The 4.0 industrial revolution called the digital and virtual era triggered the birth of innovation in learning as well as emerging trends and issues within the scope of Educational Technology. A leading trend is a sharp increase in investment in learning technology. The existence of a very significant change in game design that has only been a mere game, has now been able to provide an extraordinary learning experience to students. The availability of information in various types of digital-based has made it easy for educators and students to enrich the insights of their learners.

The industrial revolution gave rise to opportunities in various forms of new digital-based skills, but also posed difficult challenges. The virtual world, the interconnectivity of people based on cloud, machines, and big data provides new challenges for us in an educational technology environment. The education technology community must be able to make the most of the opportunities and have the ability to overcome challenges and have sufficient competence to adapt to technological developments in learning.

Trends and issues regarding the testing of the use of various sophisticated communication devices throughout life in various strata of society also give rise to symptomatic phenomena throughout the world. The latest research results in the use of devices and connections to the internet (Bindu Ranaut: 2016 in Darmansyah: 2018) stated that secondary school students in the United States have access to smart phones connected to the Internet 89%; 50% of students in grades 3 through 5 have elementary school access to the same type of device; High school student access to tablets reaches 50 percent and laptops reach 60 percent. In addition to personal access, the survey found that about one third of students have access to a device (usually a laptop or tablet) at their school. According to the study, 64 percent of students surveyed identified 3G or 4G enabled devices as their primary means of connecting to the Internet, with others; 23% said they were connected via the Internet; 46% of teachers use video in the classroom; One third of students access online videos - through their own initiative - to help with their homework. ; 23% of students access videos created by their teachers.

Industrial Revolution 4.0 has resounded throughout the world including Indonesia. We must immediately adapt to the various surprises that occur and be ready to accept the effects including negative impacts though. As

practitioners of education certainly do not want to be victims, but must take the role of taking part as a key player and be a determining direction in which the revolution will move forward specifically in learning. In the context of learning, it is also impossible to avoid negative impacts and must be part of the industrial revolution. This opportunity must be taken by experts and learning practitioners to move immediately to get benefits by innovating and creating optimally. This paper will explain the innovations in the field of educational technology that occur in the international world and the role that must be played by educational technology in the context of learning.

II. LITERATURE REVIEW

Phase Of The Industrial Revolution And Higher Education Policy

The phase of the industrial revolution has proceeded in such a way that it reached the fourth stage as it is currently happening. There are several important jumps at each stage of the industrial revolution. Each of these phases can be briefly described as follows:

Table 1. Phase of Industrial revolution

Phase	Development of the Industrial World	Period	Explanation
First	Massive changes in agriculture, manufacturing, mining, transportation and technology and have a profound impact on social, economic and cultural conditions in the world.	1750-1850	Industrial Revolution 1,0
Second	The second phase of the industrial revolution was marked by the emergence of power plants and combustion chambers. This discovery triggered the emergence of telephone sets, cars, airplanes, etc. which changed the face of the world significantly	1850-1950	Industrial Revolution 2,0
Third	Intrigued by the emergence of digital technology and the internet as a process of compressing time and space. Time and space are no longer apart. The second revolution with the presence of the car makes time and distance closer. The industrial revolution in this phase unites the two by carrying out the present moment (real time).	1950-2015	Industrial Revolution 3,0
Fourth	Integrated manufacturing activities through massive use of wireless technology and big data. Characterized by a cyber-physical system that begins to touch the virtual world, in the form of human, machine and data connectivity, everything is everywhere. This term is known as the internet of things	2015-Until Now	Industrial Revolution 4,0

(Adapted from various sources: 2018-in Darmansyah:2018)

The big challenge that arises in this era is the loss of employment opportunities that were absorbed before by the emergence of work process automation in various industries and businesses. The era of digitalization will eliminate around 1 - 1.5 billion jobs throughout 2015-2025 due to the replacement of human positions with automatic machines (Gerd Leonhard, Futurist). Therefore our education world needs to immediately prepare itself by taking strategic steps starting from developing learning designs, revolutionizing the learning process and of course the need for efforts to reform the learning evaluation system.

Learning Technology Innovation

Innovations in educational technology (edtech) have an impact on how business professionals want to learn. The emergence of various ideas such as: Virtual classrooms, mobile devices, digital readers, on-demand video, online games, cloud-based LMS. Provide broader opportunities for Learning Technology to take part in developing more innovative learning. There are some very interesting things about trends that occur in world education technology.

