

Employability Skills for High School Students According to the Needs of Industry 4.0

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Abstract: The candidates of vocational schools graduates (SMK) who suit the needs of industry should have the technical skills and employability skills, and the start of the learning process. This paper aims to reveal the characteristics of employability skills for vocational students according to the needs of industrial revolution 4.0. Education is one of the ways to prepare for the 4.0 industrial revolution. Through education, the community can be well educated especially the various skills required to face increasingly harsh competition. Preparation of a more innovative learning system can be performed from adjusting the learning curriculum, and increasing students' abilities in terms of Information Technology (IT), Operational Technology (OT), Internet of Things (IoT), and Big Data Analytics. At the same time integrating physical, digital and human objects to produce competitive and skilled vocational graduates especially in the aspects of data literacy, technological literacy and human literacy.

1 CHALLENGES OF VOCATIONAL SCHOOLS IN THE INDUSTRIAL 4.0 ERA

The industrial revolution 4.0 encourages innovation and creation of Vocational High Schools (VHS). The government needs to review the relevance of vocational high schools and existing jobs to respond to changes, challenges and job opportunities in the era of industrial revolution 4.0. Responding to the challenges of the industrial revolution 4.0, Bukit (2014) explains that vocational education as an education which is distinctive from other types of education should have these following characteristics; 1) oriented to individual performance in the occupational world; 2) specific justification on real needs on the field; 3) the focus of the curriculum are on psychomotor, affective, and cognitive aspects; 4) the benchmark for success is not limited to school; 5) sensitivity to the development of the occupational world; 6) adequate facilities and infrastructure are required; and 7) community support. (Bukit, M, 2014).

Vocational school graduates are required to have the competence and good social skills, that they can interact, adapt, and cooperate well at the workplace (Burmeister, Luettgens, and Piller, 2015; de Guzman and Choi, 2013; Oviawe, 2010; Hadromi, et. al, 2015).

2 INDUSTRIAL REVOLUTIONM 4.0

The history of the industrial revolution began in industry 1.0. In addition, we are now entering the industrial revolution 4.0. The industrial phase is a real transformation. Industry 1.0 was characterized by the mechanization of production to support the effectiveness and efficiency of human activities. In addition, industry 2.0 was characterized by mass production and quality standardization. Industry 3.0 was characterized by mass adjustment and flexibility of automation-based manufacturing and robots. Industry 4.0 then now replaces industry 3.0 which is characterized by cyber physical and manufacturing collaboration (Hermann et al, 2015; Irianto, 2017). The term industry 4.0 comes from a

project initiated by the German government to promote computerization of manufacturing. Digitalization is one of the big trends of this century and has the potential to drastically change various industries and production techniques (Gulati, & Soni, 2015: 60-67).

Based on this trend, the term "Industry 4.0" has emerged, which is defined as digitizing the manufacturing sector, with sensors embedded in almost all components of manufacturing products and equipment, ubiquitous physical-cyber systems, and analysis of all relevant data [Wee, et al: 2015]

Furthermore, Hermann et. al. (2016) added that there are four industrial design principles 4.0. First, interconnection (connection): 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. Second, information transparency is an information system's ability to create virtual copies of the physical world by enriching digital models with sensor data including data analysis and information provision. Third, technical assistance which includes; (a) the ability of the assistance system to support humans by combining and evaluating information consciously to make the right decisions and solve urgent problems in a short period of time; (b) the ability of the system to support humans by carrying out various tasks that are unpleasant, too tiring, or unsafe; (c) includes visual and physical assistance. Fourth, decentralized decisions which are the ability of the virtual physical system to make their own decisions and carry out their tasks as effectively as possible.

Table 1 describes the list of transitions expected in all business models with the implementation of Industry 4.0. Industry 4.0 represents a paradigm shift from a previous era the rigid, focused on efficiency and manual manufacturing to a more dynamic, agile, and automation. This is marked by a shift from mass production to mass customization, made possible by flexible production and shorter lead times. There will be a transition from large - scale specialized product factories to smart factories with high-tech equipment that can produce many products at competitive costs. Flexibility is also realized in the ability to work remotely using technologies such as augmented reality.

The business metrics of success also changes from achieving low cost efficiency to extracting higher return on capital. Industry 4.0 increases profitability by facilitating greater adjustments, reducing labor costs and reducing the cost of

complexity. In parallel, this helps reduce the capital used by allowing greater flexibility and utilization of assets.

Table 1. Industry 4.0: What is changing for companies?

	Traditional Manufacturing	Industry 4.0 Manufacturing
PROCESS	Rigid and manual	Agile and automated
PRODUCT	Standardized	Personalized and customized
SCALE OF FACTORIES	Large factories at centralized locations	Small factories at decentralized locations
SUPPLY CHAIN	Stock - based planning	Dynamic and predictive
SUCCESS MATRIC	Low cost, high efficiency	High return on capital employed (ROCE)
CLIENT RELATIONSHIP	Low and indirect	High and direct

(Source: Roland Berger: WHITEPAPER, Skill Development for Industry 4.0 BRICS Skill Development Working Group. India, 2016: 2)

3 EFFECTS OF JOB CHANGES AS THE IMPACT OF INDUSTRY 4.0

There are two schools of thoughts that arise regarding the impact of Industry 4.0 on employment. Some experts believe that the adoption of the Industry 4.0 can increase the use of automation and robotics. Given that this robot is able to perform tasks several times with a high degree of accuracy and in a shorter period of time than humans, the robot will act as a substitute for efficient labour.

