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PERCEPTION TOWARDS INFORMATION SYSTEMS STUDY IN TEACHERS AND PRINCIPALS OF VOCATIONAL HIGH SCHOOLS

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ABSTRACT

The development of information technology has led to changes in society, including demands for workers in various fields. One of the suppliers of human resources who master Information Systems is vocational education. This study aims to determine the perception of vocational school teachers and principals regarding information systems learning that is ongoing and their expectations of information systems learning. This study was carried out mainly with a qualitative descriptive method. Data collection involved h in-depth interviews, observation, and questionnaires. The research participant included one teacher and one headmaster from a vocational school in Belitung, two vocational school teachers and headmasters in Salatiga; a vocational school principal in Surakarta; and vocational students in Salatiga. In order to enrich the main data in the form of interview results, 33 vocational students were given a questionnaire regarding adaptation to technology, to acquire an overview of student acceptance of technology. The results showed that the information system in the LMS (Learning Management System) context had been implemented in schools. The information system has also begun to be implemented implicitly in several majors. Nevertheless, there are still obstacles to the use of information systems as learning for students in vocational schools. In addition, based on the questionnaire distributed, it was found that vocational students are quite familiar with the use of technology, but are not yet proficient in operating them technically. Meanwhile, some teachers in vocational schools fail to understand the concepts of information systems in detail, so further introduction is needed for teachers and school principals. The results of this study can serve as input for constructing vocational education policy, as well as teachers in designing learning related to information systems at the vocational level.

Keywords: *Information systems, vocational school, artificial intelligence, big data, business intelligence*

1. PREFACE

The development of technology led to many changes in society, including changes in the workings of industry and education. The development of this technology brings a new era in the integration between industry and technology called the Industrial 4.0. According to Bailey et al. (2020), Industrial 4.0 is a transformation in the production and distribution field where the industry utilizes technology such as Internet of Things (IoT), Artificial Intelligence (AI), Big Data, and Business Intelligence (BI).

Indonesia is one of the countries that possess the most human resources (HR) in the world, with a population of 270 million people (Central Statistics Agency, 2020) that is undergoing developments towards the industrial era 4.0. Capable human resources need to prepare themselves for the development of the industrial era 4.0. These human resources can be developed through vocational education or vocational high school (SMK) which focuses on the development of work skills (Ministry of Communication and Information of the Republic of Indonesia, 2019). According to the Central Statistics Agency (2021), human resources measured by the Human Development Index (HDI), increased as much as 0.76 percent from 2010 to 2021 to 72.29. However, when compared to other countries, Indonesia was ranked 130 of 199 countries (Murdianingsih, 2022). This low ranking can be interpreted as an urgency showing the low quality of human resources in Indonesia. This shows that many human resources cannot adapt to the development of the industrial era 4.0.

To understand and adapt to the development of the industrial era 4.0, an understanding of the Information Systems is needed. This is evidenced by research conducted by Vrontis et al., (2020) regarding the application of AI in Human Resource Management. In this study, Vrontis et al. states that there are increased productivity when using industrial technology 4.0 such as AI and Robot that can assist with tasks. Therefore, it can be concluded that a deep understanding is important to deal with changes to the industrial era 4.0 and compete with other global industries.

Some of the HR suppliers who can help students to understand Information Systems are teachers and school principals, including those at the vocational level. Information Systems must be broadened because at the SMK level, students have used a plethora of technology such as mobile devices and the internet (Tji Beng et al., 2021). The teacher plays an important role in developing optimal teaching and learning activities in schools (Supriyoko et al., 2022). In addition to teachers, school principals are no less important. School principals play an important role because they can be the main motivator in developing human resources in education. This is also caused by the role of leadership that can influence other teachers to adapt, think critically, innovate, and collaborate in the industrial 4.0 (Prestiadi et al., 2019).

The development of education in Information Systems has been done before, but only in tertiary education and not in Indonesia (Dang & Vartian, 2022; Mchenry, 2022). Based on the above thought, the research team sees how important is contribution of teachers and principals in the development of human resources in the industrial era 4.0. Thus the research team intends to know the perception of teachers and principals towards IS learning, in the context of advancing the development of human resources. How deep the understanding and perceptions of school teachers and principals regarding IS learning in the vocational level. The material to be asked will discuss AI, Big Data, and BI.

