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THE ANALYSIS OF STUDENTS' READINESS OF VOCATIONAL EDUCATION IN FACING THE OPPORTUNITIES AND THREATS ON THE INDUSTRIAL REVOLUTION 4.0

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KEYWORDS

Students Readiness,
Vocational Education,
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ABSTRACT

This study aims to determine: 1. The perception of vocational education students towards the opportunities and threats of the Industrial Revolution 4.0. 2. The readiness of vocational education students in facing the opportunities and threats of the Industrial Revolution 4.0. This research is descriptive research with quantitative approach. The study was conducted in vocational technical education courses FKIP UNS. The population were 6th semester student from three courses (Mechanical Engineering Education, Building Engineering Education, and Informatics Engineering Education) that obtained the sample were 119 people. Data that were collected by questionnaire. Data validity is examined by expert judgment. The techniques of data analysis are frequency description and Top Two Boxes. The results showed that the respondents' perceptions towards the opportunities and threats of the Industrial Revolution 4.0 are good. This is supported by the results of the percentage of Top Two Boxes (T2B) by 71%. Then, the respondent's perception of the ability in facing the Industrial Revolution 4.0 as prospective educators classified in the very well category. It is supported by 80% T2B. However, the perceptions of the respondents' in organization of vocational education belong to the enough category. That is, with the acquisition of 58% T2B.

INTRODUCTION

In fact, the industrial world actually has a very long history of civilization and its effects that have created a period of the industrial revolution. Starting from the First Industrial Revolution where at that time a steam engine was invented as a substitute for human power by the British State. Then the Industrial Revolution 2.0 or often referred to as the Technology Revolution began in the 1890s. This second revolution was marked by the emergence of electric power generating engines and internal combustion motors. This discovery triggered the appearance of telephones, cars, airplanes, and so on. Significantly changing the face of the world. Then the emergence of digital technology and the internet was used as a sign of the start of the 3.0 Industrial Revolution, which was around the 1960s. The use of electronics and information technology systems and automation is a hallmark of the Third Industrial Revolution (Digital Revolution).

After the third revolution, namely the Industrial Revolution 4.0. Marked by the emergence of cyber-physical systems. Professor Klaus Schawb (2016) explains the Cyber-Physical System as a combination of digital, biotechnology, and physical domains. Furthermore, the three domains are detailed with digital provisions including Big Data, Internet of Things (IoT), and Artificial Intelligence (AI). The industry is starting to touch the virtual world. The form of connectivity between humans, machines, and data. Lee et al (2013) in Yahya (2018: 2) also explain Industry 4.0 is marked by an increase in manufacturing digitization driven by four factors: 1) Increased data volume, computing power, and connectivity. 2) The emergence of business analysis, skills, and intelligence. 3) The

occurrence of a new form of interaction between humans and machines. 4) Improved digital transfer instructions to the physical world, such as robotics and 3D printing. This fourth revolution will also have an impact like the previous revolutions which will radically change the way humans live and work (Savitri, 2019: 66). Both in the form of opportunities and threats. The era of the Industrial Revolution 4.0 leads to an era of disruption, which is where there will be many changes that will occur in every aspect of life (Prasetyo, 2018: 2). Especially in terms of manpower, which clearly requires competent competencies according to the times.

Thus, Indonesia is required to provide Human Resources (HR) to be able to survive and compete globally. There must be an increase in the competence of human resources. Through higher education, it is hoped that a quality workforce will be created. Higher education institutions as suppliers of experts should have prepared themselves to adapt to the needs of the industrial revolution. Vocational teacher education study programs organized by universities are part of the parties required to participate in welcoming the Industrial Revolution 4.0. It is hoped that these vocational teacher education graduates can become educators with integrity and professionalism. Therefore, it is necessary to conduct research to determine the readiness of vocational teacher education students in facing the Industrial Revolution 4.0. What are their views to anticipate and adapt to changes that pass quickly, especially in the scope of vocational education? Survive and do not experience cultural shock when they are directly involved in the world of work, namely as educators.

RESEARCH METHODS

This study aims to determine the perceptions of vocational education students on the opportunities and threats of the Industrial Revolution 4.0. As well as to determine the readiness of vocational education students in facing the opportunities and threats of the Industrial Revolution 4.0. The form of research used is descriptive research with a quantitative approach.

