BUILDING THE HIGHER EDUCATION 4.0 IN THE ARMED FORCES ASSOCIATED WITH THE INDUSTRY 4.0: POTENTIAL AND CHALLENGES

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Abstract: Statement of the problem. Industry 4.0 is expected to bring unprecedented far-reaching influence, change the face of the world as well as raise concerns – where, the rapid development and diffusion of intelligent machines can lead to security and defense threats when the achievements of the fourth revolution are applied to an unreasonable purpose. Higher education 4.0 using the advanced technology of the Industry 4.0 will open up the potential for training and learning as well as the difficult challenges that the education institution will face. Purpose of the work. With the change and far-reaching international integration, the higher education 4.0 in the armed forces needs to transform itself to meet the changes of the Industry 4.0 in the new situation. Used methods. A systematic approach, methods of analysis, synthesis and comparison method is used to systematize, analyze and aggregate resources, and compared with model universities in the world which provide the most accurate 4.0 University Education model for the armed forces. Results. Successfully building the higher education 4.0 in the armed forces with five elements: Teaching 4.0, Research 4.0, Management 4.0, Training 4.0 and Operations 4.0; It aims to train a team of high-quality professional officers to serve the cause of security and to order protection and defense for the country. Professional human resources are confronting with urgent issues in the current period. Practical value. This is a current issue having theoretical value, high scientific and practical significance to help the higher education institutions in the armed forces to develop and meet the political and professional requirements.

Keywords: Higher education model 4.0, industrial revolution, potentials and problems, armed forces, national security.

1 Introduction

Emerged from 2011 at Hannover Fair (1, p34), Industry 4.0 promises to give people unprecedented opportunities and challenges.

We cannot accurately predict the speed or the application of technology in the future life and in education, however, the trend of education and training must be approached with the hi-tech view is inevitable. For example, we could indicate a few trends of technological education. For example, in the digital classroom: instead of only consider information technology as a singular tool and skill, it should be viewed as a trend and will change the modern classroom. For example, tablet PCs, electronic screen, interactive white boards, data projectors, etc. Tangible smart devices: the process of embedding available programs into physical materials through smart devices, connect everything via the Internet and will have a powerful impact which will change the mechanisms of learning and receiving information of the person, e.g. the reactive materials, reactive furniture, 3D printers, fact-finding through space number. Mobile applications. Mobile devices are popular technology, which has broad coverage and all the research and application are associated with a specific product. The trends of learning through mobile application have been approved for a while. Mobile and tablet devices are available everywhere, it is a tool that connects directly to the valuable resources to support learning. Distribution courses on mobile phones help students to easily learn anytime, anywhere, saving time and costs. All learning content is put in a friendly smartphone and can easily be accessed. (2-3)

One of the definitions of revolution is "the process of major and fundamental change in direction of progress in a certain field". (4, p122) Thus, we can consider that it is an Industrial Revolution when there are innovation and industrial development that transformed the face of the whole society, from economics and culture to politics. The first industrial revolution (late XVII century - the first half of the XIX century) occurred when the steam engine was invented. The second industrial revolution (late XIX century - early XX century) occurred with the emergence of power applications for mass production. The third industrial revolution, known as the Digital

Revolution (from the 1970s onwards) occurred with the help of electronic devices, digital technology, information technology promoting production automation into reality. As above revolutionaries occurred, the Industry 4.0 which has potentially developing technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Big data, nanotechnology, etc. will change the way people live, think and look at the problem. Even this revolution far exceeds previous revolutions, with "unprecedented" breakthrough speed under exponential function, not linear leading to far-reaching changes. It will break and is breaking most industrial branches in every country. (5)

Education 4.0 is catering to the need of the society in 'innovative era'. It is in accordance with the changing behavior with the special characteristics of parallelism, connectivism (6), and visualization. This learning management must help to develop the learner's ability to apply the new technology, which will help the learners to develop according to the changes in society. Sinlarat (7) stated that the learning management of this era is a new learning system, allowing the learner to grow with knowledge and skills for the whole life, not just to know how to read and write. To be able to live in a society and to be equipped with the best of his/her ability. Therefore, Education 4.0 will be more than just an education.

The skills which derive from integrating life skills and innovative skills together becomes the main characteristics, to develop individuals to use Intelligent agents, Mobile technologies, Cloud computing and services, which Marinela and Andreescu (8) explained that they are the main attributes of cloud computing which are service-based, scalable, elastic, shared, metered by use, and delivered through internet technologies.