Definition of SI

Information System is a system that collects, processes, stores, analyzes, and disseminates information for a specific purpose. The purpose of an Information System is defined as the right information to the right people, at the right time, in the right amount, and in the right format. Information systems have two terms that are closely related: data and knowledge (Supriadi et al., 2021). Information systems have main components in the form of hardware and software on computers, telecommunications, databases and data warehouses, human resources, and procedures. According to Baglieri et al. (2014) Information Systems is often described as the technology for managing staff actions and generating information to enhance managers' ability to monitor work results. Lake and Drake (in Supriadi et al., 2021) claimed that Information

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Systems is an important agent of organizational change for school leaders to manage the effects of change.

Defining Artificial Intelligence

AI itself is an interdisciplinary area with teams of researchers and experts from various fields, for example, neuroscience, psychology, and linguistics, continuously contributing by bringing their perceptions, knowledge, and terminology. Many scholars are trying to define AI, for example, Russell & Norvig, (2016) in Chen et al., (2020) indicated that AI is used to describe machines or computers that mimic cognitive functions, for example, learning and problem-solving, which are related to the human mind. Poole et al., (1998) in Chen et al., (2020) consider AI as the study of intelligent agents who can regulate themselves and achieve certain goals by maximizing probabilities. Kaplan & Haenlein, (2019) in Chen et al., (2020) consider AI as the ability of a system to interpret and learn correctly from inputted data, and to make better use of what it learns to achieve certain goals.

Big Data and Business Intelligence

Big Data is data that is more varied, in increased volume, and moving at a higher speed. Big Data is a new concept of edge computing technology with changes in education that cannot be ignored. Big Data is known as the three Vs, volume, variety, and velocity. Volume refers to data volume, large data sizes are reported in terabytes and petabytes. Variety leads to structural heterogeneity in the data set. Advances in technology can enable companies to use various types of structured, semi-structured, and unstructured data. Velocity refers to the speed with which data is generated then data must be analyzed and acted upon. According to Gandomi & Haider (2015), Big Data is a high-volume, high-speed, and high-variety information asset that demands a cost-effective and innovative form of information processing to enhance insight and decision-making. Ekbia et al., (2015) said that Big Data is a term that describes large volumes, high speed, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management and analysis of information.

In the technical definition, BI is the equipment, technology, and software to collect interrelated data from various sources to be analyzed, integrated, and disseminated. In this process, BI utilizes data warehouses, online analytical processing (OLAP), and data mining techniques. Managerially, BI is a synergy between data, information, processes, tools, and technology for data mining and multidimensional analysis. This synergy is used to develop expert qualities, form forecasts of events, develop decision-making processes and develop good businesses (Olszak, 2022). According to Duque et al., (2022), in BI, data is collected, compiled, and processed to assist the decision-making process. BI uses dashboards to process data in real time which can then be used to enrich information for users. BI can be used to produce accurate predictions and understand consumers by analyzing past usage data.

2. RESEARCH METHOD

The research was conducted using a mixed method, qualitative and quantitative. The main data collection tools are interviews and observation. The research team conducted interviews with 2 vocational school teachers in Belitung, 2 teachers and the principal of a vocational school in Salatiga; and a vocational school principal in Surakarta. The interview guide was made to find an overview of IS understanding and how far concepts such as AI, Big Data, and BI have been implemented in the chosen schools. The data from the questionnaire will be processed and analyzed using IBM SPSS and the data from the interviews will be analyzed after putting the results in writing.

To supplement, data collection was also conducted through questionnaires given to students. The questionnaire was adapted from two questionnaires, namely Technological Pedagogical Content Knowledge and Digital Adaptability Scale. The resulting questionnaire is called the Adaptation Towards Technology (ATT). The ATT questionnaire was distributed to 33 vocational students from the city of Salatiga, Central Java.