For example, an employee whose job is to repair certain parts when assembling a machine will be replaced by a robot that will do the same job accurately and in a shorter time. However, quantum job losses are estimated to vary according to the level of automation of an industry.

On the other hand, experts believe that the use of industrial technology 4.0 will not result in losing a job. The basis behind such a statement is the fact that Industry 4.0 will produce an increase in labour productivity and the quality of products being manufactured. As a result, the demand for quality products being manufactured will increase which result in the companies' increasing capacity to meet

demands. Therefore, jobs with certain low skills will be eliminated.

However, it is expected that capacity building will have a positive impact on job creation, which requires a higher level of skills. Employees who are considered unemployed due to the loss of low-skilled jobs must have re-skills or increased skills so that they are prepared for new requirements. Overall, the creation of new high-skilled jobs will compensate, in large part, for eliminating low-skilled jobs.

4 ADAPTABILITY SKILLS

When students are in a new environment with a variety of different cultures, including occupational; culture, students will learn to adapt and communicate well. The results of research in Texas show that new environments have a large impact on students' adaptation and communication skills (Williams, 2005; Hadromi, 2018). Because humans are biopsychosocial creatures as a whole, in meeting their needs, humans are always faced with complex problems, so they are required to adapt (Khandu, 2014). In addition, students must be able to adapt to the work environment (Gresham, et. Al., 2011) and have the willingness and desire to work and study. The ability to adapt needs to be supported by perseverance, resilience and moral character, such as integrity, justice, empathy and ethics. These characters must be established both at school and in the workplace to help active and responsible individuals (Rocha, 2012). This shows that human factors as labour in the industrial era 4.0 must have the ability to control or use smart equipment properly, have good performance to support the system applied to workers. The ability of the workforce to be able to adapt to various phenomena that exist in the industrial era 4.0 is necessary (Jones, et.al., 2017).

5 INCREASE IN EMPLOYABILITY SKILLS OF PROSPECTIVE 4.0 GRADUATES

Challenges arising from the impact of the industrial revolution 4.0 must be responded quickly and precisely so as not to contribute to the increase in unemployment. The government seeks to respond to the challenges of industry 4.0 by continuing to focus on improving the quality of human resources through vocational education. The government through cross-ministerial and agency policies has

issued various policies. One of the government policies in 2018 is the revitalization of Indonesian vocational education. Government support includes, 1) learning systems, 2) education units, 3) students, and 4) educators and education personnel are also required.

The pattern of occupation that is changing rapidly makes it difficult for us to design a vocational education curriculum. Jorgen Moller argues that it does not matter how long education takes place, what is important is that graduates have the ability to adapt to the needs of the workforce (Moller, Jorgen O., 2011). Vocational education which is too specific can be easily obsolete. Meanwhile, vocational education that lasts too long has the risk that the skills learned will be obsolete when the graduates finish their education and enter the workforce.

In line with Moller, Yildan Wang suggested vocational education should be flexible to provide everyone the widest opportunity to receive education, training or retraining according to the needs of the workforce (Wang, Yidan, 2012). Modular patterns taking into account learning areas can be more effective (Gessler, Michael, 2017). The pattern is implemented with a block system and supported by a good occupational culture that will enable students to obtain full competence. The modular pattern applied to TVET in Germany can be a good material of reference (Samani, Muchlas, 2016).

If the modular system is implemented and combined with a multi-entry and multi-exit system (MEMES), the separation of formal and non-formal education in education becomes irrelevant (MoEC-Mini standard of Education and Culture, 1997). Moreover, using the principle of prior learning recognition (RPL) combined with the application of the Indonesian National Qualification Framework (KKNI) makes the separation of Vocational Schools (Vocational Schools) and Polytechnics (Diplomas) less relevant. That is, vocational education in the era of Industry 4.0 becomes a flexible and integrated system (Republic of Indonesia Regulation No. 8 of 2012).

For the Indonesian context with unique geographical conditions and very diverse economic potential, the concept proposed by King and Palmer (2010) is very suitable. The development of vocational education is tailored to the potential of the region, so that it can support each other. On the other hand, vocational education will make it easier for students to get partners for industrial internship. Furthermore, the industry can also employ a

workforce that suits their needs. Based on this idea, the concept of developing commodity-based vocational education (CBVED) can be applied to develop vocational education that is suitable for the commodities manufactured in a certain areas (Samani, Muchlas, 2018).

In response to the industrial revolution 4.0, the strengthening of the four elements in the education system requires a revolutionary movement. One of the movements proclaimed by the government is a new literacy movement as a reinforcement and even a shift for the old literacy movement. The new literacy movement is intended to focus on three main literacies: 1) digital literacy, 2) technology literacy, and 3) human literacy (Aoun, 2017). These three skills are predicted to be skills that are needed in the future or in the industrial era 4.0. (YAHYA, 2018).

6 CONCLUSION

The Industrial Age 4.0 is a challenge as well as a job opportunity for prospective vocational high school graduates. Revitalization of vocational high school is required as an effort to supply workforce which corresponds the needs of industry 4.0. Four points that become the focus of revitalization of Vocational High Schools (SMK) mandated in Presidential Instruction No.9 of 2016. The four points cover curriculum revitalization, educators & education staff, partnership, and graduates. The success of revitalization on all four points will support the prospective vocational school graduates to compete and have the employability skills which suit the job qualification in the era of industry 4.0.

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