The research was conducted in the vocational-technical education study program, FKIP UNS. The population is students of class 2016 from three study programs (Mechanical Engineering Education, Building Engineering Education, and Informatics Engineering Education) which are included in the vocational engineering study program. The author uses the Probability Sampling technique developed by Isaac and Michael with an error rate of 5%. Based on the calculation table that has been determined, from a population of 180 people the sample was taken is 119 people. The techniques and methods used by the author in collecting data using a questionnaire. The questionnaire is a data collection technique with the aim of obtaining relevant information about the research variables measured in this study.

The data analysis technique used is the Frequency Distribution method and Top Two Boxes (T2B). T2B is a method commonly used to create reports or to analyze questions on a scale. This method will combine the percentage of respondents who choose the top two answers to the scale. The scale uses a Likert scale, namely with a score of 1 s.d. 5. Then calculate the percentage of the answers to the questionnaire on the two highest Likert scales, namely 5 and 4. The formula for finding the percentage of Top Two Boxes is as follows:

$$\%T2B_{\square} = \frac{\Sigma_{i=1}^{q}(F_{i4} + F_{i5})}{N_{Responden}} \times 100\%$$

The explanation :

$\%T2B$: Percentage of Top Two Boxes

F_{i4} : The frequency scale is four throughout the statement

$\mathrm{F_{i3}}$: The frequency scale is five throughout the statement

$\mathrm{N_{Unit}}$: Total number of respondents

After getting the% T2B amount, then the number is consulted against the score interpretation criteria on the Likert scale. This stage means that the% T2B figure obtained can be translated into several categories ranging from very bad to very good. The calculation of the score interval is as follows:
"I = 100 / Total Score (Likert), Then = 100/5 = 20. Result (I) = 20 (This is the interval from the lowest 0% to the highest 100%)". The following are the criteria for interpreting the scores based on the interval:

- Number 0 - 19.99% = Very not good
- Number 20 - 39.99% = Not good
- Number 40 - 59.99% = Enough
- Number 60 - 79.99% = Good
- Number 80 - 100% = Very Good

The data taken by the author is data in the form of numbers because the questionnaire instrument uses a Likert scale. Then the authors categorized the instruments into several grids in the questionnaire as shown in Table 1 below:

Table 1 Grid Questionnaire

Numb	Questionnaire Item Indicator
1	Perceptions and knowledge of FKIP UNS Vocational Education Students regarding vocational education
2	Perceptions and knowledge of FKIP UNS Vocational Education Students regarding the opportunities and threats of the Industrial Revolution 4.0
3	Perceptions of the ability of FKIP UNS Vocational Education Students to face the Industrial Revolution 4.0

RESULTS AND DISCUSSION

Perceptions and knowledge of FKIP UNS Vocational Education Students Regarding Vocational Education

In this section, respondents are first asked about their knowledge of vocational education. Respondents were asked to assess the progress of each study program as part of the provision of vocational education. The total number of statement items submitted was 12 items.

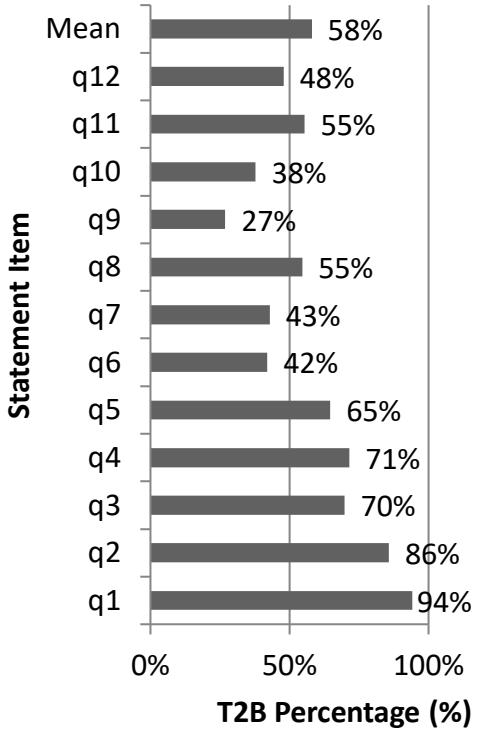

Figure 1. T2B Student Perception of Vocational Education

Based on the data in Figure 1, the total percentage of Top Two Boxes (T2B) in this grid questionnaire obtained is 58%. If this figure is consulted with the interpretation of the score based on the interval, it is included in the sufficient category, namely from the range of 40% - 59.99%. This means that respondents perceive that the implementation of the vocational education learning process in their study program is a fairly good assessment.