***Technological Pedagogical Content Knowledge* (TPACK)**

Technological Pedagogical Content Knowledge (TPACK) is the most prominent model of the effective use of digital technology in teaching by teachers. This measuring instrument is used to measure the knowledge and implementation of technology in teachers. TPACK has 7 components, namely (1) Pedagogical Knowledge (PK), (2) Content Knowledge (CK), (3) Technological Knowledge (TK), (4) Pedagogical Content Knowledge (PCK), (5) Technological Pedagogical Knowledge (TPK), (6) Technological Content Knowledge (TCK), and (7) Technological Pedagogical Content Knowledge (TPCK) (Schmid et al., 2020). The research team extracted questions from the TK dimension to come up with questions that were more appropriate for SMK students. Cronbach alpha of TPACK is relatively good ($0.75<\alpha<0.9$). The questions used by the research team were as follows, using very unlike me, unlike me, undecided, like me, and very much like me answer choices: (a) I follow the latest technological developments; (b) I often tinker with technological devices or features; (c) I have extensive knowledge about the types of technological devices or features; (d) I have the technical ability to use technological devices or features; and (e) I use digital technology to communicate with teachers and classmates (for example: e-mail, school website, etc.).

Digital Adaptability Scale

The Digital Adaptability Scale was developed to define or as a measure of what individuals do to learn new technologies for themselves and empirically relate them to inequality. The inequality in question is the ability of individuals to adapt to technological changes by learning new technologies. Digital Adaptability (DA) identifies the use of 5 habits that help individuals to learn new technologies for them. The 5 habits referred to in DA, are (a) Design logic; (b) Efficiency; (c) Management of frustration and boredom; (d) Willingness to try and fail; and (e) Use of models (Puckett, 2022). The Digital Adaptability Scale has a fairly good reliability, namely $\alpha = 0.84$. The questions used by the research team covered these 5 habits. The following questions are used with answer choices using a Likert scale ranging from from very unlike me, unlike me, undecided, like me, and very much like me. The example of the question such as: (a) When I study a new technology device or feature, I don't think about the benefits of that technology; (b) I always know how to seek help if I have problems using technology; (c) I feel frustrated when I learn how to use technology, so I give up or let someone else do it for me; (d) I try to find the fastest way to use technology (such as using shortcuts, right-click menus, etc.); (e) I usually don't know how to use new technology, so I don't like learning how to use it; (f) When I am learning how to use a new technology, I try to relate to other technologies that I have already used; (g) When I learn a new technology, I compare what I want to do with what the technology is designed to do; (h) Even though I feel frustrated, I never give up on learning new technologies; (i) I want to learn new technology even if I fail; (j) I don't waste time learning quick ways to master technological devices or features; (k) I don't always know how to seek help if I have problems using technology; (l) I think about the benefit of the technology while learning how to use it; (m) Learning tricks to use technology faster is important to me; (n) I do

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not like to use new technology because I am afraid of making mistakes; and (o) Even though learning to use technology is boring, I never give up.

Semi-structured Interview

The interview conducted was a semi-structured interview. The research team has formulated an interview guideline asking about understanding, implementation, and suggestions of teachers and principalsto be used as data. Interviewees have signed and filled out informed consent and have agreed to have their statements and recordings used in this study. The interview guidelines used by the research team are as follows: (a) Has your school implemented an information system learning system for vocational students? If so, what is the learning like, and if not, do you think you are needed in the learning model?; (b) What are the programming languages taught at the beginning of learning?; (c) Why were those programming languages chosen?; (d) Are students able to follow the lesson?; (e) What are the obstacles experienced by students and teachers when studying programming?; (f) Are you familiar with the term Business Intelligence (BI), Big Data, and Artificial Intelligence (AI)?; (g) What are your views towards B.I, Big Data, and AI?; and (h) According to you, are Business Intelligence, Artificial Intelligence, and Big Data suitable to be implemented in learning for vocational students?

3. RESULT AND DISCUSSION

The data obtained from the questionnaire are processed using the IBM SPSS application. A total of 33 questionnaires have been filled out by vocational students in Salatiga. 93.93% (31) were female students and the rest (2) were male students. Filling out the questionnaire took 06.12 minutes. Answers from participants were inserted, and then negative items are recoded to reflect the desired results. First, a validity test is conducted to see whether the data obtained has a valid item. After using the Pearson correlation, it was found that seven items had to be removed from the analysis because they did not meet the significance criteria of <0.05. The team then conducted a reliability test using Cronbach Alpha and then, testing the data normality. Cronbach Alpha testing shows the questionnaire to be reliable but not very consistent internally, being above 0.5, at 0.74 specifically. The following is a data presentation in the form of a table.

Table 1
Cronbach's Alpha test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of items
0.741	0.751	13

Furthermore, the normality test was conducted by looking at the significance number of Kolmogorov-Smirnov. The number obtained is 0.200 which is above 0.005, so that it can be considered normal.

