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Vocational Teacher Perception on Industry 4.0 and Society 5.0

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Abstract. In today's digital era two dominant paradigms running in parallel were first developed in Germany and Japan, namely the industrial 4.0 and the community paradigm 5.0. These two paradigms will provide significant multiple effects on the education system, both content, methodology and learning models. The main problem that will occur is a shift in values, models and technological procedures that occur in extreme and fundamental ways. The Industrial Revolution 4.0 developed a model of an internet-based system (IoT) with various infrastructure approaches, both hardware, and software. Japan addressed the high-level application of revolution 4.0 by developing a community model system 5.0 (Society 5.0). This model gave up most of the management of the system in artificial intelligence autonomously in carrying out executions of various life issues extensively. This condition certainly brings new wisdom to the process of cultural transformation of interfaces between humans and intelligent machines. Technology and vocational education will come into direct contact with these two significant paradigms related to substance, application, and cultural concepts. In this context, especially vocational technology education teachers who play an important role in forming and producing competent graduates need to understand and master the concepts of industrial 4.0 and the phenomenon of society 5.0. Therefore the purpose of writing this article will be to map comprehensively the perceptions of vocational teachers towards the implementation of the industrial era 4.0 and society 5.0 and its output will produce a qualitative model of vocational teacher perceptions.

Keywords: Vocational Technology Education, Vocational Teacher Perception, Industrial Revolution Era 4.0, society 5.0

1. Introduction

Lifelong education has become the classic paradigm of the process of improving the quality of human resources in certain professions, including professional vocational teachers. The teacher is the heart of the education process that will pass on good cultural, social and life values to students. The approach and model of professional teacher development in decades continues to change in a more open, transparent and modern direction. The competency indicators of professional vocational teachers are

measured measurably so that the competency achievements of students can be determined according to industry needs. Transparency runs in the anatomy of work profiles, curriculum and education regulations to anticipate the substance posture of curriculum dynamics due to technological developments that are running very fast (Rauner, 2012).

The mechanism of the education process in the 21st-century era in the context of human resource development has been organized within the framework of technology-based systems and takes into account increasingly stringent world economic competition (Day, 2014). It is hard to argue in modern education that innovative, reformist and forward-looking teachers are needed. Teachers with competency capabilities that develop continuously are an absolute requirement for professional work. Of course in addition to the competency of knowledge and skills that must be possessed by a professional teacher, also must pay attention to personal and social aspects. Adaptation of teacher competencies in the community dynamically involves three dimensions, namely sensitivity to the social life of the community, life experience backgrounds that have been experienced and professional attitudes in various work situations including new phenomena of technological development in the context of industrial revolution 4.0 and society 5.0 (Potolea & Toma, 2015) Therefore an increase in job professionalism cannot be separated from the learning dimension, which includes learning structured individually with standard values that must be achieved. Then the next aspect is related to a comprehensive understanding of the institutional value system of school organizations. The final dimension is the influence of the external environment of various relevant professional organizations. Institutionally on a broader scale, the three aspects above are better known as the learning process of three approaches, namely vertical learning networks, external learning networks, and horizontal learning networks (Rob F. Poell, Geoff E. Chivers, 2000).

Vocational education comprehensively refers to aspects of culture that involve general education, related technology studies, the development of acquisition of practical skills, attitudes and life skills. Besides, that vocational education must be understood as an integral part of general knowledge, a means of preparing a quality workforce and tools to promote environmentally sound and sustainable development (Mar 2011). The definition and scope of vocational education are not only solely for developing training, but rather on developing other sectors in the context of national development. The terminology of vocational training is broadly related to social, economic and labor development. Vocational education is also the main instrument in developing human resources that will enter the labor market, industry and global markets (L. Clarke & Winch, 2007). Therefore the constellation of vocational education is substantially different, operational and functional with general knowledge. Vocational training is more complex with multidimensional expertise programs that require high demand driven from industry and the labor market.