1. *Investment in EdTech continues to increase.* Content development and delivery, digital reader, virtual delivery, strengthening library content, games, and cloud-based administration systems that bring high-level innovation. This prompted most investors who used to come from companies engaged in public and post-secondary education, but are now shifting their focus to the broader corporate market..
2. *The Ubiquity of Learning Libraries.* The abundance of information is positive for learners, but training professionals have a strategy to ensure learners consume content specifically designed for their work needs. Professional training can more easily meet the needs of students through digital libraries and quality learning with more adequate competencies.
3. *Adopting Campaign Marketing To Enhance Learner Engagement.* Adopt a marketing-based approach to understanding learners' needs by using demand-supply strategies and analysis Using data analysis and "intelligence" about learners' needs to target content that is better, more precise, more suited to students' needs directly.
4. *Adaptive Learning*. Personalize the learning experience so that it can reduce the time needed by students to become proficient, increasing the effectiveness of programs that focus on what is absolutely needed. The success of future adaptive learning is not only in the design of technology, but in the design of content that is modified into learning objects so that it can be consumed based on what the learner needs.
5. *Multimodal Learning*. Expanding learning experiences before and after learning requires a lot of touch along the learning experience and technology changes the way content is accessed and consumed. In a 2016 study, 79 percent of training designers stated that offering alternatives to learning modalities was essential for success and driving this change in behavior and touch turned events into learning experiences.
6. *Burst Training Campaigns Growing for Sourcing Engagements* The supplier of a new product is contracted to manage all the processes associated with the training initiative. Burst's involvement provides innovative options for training designers and substantially reduces the risk of unfavorable transfer competency processes.
7. *Shifting to a Culture of Coaching*. The most effective way to transfer exclusive knowledge is through guidance / training and to learn something new is to teach it. Mentoring not only develops people who follow our footsteps, but also extraordinary ways to develop leadership talents and work as much as we should.
8. Smaller Class Sizes. There is always a conflict with the idea that a relatively small class size is better for students; while larger class sizes are more economically efficient. Now the business needs and needs of students are in line with the idea that training becomes more affordable to be delivered in smaller groups of course using technology.
9. *Evolution of Gaming Theory and Mechanics*. Game-based learning increases motivation, involvement and knowledge retention, which initially focused on replacing experiences, then instilling games in learning programs. The evolution of game theory has found that using the principle of storytelling and educational involvement is the key to attracting emotions while increasing students' involvement and memory.
10. *Community-Based Learning.* The emergence of new communities that encourage more social media platforms both in educational institutions and in the community. The online social media platform will make it easier for pesdik and educators to exchange eBooks, media, videos, test results, and other learning material.
11. *Mobile Learning.* The emergence of innovations in the use of smart phone devices that allow students to get rich learning experiences in the form of varied message designs to meet the needs of various learning styles of students.

The above trends certainly do not just come without a trigger factor. The digital and virtual era as an indication of the industrial revolution 4.0 has ignited the initiatives of the world's educational practitioners and experts to find various innovations especially those related to the development of information technology and its application in learning. This moment is the beginning of the gait of Indonesian educational technology to increase its existence to welcome the era of the industrial revolution 4.0.

Challenges For Students

The biggest challenge for scholars is the emergence of specialized types of work that require digital-based skills. World Economic Forum (2018 in Ainun Na'im: 2018):

1. *Complex Problem Solving*
   The ability to solve unknown and unknown solutions in the real world.
2. *Social Skill*
   The ability to coordinate, negotiate, persuasion, mentoring, sensitivity in providing assistance to emotional intelligence
3. *Process Skill*
   The ability consists of: active listening, logical thinking, and monitoring self and the others
4. *System Skill*
   The ability to be able to make judgments and decisions with consideration of cost-benefits and the ability to know how a system is created and run
5. *Cognitive Abilities*
   Skills consisting of: Cognitive Flexibility, Creativity, Logical Reasoning, Problem Sensitivity, Mathematical Reasoning, and Visualization .

In addition to the challenges, of course we have great opportunities to take part in the era of the industrial revolution, including in the world of educational technology. The whole learning process that will take place in this era, requires the help of educational technology. Digitalisation and virtualization of learning requires reliable technology-based learning designers in the future. That opportunity can only be filled by educational technologists who are able and willing to adapt to current real conditions.