Table 2
Kolmogorov-Smirnov Normality test

	Kolmogorov-Smirnov [a]		
	Statistic	df	Sig.
Total score	0.106	33	0.200*

After conducting the test, the research team concluded that the data can be used and carried out the next stage, that is finding descriptive reports from the data obtained. The research team

acquires mean, standard deviation, minimum value, maximum value, skewness, and kurtosis. The following is a presentation of descriptive data that has been obtained. The team set norms to determine which data was considered high, medium, and low.

Table 3
Descriptive Data

	M	SD	Min	Max	Skew.	Kurt.
Total score	50.1866	5.18581	40.00	58.00	-0.308	-0.858

Table 4
Norms

		frequency	percent	valid percent	cumulative percent
valid	low	8	24.2	24.2	24.2
	middle	17	51.5	51.5	75.8
	high	8	24.2	24.2	100.0
		33	100.0	100.0	

From the data obtained, it was found that the highest value that can be obtained is 65 and the smallest value that can be obtained is 13. The average obtained from the questionnaire is 50.18 with a standard deviation of 5.18. The lowest value obtained is 40 and the highest value is 58. Skewness and Kurtosis obtained are -0.308 and -0.858 respectively.

After checking, the research team conducted an exploratory factor analysis to see whether the number of dimensions measured was appropriate and valid to use. The results dictated that ATT has five dimensions consisting of; (a) the courage to use technology; (b) technological skills and knowledge; (c) deepening technology; (d) technological familiarity; and (e) the willingness to learn technology. Factors have been tested and declared significant because the KMO value is more than 0.5. The items of the question have also been distributed to the appropriate factors, following the rotation of varimax and the extraction of the maximum likelihood. The following are the results obtained.

Table 5
KMO and Barlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.591
Barlett's Test of Sphericity	Approx. Chi-Square	113.590
	df	78
	Sig.	0.005

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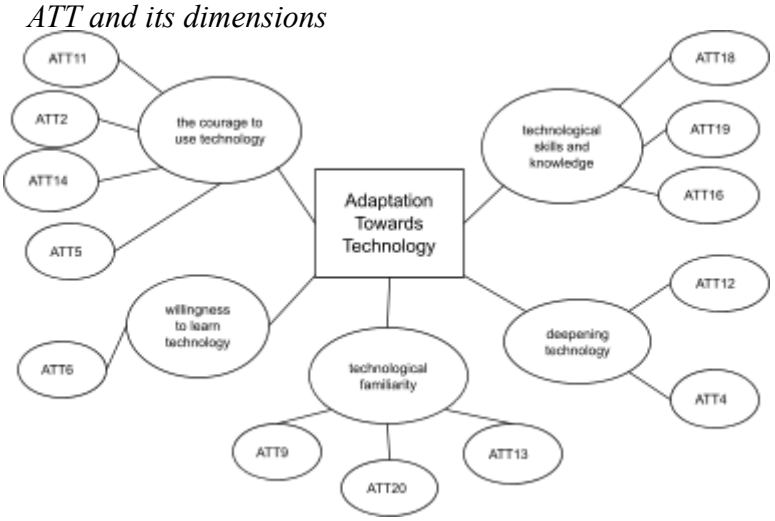
Figure 1
ATT and its dimensions



Questionnaire Data Discussion

From the data obtained, it can be seen that the average total score obtained by the participants is relatively good with the score of 50,186 of 65 (the maximum score that can be obtained) which signifies a high score because it exceeds the middle score of 37.5. This score can be interpreted as a relatively high proficiency to adapt to technology. The dimensions available indicate that the instrument, through adapting from other measuring instruments has been well-designed. The division is done in accordance with the matrix factors obtained and named according to the existing items. However, there are six items that need to be removed so that it can be adapted better. Regarding the questionnaire, the research team observed that one of the students filled out the questionnaire while playing with their gadget and averting their eyes towards their friends as if cheating. 80% other participants worked on the questionnaire while engaged in a conversation, therefore not being fully engaged in the process. This discovery can be an indicator that the results obtained can be negatively influenced by the questionnaire filling behavior.