Many concepts of the learning management for the 21st Century Skills are still very interesting or could be used, such as the concept of Zhoa (9), Sinlarat (7) and Gomaratat. (10) The concept of Zhoa (9) is to arrange the learning process such as being in the real situation of working in the plant. As of Sinlarat (7), there are 4 ways: 1) Critical-Based Instruction, 2) Creativity-Based Instruction, 3) Productivity-Based Instruction, and 4) Responsibility-Based Instruction. From Gomaratat (10), arranged to adapt the Constructionist Learning, that is 3R, 3I, and 3P. The 3R is regulating the understanding, which consists of Recalling, Relating, Refining; the 3I is investigating, that consists of Inquiring, Interacting, Interpreting; and 3P is Producing, creating work by Participating, Processing, Presenting. Jeschke (11) proposed that Social & Virtual Learning must have been learning with social media, in large groups, and in a virtual environment.

The emerging technologies have huge effect on the education of people. Only qualified and highly educated employees will be able to control these technologies. The industry should collaborate with universities. The main vision the following of Industry 4.0 is the emergence of "smart factories" that will be connected to the production facilities Cyber-physical systems called CPS. (12) Using of the Internet of Things, the Internet of Services and the Internet of People will make a connection: machine-machine, human-machine or human-human, and at the same time an enormous amount of data will be obtained. (13) For this reason, it will be necessary to analyze large data (Big Data) to be able to predict possible failures and adapt in real time to the changed conditions. Currently, the human is an operator of machines and these machines only passively follow the operator's commands. (14) The main trend of Industry 4.0 will therefore replace this condition with the Prognostics-monitoring system. Production processes will have to allow effective production and at the same time be flexible due to the changing customer demand for particular products. For this reason, the companies will produce smart products. (15) The timely analysis of the obtained data is important for planning and managing in all fields including armed forces. (16)

Thus, one of the important tasks of Vietnam today is to prepare the foundation for the Industry 4.0, welcome the progress of humanity. Higher education in general, and higher education in schools of the armed forces, in particular, cannot stand outside that inevitable trend.

2 Materials and Methods

2.1 Higher Education 4.0

When Industry 4.0 occurs, it will change every field, erase the boundaries between industries, many jobs will disappear and, simultaneously, innumerable new jobs will be generated. Because robot will replace human beings to undertake heavy manual labors and Artificial Intelligence will be able to undertake complex calculation works which need intellect with high accuracy, the labor will need "talent" more than "skill" in order to desire to exist in the world of Technology 4.0.

Thus, one of the duties of higher education 4.0 in general, and higher education 4.0, in particular, is to train the human resources who are able to meet the demands of higher education 4.0 to confront with the new era opened by Industry 4.0. Therefore, an essential educational foundation 4.0 must have an enormous change in training target, transfer from transmitting knowledge to the majority to capacity exploitation (emancipate potential, capacity, motivation). Also, empower innovation to each individual. Creation, innovation will be the foundations of higher education 4.0. The trained candidates in higher education 4.0 must have not only specialized knowledge, but also high-ranking skills which cannot be replaceable by robot: problem-solving capacity, logical reasoning capacity, quick adaptation capacity, communication and skills, persuasion, teamwork skills, the demand of active, frequent, lifelong studying, etc. (17, p21)

On the other hand, higher education 4.0 is the educational model relating to applying the concept of industry 4.0 into education, is the model applying the achievement of Industry 4.0 to enhance the quality of teaching and studying. In higher education 4.0, training will be personalized meanwhile the mission of training will be directed beyond the boundary of countries to serve humankind. Higher Education 4.0 is an intelligent model linking critically between schools and managers and enterprises, to create favorable conditions for creating, increasing labor productivity in the knowledge society. Information technological breakthroughs entered into schools will improve training effectiveness, help teaching and studying take place everywhere and every time. Also, it will facilitate the cooperation between higher education and industry and unite developing efforts on sectoral and local economy.

One of the ideas concretizing this model is proposed by Prof. Gottfried Vossen (Münster University, Germany) and consists of Teaching 4.0, Research 4.0, and Management 4.0 described below.