Vocational education is part of a continuously evolving social and economic context in response to the major changes that have affected society in the past few decades. The school system, in general, and the vocational education sector, in particular, must adapt to this change, and the teaching approach has also changed. As a result, the content and process of vocational education teacher training programs must be modified to adapt to changes that occur in the community as a whole. Besides science and technology in the context of learning both as media and as scientific content accelerates very dynamically. Of course, this dynamic requires that teachers always improve and adjust their competencies to be able to develop and present actual subject matter using the latest approaches, methods and learning technologies. Conceptually the teacher must carry out the learning process that can bring students into the workforce according to the needs and challenges of their time. Many facts in the field doubt the teacher's competence both in the field of study taught and in other fields

2. Industry 4.0 and Society 5.0 Analysis

Vocational teachers in the present era need to apply a new paradigm of industry 4.0, which is an integrated and holistic approach that strictly combines all the elements to make a system. The second new paradigm associated with adaptation is the ability to interact with the physical, cyber system through complex and open communication technologies. The next new model of local culture is a physical ability; the spatial nature of the environment limits cyber systems, the system dynamics that occur are not discrete, and are adaptive because they have mechanical abilities, such as automatic learning, assembly, and autonomy. All of this offers not only unlimited opportunities to optimize production and supporting processes but also can overcome the complexities of modern manufacturing automation [11]. Vocational teachers need comprehensive understanding and competence of important elements of industry 4.0 which include mobile devices, IoT platforms, location detection technologies, advanced human-machine interfaces, fraud authentication, and detection, 3D printing, intelligent sensors, big data analytics and advanced algorithms, multilevel customer interaction and professional customers, augmented reality, and cloud computing. Connectivity devices are connected to mechanical and physical devices. The aim is to receive and send data by specified orders, both manually and automatically based on artificial intelligence. IoT devices in Industry 4.0 are known as Industrial Internet of Things, which were previously very useful for internal monitoring. In the industry 4.0 concept, IoT devices can connect to WAN networks through a cloud environment. [12], [13]. Arriving in the cloud environment, data can be processed and distributed to other parties. Here requires automation and orchestration in a hybrid cloud environment. One way is to use the DevOps approach that uses a container system to make it easier for developers and operational parties to continue to improve performance and services. The complexity of competencies that must be mastered is also increasingly multi-model and approach.

The main problem in industry 4.0 is related to big data problems because all systems focus on human-generated data 'not just' data supplied by machines or industrial data,' in the form of machine controllers, sensors, and manufacturing systems. Industry 4.0, involves intelligent, analytical devices and virtual physical systems that work together to realize new thinking in the industrialization process. Extensive data is input from the appropriate sensor installation and various signals such as vibration, pressure, and temperature. Also, historical data can be taken from further data mining through communication protocols, such as MT Connect and OPC, which can help users record controller signals. When all data is collected, this combination is called "Big Data." [13] [14]. Transformation agents consist of several components: integrated platforms, predictive analysis, and visualization tools. Deployment platform is chosen based on calculation speed, investment costs, ease of deployment and renewal. Processing actual large data into useful information is the key to continuous innovation in Industry 4.0. [14] [15].

The phenomenon of community constellation 5.0 which was launched in the vision of the model of Japanese society reached a high level of convergence between virtual space and real space. In the era of community 4.0 between these two spaces, there is a gap that is quite far away and runs serially. So that people 4.0 will access database services in cyberspace through the internet and search, retrieve, and analyze information or data. Meanwhile, in Society 5.0, a large amount of information from sensors in physical space accumulated in cyberspace. In cyberspace, this big data is analyzed by artificial intelligence), and the results of the analysis are fed back to humans in physical space in various forms. In the past information society, the general practice was to gather information through networks and analyze it by humans. However, in Society 5.0, people, things, and systems are all connected in cyberspace, and the optimal results obtained by AI exceed human capabilities are given feedback to physical space. This process brings new value to industry and society in previously impossible ways. In Society 5.0, new costs created through innovation will eliminate regional, age, gender, and language gaps and allow the provision of finely designed products and services to varying individual needs and latent needs. In this way, it will be possible to reach a society that can promote economic development and find solutions to social problems.

In society up to now, priority has generally been placed on social, economic, and organizational systems with the result that disparities have emerged in the products and services received by individuals based on individual abilities and other reasons. In contrast, Society 5.0 achieves advanced convergence between cyberspace and physical space, enabling AI to be based on extensive data and robots to perform or support as agents of work and adjustments that have been carried out by humans until now. This frees people from theoretical work and daily tasks that they do not master well, and through the creation of new values, this enables the provision of only the products and services needed by the people who need them when required, thereby optimizing the entire system social and organizational. This is a people-centered and not a future society that is controlled and monitored by AI and robots. Reaching Society 5.0 with these attributes will enable not only Japan but the world to realize economic development while solving major social problems. It will also contribute to meeting the United Nations Sustainable Development Goals (SDGs). Japan aims to become the first country in the world to achieve a human-centered society (Society 5.0) where everyone can enjoy a high-quality life that vigorously. The approach taken towards community gateways 5.0 is by combining advanced autonomous technology in a variety of industries and social activities to drive innovation fundamentally and create new value systems.