The questionnaire was filled out quickly, which took 6 minutes. From this, it can be concluded that participants did not spend too much time trying to understand the questionnaire. The research team also observed the results of the average comparison of each questionnaire item. It was found that the ATT20 item [I use digital technology to communicate with teachers and classmates (such as examples: e-mail, school websites, etc.)] has the highest average of 4.42 while the ATT19 item [I have the technical ability to use technological device or features] has the lowest average with a score of 3.12. It can be concluded that most participants have regularly used technology to communicate, but still lack the technical skills to use technology.

Interview Result

JM is the head of the software engineering department in a vocational high school in Belitung. According to him, information systems learning have been implemented in schools. In grade 10, the Software Engineering class studies basic knowledge using Pascal and Scratch applications. According to him, students can still follow the Pascal application that uses English because since young, students have been familiar with English. In addition, the SCRATCH application is considered able to motivate students because there is a drag and drop mode that helps students to learn basic programming languages.

The obstacle experienced by JM in conducting learning activities in class about information technology is the issue with student learning motivation. Some students have a fairly high level of learning motivation, but some students show otherwise. According to him, low motivation is typical of students from rural area. JM said that students from rural area preferred to work as tin mining workers when they graduate. That is because tin ore can be sold at a high price and work as a tin mining laborer does not require previous education.

Another depiction that has been explained about the learning of artificial intelligence, big data, and business intelligence in vocational high schools in Belitung shows that students have varied understanding capabilities. JM also added that it is necessary for students to continue to study technological developments, especially students within the Departments of Software Development, Games, Computer Network and Telecommunications Engineering.

In the same school, a leading teacher with the initials AM was also interviewed by the research team. AM stated that all study programs in the school had undergone digitalization process. For example, Business and Management study program, which later turned into Digital Marketing Business. Then the Accounting department changes to an Accounting Computer. When asked about information system (AI, Big Data, and BI), AM said that some teachers are still incapable to implement information system learning because some teachers are high school graduates.

An interview was also conducted with two teachers from a vocational high school in Salatiga with the initials F and S. Following the questions that have been designed, their perception about the information systems learning have been acquired. The results of the interview stated that in the school there was no specific subject regarding Information System, but there were subjects that touched on informatics.

F states that the subjects regarding informatics in their vocational school in Salatiga are Basis of Informatics and Social Impact of informatics. Examples of the social impact of informatics are the creation of creative ideas, copyright, ITE Law, and sorting content that is suitable to be uploaded on social media. Informatics learning in class is usually carried out based on projects. According to F, this is in line with the independent learning curriculum that requires students to think creatively. Teacher F explains the project assignments carried out by students are to train students to produce creative ideas for solving a problem,

"Yes, for now, we are required to have an independent learning curriculum, which means projects. So we are more focused on projects. The project usually involves students making a poster, and then a video. We are trying to encourage them to make creative videos to convey the creative ideas of a problem. So for example there are problems around here, then I encourage them to come up with an idea to solve the problem and their creative ideas in making an application. They only design, not make (the applications) to solve the problem. They are free to choose the problems in question whether it is based on their majors or surrounding areas.".

F also emphasized that he did not want students to plagiarize, "maybe they have seen certain applications, but I'd like for them to make ideas that can be distinguished from others". In addition, F and S also mentioned that the informatics subject project carried out by students was still related to the majors of each student. Therefore, they can practice their ability to solve problems. For example, for the Department of Catering, Marketing, and Clothing, the project carried out by one of the students is to design an application to overcome skin problems in humans that affect self-confidence.

"Oh, for example, one of them made a beauty app. They claimed that the problem is that women often grow acne. Acnes make women feel insecure, ashamed, and not confident. They went looking for a solution. They came up with an application to point out skincare that is suitable for their acne-prone skin. The app scans faces, and if the skin appears oily, they recommend the suitable skincare products."

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Learning, of course, is based on the participation of teachers and students. The enthusiasm of students about informatics learning according to F and S is different. Computer learning intentions in students majoring in accounting tend to be high. Unlike accounting, other majors such as tourism and marketing majors tend to require encouragement to learn.

One of the problems that must be faced by teachers in vocational schools is the learning intention and motivation of students. Students want things to be instant. Another issue is that teachers who teach informatics despite being unqualified. F and S also believe that students are not ready to learn to program. S also added that teachers were also unable to teach programming. He claimed that there was coding macro training for accounting majors, but in the end, the students gave up on it.