- Teaching 4.0: there are many new studying forms, flexible time and place for studying, many appropriate changes with studying candidate, provide more appropriate skills.
- Research 4.0: new research form (include speed, result, assessment process), data system with bigger scope and more diversified sources.
- Management 4.0 consists of teaching (software system implementing more targets, more effective management tools, larger information system), scientific research (on an information system for scientific research, project management), training foundation management, financial support division. (18)

4.0 University Model has been applied to several Universities such as Coventry University (England), Complutense University de Madrid (Spain), Yeungnam University (Korea), Malaysia University of Technology, Lorraine University (France) etc. According to professor Gottfried Vossen, 4.0 education includes multiple innovative learning methods: learning through playing, interacting and communicating, group learning, learning by doing projects… The time and location of the student is unbounded and can be changed if they want. 4.0 Education provide more suitable skills for the learner: know how to apply knowledge into practice, develop the ability to solve practical problems based on scientific knowledge, proactive and creative learning...As a result, students will not only have learned scientific knowledge but also known how to apply them in practice. For example, when learning about the types of electric circuit, learners can establish a network connection and electricity used in practice instead of learning through books; the same goes to martial arts training, shooting or electronic warfare, which learners have access to the interactive model as practical work, fight. This helps remove the gap between academic knowledge and practices. (19)

In Vietnam, one of the most typical and popular example in higher education 4.0 application is the HOCMAI educational system. Up to 2018, there have been more than 3 million members who study online from Primary School to High School. Beside, FUNIX is the first online university established in our country with more than 1000 students studying. With this form of learning, a learner can actively choose among the available lectures base on his/her desire. In addition, students can choose the appropriate teachers, interacting with teachers and friends at school anytime, anywhere through the Internet and technology equipment. For truly effective learning, learners need to improve knowledge about technology, actively research and update new information. The learners also need to experience and practice the things that are learning to accumulate experience for research and development. (19)

2.2 Higher Education 4.0 in the Armed Forces

National security, as well as all other aspects, will face with many large and complex changes when the Revolution 4.0 occurred. One of the remarkable changes is the breakthrough in research and development of new technologies: nanotechnology, virtual reality technology, artificial intelligence, robotics, etc. The rate of technological development and innovation is very fast, the cost of production is getting cheaper, at present, there are no laws and international rules clearly regulating the process of monitoring and controlling research. Advances in technology 4.0 are applied to the development of military technology and military weapons. All of these factors suggest risks and threats that could threaten national security, order, and defense. The achievements of the Revolution 4.0 can be used to make genetically modified biological weapons, energy weapons, combat robots, etc. to create new types of warfare and combat. The forces, especially the powerful forces, may use Technology 4.0 for illicit purposes, intervention secret, controlling the internal situation of other countries, remote controlling for less developed countries and developing countries are depended on us. Although the cost of production will continue to decline, smaller nations will be forced to depend on larger nations on demand for the latest advanced technology in the arms race. (20) In addition, technological advances can also be used in criminal acts such as money laundering and transnational crime, or in attacks on the national information network, especially the network of national security and defense, leading to a decline in social order and security and the threat of armed struggle to protect information of national defense and security. (21)

Thus, one of the tasks of armed forces education is to equip the leaners with necessary knowledge and skills to cope with dangers posed by Industry 4.0. Namely, the higher education programs in the armed forces need to be renewed in content. The most up-to-date technologies must be constantly updated. At the same time, the curriculum must pay attention to training, practicing decision-making skills, integrate information, solving problems in unexpected cases, because, with the rate of development of technology and the modern technology as today and predicted in the future, an officer will face complex multidimensional situations and rapid changes and will not have much time to build tactics; the complex changes in the blink of an eye will make it easy to make wrong decisions based on misleading information. (22)

Higher education in the armed forces has also made important contributions to the provision of high-quality professional officers for the protection of national security, the maintenance of social order and the safety of the country. However, in keeping with the changes that accompanied the Industry 4.0 as well as the deepening international integration, the Higher education in the armed forces needs to develop a new higher education model, which has not only caught up with the industry 4.0 but also ensured the requirements of politics, professional, socio-economic and international integration.

With the peculiarities of higher education in the armed forces, we propose the Higher Education 4.0 in the Armed Forces comprising five elements: Teaching 4.0, Research 4.0, Management 4.0, Training 4.0, and Operations 4.0 with

- Three elements (Teaching 4.0, Research 4.0 and Management 4.0) inheriting the model of Professor Gottfried Vossen (University of Münster, Germany).

- Training 4.0: new training (includes using technology, increasing speed, training skills, reflexes, results, evaluation process).

Virtual Reality (VR) technology is being used by the armed forces around the world to train and train the officers, especially to simulate dangerous, complex environments or expensive environments if trained in the traditional way. Thanks to the superior capabilities of Big Data, training scenarios are simulated very flexibly from the data collected on the system. Commanders continually offer training situations close to the reality, in accordance with the capabilities of the officers, the features of weapons equipped, arbitrarily adjust according to their intention to help improve the efficiency of training, combat skills without building training ground, selecting training locations, building props, etc. (23)

- Operations 4.0: Researching, proposing many new operational models, in accordance with the reality and the international situation, having appropriate changes to the learners, providing many practical situations.