When viewed from the percentage of each statement item, there are five items that get a good and very good T2B percentage value. The five items were q1, q2, q3, q4, and q5 with the respective gains of 94%, 86%, 70%, 71%, and 65%. The data explain sequentially on each item, that respondents know their study program is included in a vocational education institution. They agree that the study program is preparing students so that they have skills as educators who are ready to work. The teaching skills and special areas of expertise they acquire are in accordance with the needs of today's vocational education world. As well as the curriculum built in the study program has been compiled based on science and technology.

Then in other statement items, there are five items that get a sufficient or moderate T2B percentage, namely at q6, q7, q8, q11, and q12. Each of these items got a percentage of 42%, 43%, 55%, 55%, and 48%. The explanation of each item consecutively is that the respondent assesses quite a number of things in their study program including the learning process in all courses that have been arranged innovatively and are able to make them think critically,

the implementation of education based on cooperation with industry, and the attitude of the study program. adaptive and anticipatory to developments in technology and information.

Meanwhile, for the last two items of the grid questionnaire, Percentage T2B was included in the low category. The two items are q9 and q10. Each item only received a T2B percentage of 27% and 38%. Both discussed the matter of facilities and infrastructure both in theoretical and practical learning.

Seeing this data, there should be an evaluation related to the learning process. Where good learning is when students can experience memorable learning experiences by covering affective, cognitive, and psychomotor aspects. Able to generate sensitivity from students to the development of the world of work, namely as educators. In this case, the study program must strive for students to understand the ongoing and future market demands.

Therefore, study programs need to produce educators who have the skills needed by the times. These skills are critical thinking, creative, innovative, collaborative, communicative, and problem-solving skills. Skills that fall into the category of high-order thinking skills (HOTS) should have been integrated by the study program into the curriculum for implementing learning.

Perceptions and knowledge of FKIP UNS Vocational Education Students regarding the opportunities and threats of the Industrial Revolution 4.0

Then this section will explain the extent of respondents' perceptions and knowledge of the Industrial Revolution 4.0. The statements submitted contained several opportunities and threats for the coming of the Industrial Revolution 4.0 in general which covered all aspects. There are 18 statements that must be answered by respondents. With details q1-q8 is an opportunity related question. As well as q9-q18 is a statement regarding the threat of the Industrial Revolution 4.0

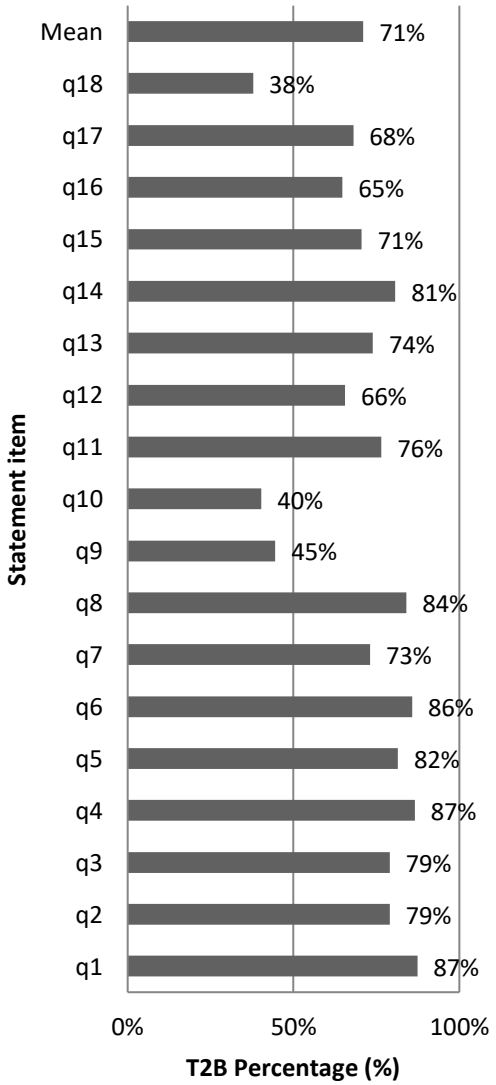

Figure 2. T2B Student Perceptions of the Opportunities and Threats of the Industrial Revolution 4.0

The statement regarding the opportunities displayed in sequence on the questionnaire which consists of several conditions such as, Industrial Revolution 4.0 creates new trade patterns, the global economy will increase,

changes in the skills needs of the world of work will take place quickly, the business world is unstable, those with capital and those who master technology will benefit, there is a gap in the workforce due to skills and wages, and the flow of information takes place openly and at high speed.