When asked about Business Intelligence (BI), Big Data, and Artificial Intelligence (AI), S understand AI better than others. S also understands big data with cloud as an example. S then asked to be explained about BI because he did not understand the concept of BI. S concluded that the teachers in the vocational school serve more as users of the technological development, such as the use of e-Raport. Likewise with JM at Belitung Vocational School which is familiar with using fingerprint scanning. According to S, learning from the three topics is important to be implemented into the learning curriculum in accordance with its majors.

In the same vocational school, the research team has also interviewed the principal with the initials SY. Agreeing with F and S, SY said that the concept of AI, Big Data, and BI had been implicitly integrated into learning at the vocational school. The concept of information systems implemented is more directed towards practical uses and marketing. Sy said that "in certain majors, for example fashion, it has been directed to digital design. They no longer design clothing with a pencil. Those in fashion have been doing three-dimensional digital design."

The research team then interviewed one of the management of a foundation as well as a school in Surakarta with the initial P regarding information systems learning . P said that the Knowledge Management System (KMS) learning had been implemented in Vocational High Schools in Surakarta managed by the foundation. In addition, students have also been taught about product-based learning.

From the results obtained, the research team found that the information system had been applied in all schools interviewed. The application of AI, big data, and BI concepts has been applied in learning, but still not in depth nor specific. This is evidenced by several teachers such as F and S who barely understand concepts that have been mentioned even though they have been applied implicitly. The research team also found that the obstacle that often arises from learning information systems, is the lack of students' interest in going through challenging processes in learning the uses and concepts of information systems. This led to using simpler concepts and applications in learning. Another obstacle is the lack of qualified educators in the field of information systems. Finally, the research team found that information systems learning must be more in-depth to improve the understanding of vocational teachers and students. This is evidenced by the lack of understanding of the teachers and principals and their simple implementation.

4. CONCLUSIONS AND RECOMMENDATIONS

Information systems include learning about Artificial Intelligence (AI), Big Data, and Business Intelligence (BI). The results of data collection through a questionnaire show that students understand the use of information systems but still lack the technical ability to operate them. Teacher interview shows that they view the development of technology as extremely important for students to understand. Teachers in vocational schools initially did not understand the term 'information system', however, after some explaining, they understand the concepts of information systems. Constraints faced by teachers in vocational schools include the lack of teaching staff to teach informatics such as programming. Another obstacle is how students can not be bothered to study difficult subjects, to the point of giving up when given coding macro training.

Based on the conclusions of this study, a conducive atmosphere is vital in achieving full concentration while filling out the questionnaire. A conducive atmosphere helps prevent the negative influence of questionnaire-filling behavior. Therefore, the research team suggested setting up a conducive atmosphere before carrying out data collection. The conducive atmosphere in question is when participants can work on a questionnaire with full concentration without any significant interference. The items that have been omitted can be adjusted better in the future, making them valid and can then be used to improve the results. The items may be taken from sources other than the ones used in this research, which are TPACK and Digital Adaptability Scale.

The interview results obtained are rather conclusive and represent a fairly large area. However, in the future the research team can interview more teachers and principals to obtain data that better represents vocational schools in Indonesia to obtain more complete data. In accordance with the results received, the research team suggested to develop AI, big data, and BI learning that is simpler and more interactive so that it can attract the attention of vocational students and facilitate learning of these concepts.

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REFERENCE

Badan Pusat Statistik. (2020). *Jumlah dan distribusi penduduk*. Badan Pusat Statistik. https://sensus.bps.go.id/main/index/sp2020#:~:text=Jumlah%20dan%20Distribusi%20Penduduk,133.542.018%20untuk%20penduduk%20perempuan.

Badan Pusat Statistik. (2021). *Data indeks pembangunan manusia*. Badan Pusat Statistik. https://www.google.com/covid19/mobility.

Bailey, C., Lalanne, H., & Naghshineh, M. (2020, December 8). *Industry 4.0 with openshift and the IBM cloud pak solutions: Part I.* IBM. https://www.ibm.com/cloud/blog/industry-4-0-with-openshift-and-the-ibm-cloud-pak-solutions-part-i.

https://doi.org/10.24912/ijassh.v1i3.27417

Dang, D., & Vartiainen, T. (2022). Digital strategy in information systems: A literature review and an educational solution based on problem-based learning. *Journal of Information Systems Education*, *33*(3), 261–282. https://jise.org/Volume33/n3/JISE2022v33n3pp261-282.html.