3. Discussion

The research was conducted with respondents from vocational teachers in West Java with random samples. Respondents are productive vocational teachers who have professional certificates. Data collection from respondents is done directly from the primary data of the respondents that have been determined in the previous sample. Data collection for all teachers who are respondents is also equipped with other instruments such as observation and interviews with parties that are relevant to the teacher's professional duties. The composition of respondents consisted of 85% of men and 15% of women who showed that male groups still dominated vocational teachers. The level of academic qualifications of respondents included D-IV (2%), S-1 (780%), and S2 as much as 12%. Academically, a combination of undergraduate teachers and vocational school teachers meets the requirements to be able to improve competencies, open new insights and develop various learning innovations in the industrial era 4.0. While the teaching experience of vocational teacher respondents is in the age range of 5-20 55%, generations <6-20 reach 16% and> ages 6-20 as many as 29%. Data on teaching experience shows that respondents have been in the learning process for a long time with various models and curriculum content. So that the estimation of new learning processes that will be developed including in the industrial era 4.0 will be much more comfortable and can run well. Based on the results of data processing, it is obtained the vocation teacher's perception of the understanding of the industrial revolution and the 5.0 community phenomenon as follows:

Table 1 Understanding the Concept of Industrial Revolution 4.0

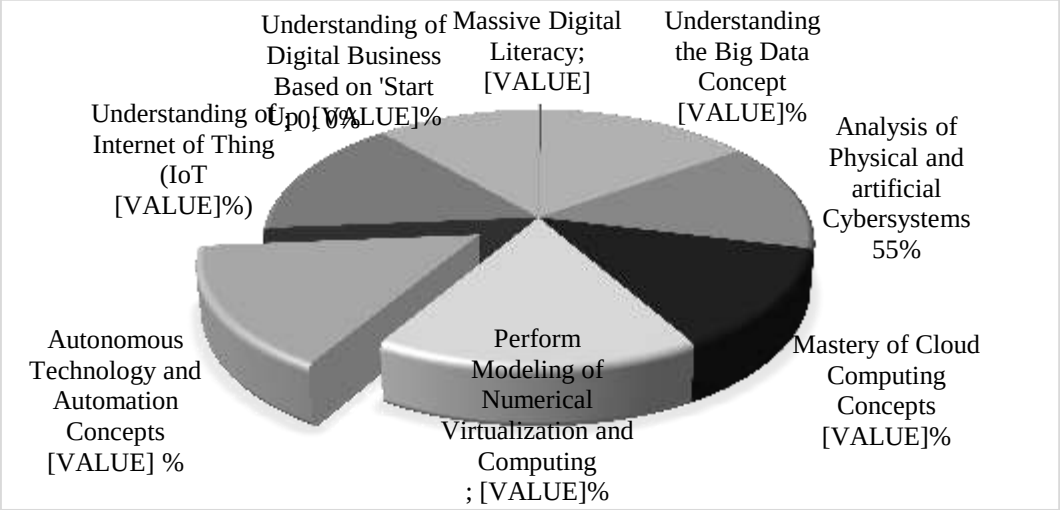
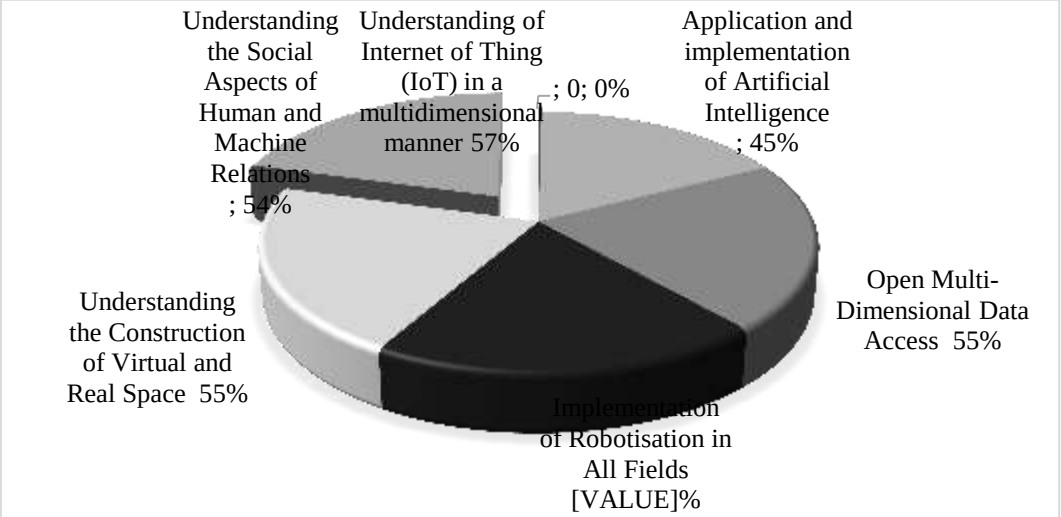