As for the threat of the Industrial Revolution 4.0, the questionnaire shows several conditions such as having a high risk of data security and privacy, the government is not ready to face changes in society, the phenomenon of human robotization, and causing chaos in all aspects of life.

Based on the data in Figure 2, the total% T2B from this grid is 71%. If consulted with the score interpretation criteria, it is in a good category. This indicates that respondents have good knowledge of the Industrial Revolution 4.0. Knowledge of the conditions of the times is mandatory for students. As a millennial generation, students are required not only to be smart and master theory, they also have to have high learning abilities to keep up with rapid changes (Fonna, 2019: 66). Educational institutions also have an important role to play in honing the abilities of their students so that they are able to answer the challenges that accompanied the coming of the Industrial Revolution 4.0.

Perceptions of the ability of FKIP UNS Vocational Education Students to face the Industrial Revolution 4.0

Furthermore, in this last questionnaire grid after being asked for their knowledge of Vocational Education and the Industrial Revolution 4.0, respondents as prospective educators will be asked about their perceptions of their ability to face the opportunities and threats of the Industrial Revolution 4.0. The statement compiled contains the competencies of educators needed in vocational education institutions in the Industrial Revolution Era 4.0. There are 10 statements that must be answered by the respondent. Sequentially, these statements, namely, the learning process is carried out anytime and anywhere. Educators are required to have the skills to read, analyze, and use data (information) in the digital world. Mastery in data literacy, technology, and humanism. As well as integrating the formation of five characters (Religious, Independent, Mutual Cooperation, and Integrity), 21st century skills or often referred to as 4C (Communication, Collaboration, Critical Thinking, and Problem Solving, and Creativity and Innovation), and high-level thinking skills (Higher Order Thinking Skills) in the learning process.

Based on the data in Figure 3, the percentage of T2B in this grid is 80%. A good number because if we consult the interpretation criteria, the score falls into the very good category. The T2B percentage yield for each item ranged from 76% to 84%. This means that some respondents feel capable when faced with the learning conditions in Era 4.0.

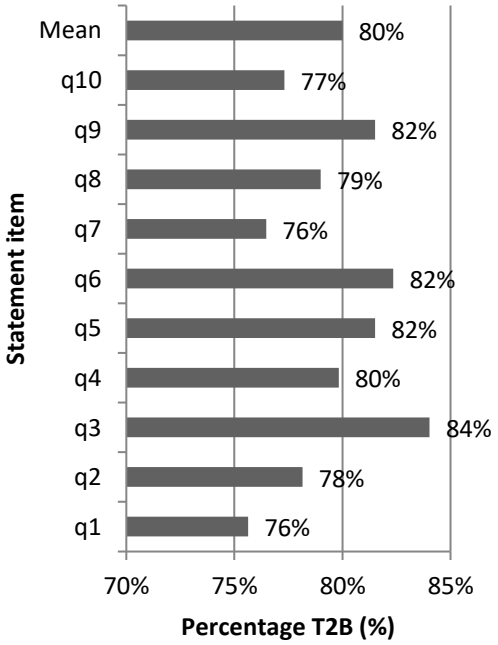

Figure 3. T2B Students' Perceptions of Ability

A good perception of ability towards some of the conditions mentioned above is at least a good asset for a prospective educator to become a professional teacher in the 4.0 century. Because the teacher will really have a high influence on the success of their students. These prospective educators must open their eyes to new developments in the teaching and learning process. Basically, the teaching-learning process and student learning outcomes are determined by the role and competence of the teacher (Normadina, 2019: 15). Therefore, it is a must

for a teacher to continue to learn and develop themselves following the changing times, for the success and creation of superior products from students who are able to bring change and good benefits.