Duque, J., Godinho, A., & Vasconcelos, J. (2022). Knowledge data extraction for business intelligence: A design science research approach. *Procedia Computer Science*, *204*, 131–139. https://doi.org/10.1016/j.procs.2022.08.016.

Ekbia, H., Mattioli, M., Kouper, I., Arave, G., Ghazinejad, A., Bowman, T., Suri, V. R., Tsou, A., Weingart, S., & Sugimoto, C. R. (2015). Big data, bigger dilemmas: A critical review. *Journal of the Association for Information Science and Technology*, *66*(8), 1523–1545. https://doi.org/10.1002/asi.23294.

Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management*, *35*(2), 137–144. https://doi.org/10.1016/j.ijinfomgt.2014.10.007.

Kementrian Komunikasi dan Informatika Republik Indonesia. (2019, February 19). *Apa itu industri 4.0 dan bagaimana Indonesia menyongsongnya*. Kementrian Komunikasi Dan Informatika Republik Indonesia. https://www.kominfo.go.id/content/detail/16505/apa-itu-industri-40-dan-bagaimana-indonesia-menyongsongnya/0/sorotan_media.

McHenry, W. K. (2022). Teaching tip: Evaluating visualizations with a compact rubric. *Journal of Information Systems Education*, *33*(4), 2022. https://jise.org/Volume33/n4/JISE2022v33n4pp324-337.html.

Murdianingsih, D. (2022, December 6). *BKKBN: Indeks pembangunan manusia Indonesia peringkat 130 dunia*. Republika.Co.Id . https://news.republika.co.id/berita/rmh1u4368/bkkbn-indeks-pembangunan-manusia-indonesia-peringkat-130-dunia.

Olszak, C. M. (2022). Business intelligence systems for innovative development of organizations. *Procedia Computer Science*, *207*, 1754–1762. https://doi.org/10.1016/j.procs.2022.09.233.

Prestiadi, D., Zulkarnain, W., & Sumarsono, R. B. (2019). Visionary leadership in total quality management: Efforts to improve the quality of education in the industrial revolution 4.0. *Proceedings of the 4th International Conference on Education and Management (COEMA 2019)*. 10.2991/coema-19.2019.40.

Puckett, C. (2022). Digital adaptability: A new measure for digital inequality research. *Social Science Computer Review*, *40*(3), 641–662. https://doi.org/10.1177/0894439320926087.

Schmid, M., Brianza, E., & Petko, D. (2020). Developing a short assessment instrument for technological pedagogical content knowledge (TPACK.xs) and comparing the factor structure of an integrative and a transformative model. *Computers and Education*, *157*. https://doi.org/10.1016/j.compedu.2020.103967.

Supriadi, D., Usman, H., & Jabar, C. S. A. (2021). The moderation effect of information systems on vocational high school principal decision-making model. *Cakrawala Pendidikan*, *40*(1), 43–55. https://doi.org/10.21831/cp.v40i1.31268.

Supriyoko, Nisa, A. F., Uktolseja, N. F., & Prasetyo, Z. K. (2022a). The nature-based school curriculum: A solution to learning-teaching that promotes students' freedom. *Cakrawala Pendidikan*, *41*(3), 643–652. https://doi.org/10.21831/CP.V41I3.47903.

Supriyoko, Nisa, A. F., Uktolseja, N. F., & Prasetyo, Z. K. (2022b). The nature-based school curriculum: A solution to learning-teaching that promotes students' freedom. *Cakrawala Pendidikan*, *41*(3), 643–652. https://doi.org/10.21831/cp.v41i3.47903.

Vrontis, D., Christofi, M., Pereira, V., Tarba, S., Makrides, A., & Trichina, E. (2022). Artificial intelligence, robotics, advanced technologies and human resource management: A systematic review. *International Journal of Human Resource Management*, *33*(6), 1237–1266. https://doi.org/10.1080/09585192.2020.1871398.

Tji Beng, J., Dinata, H., Wangi, V. H., & Tiatri, S. (2021). Gambaran perilaku dan pengaturan penggunaan telepon genggam cerdas (tgc) pada siswa sekolah menengah kejuruan. *Jurnal Muara Ilmu Sosial, Humaniora dan Seni*, *5*(2), 401–408. https://doi.org/10.24912/jmishumsen.v5i2.10086.

https://doi.org/10.24912/ijassh.v1i3.27417