Network operation is the act of disrupting information organization, preventing access and supplying data, degrading the ability or destroying information stored in the computer network as well as the computer network of the adverse party; at the same time, protecting our elements. Dr. Peter Singer, a strategist, told in Business Insider, "We are used to fighting only in a certain territory. But we have new areas, which we have not yet fought there before, and that is the area outside of space and cyberspace." (24)

Network operation happened, is happening and will happen, it is very big risk. With the terrible destructive power of many areas, it could be the hijacking of combat vehicles, important factories, military facilities, national defense and security; the inability to operate the military, political, economic and social strategic centers; combined with communication activities that creates the insecurity, chaos of a society leading the loss of control and control of a political system. (23)

However, the application of Technology 4.0 and Higher Education 4.0 will bring many benefits in the training of the armed forces.

3 Results and Discussion

3.1 The Potential of the Education 4.0 in the Armed Forces

Higher education in the armed forces following the university model 4.0 can bring great results. With many new forms of learning, learners can choose the appropriate learning method, ensuring the quality of training. Individuals can master their own skills and knowledge at their own method. Lectures, curriculum materials not only distributed and implemented in the traditional way, but also through methods such as online posting to the web, will not only reduce the cost of printing and distribution, or in the case of the lectures are the cost associated with the place, but

also help the learners can see or review the materials wherever. Not only for individuals who are trained, build online knowledge systems, and constantly update their knowledge, will also provide graduates with the opportunity to access the latest information, improve the professional skills and serve the country's defense and security work more effectively, including those working in mountainous or island areas. The workshops, the great opportunities to cultivate and acquire more knowledge, with online stream technology, will give countless individuals access to learning that they previously did not have, because many reasons they cannot attend the seminar.

One of the points that need to overcome in building the armed forces is the level of theory, acumen, sharpness and political strength of many officers and soldiers who have not matched the position, requirements, the task of the armed forces in the struggle to defend the socialist fatherland. (25) These political elements can be trained in the armed forces education at the university level by combining online classroom and flipped classroom. Learners will read the material beforehand, listen to lectures on political theory, online philosophy before entering the classroom, in the classroom, lecturers will hold debates, answer questions. This gives learners the opportunity to deepen their problems, to better understand their political ideals and philosophies, as well as to train their thinking and reasoning skills quickly and properly.

With the help of artificial intelligence and software for data collection and analysis, the system will be able to study and synthesize the most appropriate learning and training programs for each subject, these subjects can further customize the program to suit their own conditions.

If virtual reality technology is included in armed forces education, the quality of teaching and learning will also increase dramatically. Virtual reality provides a variety of simulation environments for practicing, without high expense for construction of environment or equipment in reality. The learners are trained and practiced safely in the practice area, but can still experience hazardous environments with full feeling as in practice, giving them more experience responding with pressures that is not in the classroom or practice area: Learners can use virtual reality to experience parachuting, gaining a sense of disorientation when jumping from an airplane, without the cost of a real flight. They can learn to fight fighters, submarines, tanks or armored vehicles and experience cramped and stuffy conditions. From there, when facing real situations, the officer will be more ready. Currently, virtual reality devices have been developed without wires connected to the computer, thus allowing users to move freely while wearing them with programs that can be stored locally on the device, so there is no need for network connectivity, whether wired or wireless, which can be used in any location. (26)

Updating and renovating the management system under the management model 4.0 improves management works more closely and fairly. The information stored on the system can easily be found if needed, and the editing, adding, deleting will also be simpler than the previous one.

3.2 Challenges When Building the Higher Education 4.0 in the Armed Forces

In fact, the higher education system in the armed forces at the undergraduate level is still approaching traditional teaching and learning. Sometimes, it is still a heavy institution that leads to the inhibition of development. The openness of higher education institutions is limited. Particularly, the education of the armed forces is still high, the subsidy is heavy: enrollment is recruitment, the training program is quite closed, no socialization, focused learner management, etc.

All these factors are no small obstacles to the process of developing and applying the model of Higher Education 4.0 in the armed forces.

In addition, the Higher Education 4.0 requires large installation costs, modern equipment and facilities and high-tech platform that we cannot currently meet fully; similarly, many learners do not have good financial conditions to prepare the appropriate equipment for the learning environment 4.0. Moreover, this new model requires skills and specialty that are completely different from the pattern, so if not adequately trained, the instructors will not be able to work and teach effectively in an environment of Higher Education 4.0. Not only lecturers but learners, as well as staff from other positions in education and training, also have to master many skills, especially foreign language skills and usability, problem detection and problem identification of technology products 4.0. (2)

The feature of the Higher Education 4.0 is the close and comprehensive combination of the technology in general and Industry 4.0 in particular; one of the essential conditions for the operation of the model is the powerful data security software, firewall, and antivirus software. With just one virus attack, the whole network will collapse, destroying a lot of important data and paying many expenses, effort and time to recover. Thus, a solid security system is the essential need but also the obstacle we have to overcome.