CONCLUTION

Based on the research results, it can be concluded that the respondents' perceptions of the opportunities and threats of the Industrial Revolution 4.0 are in a good category. This is supported by the results of the percentage of Top Two Boxes (% T2B) of 71% which shows that on average students already know about the Industrial Revolution 4.0. Then the respondents' perceptions of the ability to face the Industrial Revolution 4.0 as prospective educators were in the very good category. Supported by the acquisition of a% T2B figure of 80%. This means that as many as 80% of the 119 respondents stated that they were capable and very capable of facing the Industrial Revolution 4.0. However, based on the data, the respondents' perceptions of the implementation of vocational education in the FKIP UNS vocational-technical education study program belong to the sufficient category. Namely with the acquisition of% T2B of 58%. This can be due to the high expectations of students towards educational institutions.

REFERENCES

Arikunto, S. 1990. Organisasi dan Administrasi Pendidikan Teknologi dan Kejuruan. Jakarta: CV. Rajawali.

Arikunto, S. 2006. Prosedur Penelitian Suatu Pendekatan Praktik (Edisi Revisi VI). Jakarta: PT Rineka Cipta.

Aziz, H.A. 2018. Education 4.0 Made Simple: Ideas for Teaching. International Journal of Education & Literacy Studies, 6(3), 92-98.

Azwar, Saifuddin. 2007. Metode Penelitian. Pustaka Pelajar: Yogyakarta.

Bluman, A. G. 2012. Elementary Statistic A Step By Step Approach Eight Edition. New York : McGraw-Hill.

Bukit, M. 2014. Strategi dan Inovasi Pendidikan Kejuruan dari Kompetensi ke Kompetensi. Bandung : Alfabeta.

Djohar, A. 2007. Pendidikan Teknologi dan Kejuruan. Dalam Ilmu dan Aplikasi Pendidikan. Bandung: Pedagogiana Press. Hal. 1285-1300.

Djojonegoro, W. 1998. Pengembangan sumber daya manusia melalui sekolah menengah kejuruan (SMK). Jakarta: PT Jayakarta Agung Offset.

Federasi Industri Jerman. 2016. What is Industry 4.0?. Diperoleh 2 Maret 2019, dari https://english.bdi.eu/article/news/what-is-industry-40/.

Fonna, N. 2019. Pengembangan Revolusi Industri 4.0 dalam Berbagai Bidang. Medan: Guepedia.

Ghozali, I. 2002. Aplikasi Analisis Multivariat dengan Program SPSS. Semarang: Badan Penerbit Universitas Diponegoro.

Hermann, M. Pentek, T. & Otto, B. 2016. Design Principles for Industrie 4.0 Scenarios. Presented at the 49th Hawaiian International Conference on Systems Science.

Kasali, R. 2017. Disruption. Jakarta: Gramedia Pustaka.

Kementrian Riset, Teknologi dan Perguruan Tinggi. 2018. Mempersiapkan SDM Indonesia di Era Industri 4.0. Diperoleh 18 Februari 2019, dari http://sdgcenter.unpad.ac.id/wp-content/uploads/2018/09/Kemenristekdikti-Mempersiapkan-SDM-Indonesia-di-Era-Industri-4.0.pdf.

Mardiana, C.F. 2017, 29 Agustus. 63% Orang Indonesia Bekerja Tak Sesuai Jurusan. Diperoleh 18 Februari 2019, dari https://finance.detik.com/berita-ekonomi-bisnis/d-3620313/63-orang-indonesia-bekerja-tak-sesuai-jurusan.

Motyl, B et al. 2017. How will change the future engineers' skill in the Industry 4.0 framework? A questionnaire survey. Disampaikan pada 27th International Conference on Flexible Automation and Intelligent Manufacturing, 27-30 Juni 2017. Procedia Manufacturing II, hal. 1501-1509.

Mubarok, Z. 2018. Pendidikan di Era Revolusi Industi 4.0 dan Problematika Perguruan Tinggi. Yogyakarta: Gending Pustaka.

Mulyasa, H.E. 2018. Implementasi Kurikulum 2013 Revisi dalam Era Revolusi Industri 4.0. Jakarta: Bumi Aksara.

Nasution, S. 2003. Berbagai Pendekatam dalam Proses Belajar Mengajar. Jakarta : Bumi Aksara.

Normadina. 2019. Strategi dan Motivasi Konsep Cerdas Guru Profesional Revolusi Indsutri 4.0. Medan: Guepedia.

Prasetyo, H. & Sutopo, W. 8-9 Mei 2017. Perkembangan Keilmuan Teknik Industri Menuju Era Industri 4.0. Seminar dan Konferensi Nasional IDEC 2017, hlm. 488-496, Surakarta.