Table 1 shows the percentage of research results obtained in the first indicator. The use of online media in the learning process is a sub-indicator that reaches the highest score of 87% which indicates that professional vocational teachers generally have used online media as a digital literacy material quite high. The internet and other infrastructure tools that have developed rapidly making it an excellent opportunity for vocational teachers to exploit on a large scale digital-based literacy. Activities that once offline had now shifted towards online, ranging from planning, preparation, implementation to universal literacy. The percentage of accomplished performance related to industry 4.0 that connects to the concept of "startup" independent digital business is ranked last. This illustrates that vocational teachers have not comprehensively understood implementation in the digital-based entrepreneurship sector. The results of research from other indicators show that professional teachers, in general, have followed the principles, dimensions and scope and implementation of industry 4.0, especially in the learning process in schools. This certainly relates to the substance of subjects in Vocational Schools which intersect with technological developments.

Table 2 illustrates the results of teacher vocational perceptions of the phenomena of society 5.0 which are now being developed in many countries. Professional teacher perceptions of the miracle of the 5.0 community, in general, have not been high because the average reached 53%. Achievements of 53% are still far from the value of expectations; vocational teachers should be in direct contact with technology every day have a high perception of the condition of society 5.0. The highest achieved an understanding of the implementation of the internet of thing (IoT) of 57% which shows that generally in schools on a small and partial scale have been applied to several IoT supporting devices. Even some schools have implemented IoT in the learning process on a macro basis, ranging from attendance, evaluation and other activities. The next rank is occupied by the concept of data access (cloud computing) and virtual concepts of 55% which has been understood by vocational teachers, and some have applied in the learning process in the classroom.

Table 2: Vocational teacher understanding of society 5.0



The lowest percentage related to the understanding of artificial intelligence is only 45%. This is related to the substance of the application of artificial intelligence that is widely used in various sectors. So that knowledge and understanding of artificial intelligence are only limited to the demonstration in various exhibition activities. In the era of society 5.0 applications of artificial intelligence occupy a substantial portion, because real-time execution between virtual space and real space is carried out autonomously.

Based on the results of the study of two phenomena which are currently underway in the industrial era 4.0 as well as the 5.0 community model from the perspective of the vocational teacher, several essential notes must be taken seriously. Professional teachers who have basic tasks and functions to produce graduates who are competent and able to work in the industry should start thinking fundamentally based on the development of industry 4.0 and society 5.0 because the current work in various sectors will all refer to the Internet of Thing system that requires a giant data space in the form of clouds with unlimited capacity. The applications and devices used are all intelligent hardware that works autonomously. Real space and virtual space have become one with different work characteristics and procedures. All real things that are difficult to do in laboratories, workshops, classes or other places can all be done visually in virtual space mode. Vocational teachers' understanding of technological dynamics and development becomes a necessity that requires an alternative solution as soon as possible so that technology education, especially in Vocational Schools, does not lag too far.

4. Conclusion

1) Increasing the competence of vocational teachers in an increasingly high-tech era must have begun to be directed at new concepts and paradigms, both in terms of substance and social and cultural impacts of society; 2) The industrial revolution era 4.0 and the phenomenon of society 5.0 need to be anticipated comprehensively, so that there is no shock culture, especially in the process of education in vocational high schools (SMK); 3) Professional teachers need to be systematically driven to think orientation, perspective, and spirit of performance towards paradigm changes that occur in various fields.

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