The World Economic Forum (2018) states that there will be many job opportunities and other opportunities that will be open include:

- The digitalization era has the potential to provide an increase in the workforce of up to 2.1 million new jobs by 2025
- There is potential to reduce carbon emissions by approximately 26 billion metric tons from three industries: electronics (15.8 billion), logistics (9.9 billion) and automotive (540 billion) from 2015-2025.

The government through the Ministry of Research, Technology and Higher Education has adopted policies in dealing with and adapting to the industrial revolution 4.0 The main policy Of Dikti is to increase highly educated and skilled workers (Ainun Na'im: 2018).

Figure 1. Strategic Objectives and Targets of the 2015-2019 Kemenristekdikti

- This policy is implemented with a program of strengthening learning and student affairs with strategies including:
- Increase the gross enrollment rate and the number of students who are entrepreneurial
- Certified competency graduates

- Excellent accredited study programs
- Gold and national level students
- Graduates who work directly
- LPTK that improves the quality of academic education
- Prospective educators follow the teaching profession

Based on the objectives and strategic objectives of the Ministry of Research and Technology above, it can be seen that the main focus is to improve the quality of learning and student higher education through strengthening innovation. It can be understood that these two goals become the fields for the pursuit technology developers to take part in more intense activities. This is an opportunity for learning experts and practitioners to make their maximum contribution.

III. DISCUSSION

THE ROLE OF EDUCATIONAL TECHNOLOGY

The mandate of Law No.20 of 2013 on National Education System has provided an explanation that education is a conscious and planned effort to create an atmosphere of learning and learning so that students actively develop their potential ... The creation of a conducive and enjoyable learning atmosphere must be supported by the application of models, strategies , methods and a pleasant environment for students. The learning process that produces effective and efficient learning outcomes should be supported by the design of learning tools, teaching materials, media and excellent quality learning techniques.

This process is not possible in a class that uses traditional methods as has been done so far. This is where the role of Educational Technology becomes important. All learning components described above can only be implemented if supported by adequate facilities and facilities. An educator can design teaching materials, using the best strategies and methods that must involve educational technology. Without the touch of educational technology, the hope of creating enjoyable learning structures in the learning process will not be achieved properly.

Some of the roles of educational technology that are very prominent and have profound meaning in learning in this industrial revolution era are:

1. Transform traditional and passive classrooms into active and interactive classrooms, with audio-visuals, graphics and models, smart classrooms and e-learning spaces that drastically motivate and increase student attention.
2. 2. Modernize the learning climate of educational institutions. Learners are presented learning content with programs that are professionally designed using video or computer multimedia.
3. 3. Designing and organizing systematic learning content, educators are able to provide structured materials that are well integrated for students so that they save a lot of their time that can be utilized for creative work and quality improvement.
4. 4. Educational technology gives color and contributes to improving the quality of the learning process so that the achievement of learning outcomes is more effective and process-oriented. The existence of assistive devices, multimedia, such as television, radio, VCR, computers and LCD projectors, etc. has enriched and facilitated the effective transmission of knowledge.
5. 5. Educational technology improves the way of teaching by providing well-programmed teaching materials and digital-based teaching materials such as multimedia-based e-books, audiovisuals, videos, audio animations and others. .
6. 6. Strive to open up new findings in educational research in the field of research, evaluation and classroom teaching processes that enable the emergence of various forms of learning innovation.
7. 7. Educational technology provides learning practices in the form of approaches, models, strategies, methods, techniques and the latest learning media that help to teach according to individual differences in students and current needs.
8. 8. Educational Technology provides a scientific foundation for education through learning theories, multiple intelligences, learning styles that enable the optimal serving of various needs of student learners.

Thus it can be stated that educational technology is needed in every aspect of the learning process. Educational technology serves all purposes for modern education. Education today cannot go far without the help

of educational technology. Technological innovations in the field of education have led to miracles for the learning process. This not only maintains the structure but also enhances the nature of the education process itself.

IV. CONCLUSION

The industrial revolution has driven the emergence of innovation in sharing professions, especially in the field of education. Every industry is moving towards digitization and virtualization. Education is in the incubator and that's where we the education community has the opportunity to become innovative practitioners of education. Kemenristek Dikti has adopted a policy that improving the quality of learning and student affairs is the main target in the face of the industrial revolution era 4.0. This opportunity, of course, we must welcome with great enthusiasm through serious efforts and focus on creating innovation in learning, so as to strengthen the existence of Educational Technology in its mission "facilitate learners' learning"

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