According to Barrett (27), the central purpose of military education is to lead to action with a "larger objective of seeking increased global stability and security, unfettered by doctrine but informed by a shared ethical framework." Barrett continues by describing how working across the cultural divide between defense education and traditional academia adds further complexities; however, despite its uniqueness, defense education draws from all academic disciplines and must span an entire career. Cowan (28) explains how the "complexity of thought and maturity of judgment" for military members are contingent upon a strong education that counters experience.

Although military education may have a unique purpose, it also responds to typical trends in education and must consider learning technologies and approaches in moving forward. (29)

From a military perspective, changes in technology have greatly impacted traditional beliefs of a military members' role, and it is now critical to have a knowledge base that extends far beyond the task and considers the unique context locally, nationally, and internationally. (30) Given the requirement for ongoing postings and deployments that result in working in remote locations, the ability to use technology in distance education has increased learning opportunities for military students, as well as the level of interaction among students and instructors. It has also created the opportunity to engage in higher level thinking on a frequent basis.

The call for changes and necessity to respond to changes has a critical impact on the functionality of the organization. (27,29,31)

4 Conclusion

The world is preparing for the Fourth Industrial Revolution, the revolution will transform every aspect and field, including education and higher education in the Armed Forces. Getting the Education 4.0 is essential, unavoidable. However, this is not the near future. The Education 4.0 is still new, is being researched, developed, tested and perfected. (32) The application of the proposed model of 4.0 University Education in the armed forces is urgently needed in the current international situation in order to implement effectively solution, ensuring constantly improve the quality of training and retraining of staff sets, forming an elite force, gradually modernized, meet the requirements of the tasks of building and defending our Homeland. Moreover, in the current situation, Vietnam is still not qualified to build a typical higher education 4.0.

Requirements for the qualifications and skills of employees will be higher than at present, because the companies will use new technologies and smart media. (33) For this reason, the education system will be changed from Education 3.0 to Education 4.0. Education 4.0 will combine real and virtual world information. (34) Virtual resources, for example glasses for virtual reality, will be used for teaching. Higher education will be enhanced, for example the course of information science will need to include knowledge about processes management. The knowledge, qualification framework and staff training will be an essential part of Industry 4.0. Virtual learning environments (VLEs) will be used for high transfer of developed knowledge and skills. Teachers and students will meet with their avatars in the VLEs. VLE will be the first step in the education of new employees. (35) The next part of education will be the implementation of augmented reality in the real environment. In this part, the training courses of new employees will be realized through the glasses of augmented reality. These types of education are very costly. (36)

The most evident political challenge is the increasing need for funding of research programs. Governments need to support organizations with the development of new technologies as well as the integration of those technologies in the existing environment. Moreover, governments need to establish legal parameters for the usage of big data. The most important concern is the protection of privacy because data will be collected on everything while interacting with smart objects.

To mitigate diverse learners' needs, traditional instructors' roles are changing and educators need to develop relevant skills and require appropriate support to achieve current educational ideals. (37-46) Educators should regularly consider the pedagogical potential of incorporating technology into their teaching. However, in the attempt to incorporate technology into their learning, some instructors feel overwhelmed, unprepared, and nervous about implementing the changes. (39)

In considering the implications of emerging technologies on higher education, Singh (47, p5) states that "higher education institutions, faced with the massification of knowledge production and the increased use of communication information technologies, have struggled to come to terms with the current changes." The continuous changes dictated by recent trends in higher education and distance education present challenges for higher education institutions as they have yet to be fully incorporated into policy and are creating gaps of variance in ability and use by instructors. (48) Organizations must undergo a process of "unlearning" in order to change habits, routines, and welcome the current pedagogy. White (49) suggests that institutions have little "pockets" of excellence and that decision makers need to set up an institution-wide approach capitalizing on the way in which these "pockets" of individuals already function.

Building the foundation for the higher education model 4.0 requires the participation of agencies, individuals and organizations in a variety of fields, along with careful study and consideration and a clear, long-term plan. However, the faster realization of this higher education model in universities in the armed forces is accelerated, the sooner we can be in tune with the power of the times, have great effect in the protection of national sovereignty and safe life of the people.

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