Prasetyo, W. 2018. Era Revolusi Industri 4.0 dalam Aspek Kesehatan.Diperoleh 16 Februari 2019, dari http://stikeswilliambooth.ac.id/artikel-39-Era-Revolusi-Industri-dalam-aspek-Kesehatan.html.

Purwanto, Ngalim.1996.Psikologi Pendidikan.Bandung: PT Remaja Rosdakarya.

Rakhmat, J. 2007. Psikologi komunikasi. Bandung: PT Remaja Rosdakarya.

Romero, D., et al. 2016. Towards An Operator 4.0 Typology: A Human-Centric Perspective On The Fourth Industrial Revolution Technologies. CIE46 Proceedings, hlm. 1-11.

Satria. 2018. Tantangan Manusia di Era Revolusi Industri 4.0. Diperoleh 16 Februari 2019, dari https://ugm.ac.id/id/news/17203-tantangan.manusia.di.era.revolusi.industri.40.

Savitri, A. 2019. Revolusi Industri 4.0; Mengubah Tantangan Menjadi Peluang di Era Disrupsi 4.0. Yogyakarta: Genesis.

Schwab, K. 2016. The Fourth Industrial Revolution: What it Means, How to Respond. Diperoleh 15 Februari 2019, dari https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab.

Seftiawan, D. 2018, 26 Maret. 630.000 Orang Sarjana Masih Menganggur. Pikiran Rakyat. Diperoleh 17 Februari 2019, dari https://www.pikiran-rakyat.com/pendidikan/2018/03/26/630000-orang-sarjana-masih-menganggur-421873.

Setyaningsih, Ira. 2015. Kompetensi Untuk Menakar Kesiapan Mahasiswa Menghadapi Persaingan Asean Economic Community. Disampaikan pada Seminar Nasional IENACO. ISSN: 2337 – 4349. Hal. 440-446.

Shahroom, A.A. & Hussin, N. 2018. Industrial Revolution 4.0 and Education. International Journal of Academic Research in Business & Soscial Sciences, 8(9), hal. 314-319

Slameto. 2010. Belajar Dan Faktor-Faktor Yang Mempengaruhinya. Jakarta: PT. Rineka Cipta.

Soenaryo. 2002. Sejarah pendidi-kan teknik dan kejuruan di Indonesia. Jakarta: Direktorat Pendidikan Menen-gah Kejuruan

Sugiharti, H. 2014. Kesiapan Mahasiswa dalam Menghadapi Asean Economic Community 2015 (Persepsi Mahasiswa Fakultas Ekonomi, Universitas Indonesia), Jurnal Riset Akuntansi dan Keuangan, 2(3), 427-442.

Sugihartono, dkk. 2007. Psikologi Pendidikan. Yogyakarta: UNY Pers.

Sugiyono. 2015. Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif dan R&D). Penerbit CV. Alfabeta: Bandung.

Syaodih, N. 2006. Metode Penelitian Pendidikan. Bandung : PT Remaja Rosdakarya.

Tirtarahadja, U. & Sulo, S.L.La. 2008. Pengantar Pendidikan. Jakarta: Rineka Cipta.

Tjandrawinata, R.R. 2016. Industri 4.0: Revolusi Indsutri Abad Ini dan Pengaruhnya pada Bidang Kesehatan dan Bioteknologi. Jurnal Medicinus, 29(1), 31-39.

Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Sisdiknas.

Van Thai, H. & Kim Anh, M.A.L.T. 2017. The 4.0 Industrial Revolution Affecting Higher Education Organizations' Operation In Vietnam. International Journal of Management Technology, 4(2), 1-12.

Walgito, Bimo. 1992. Pengantar Psikologi Umum. Yogyakarta: Andi.

Wibawa, S. 2018, 1 Oktober. Pendidikan di Era Revolusi Industri 4.0 Bekali Peserta Didik Ketrampilan Abad 21. Diperoleh 16 Maret 2018, darihttps://krjogja.com/web/news/read/78977/Pendidikan_di_Era_Revolusi_Industri_4_0_Bekali_Peserta_Didik_Ketrampilan_Abad_21.

Yahya, M. 2018. Era Industri 4.0: Tantangan dan Peluang Perkembangan Pendidikan Kejuruan Indonesia. Disampaiakan pada Sidang Terbuka Luar Biasa Senat Universitas Negeri Makassar 14 Maret 2018.