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Outcome Based Education (OBE) Based Vocational Education Model in the Era of Artificial Intelligence (AI)

Constantinus Rudy Prihantoro[1]

[1] Technology and Vocational Education Study Program (Master Program), Universitas Negeri Jakarta - Indonesia

Correspondence: Constantinus Rudy Prihantoro, Technology and Vocational Education Study Program (Master Program), Universitas Negeri Jakarta – Indonesia. E-mail: crudy@unj.ac.id

Abstract
This study is to analyze AI indicators in terms of workforce needs relevant to the industry in the application of the OBE-based vocational education. Two models of the vocational education model were developed, namely the creative vocational education model (CVEM) and the performance vocational education model (PVEM). Model testing uses SEM to confirm theoretical models depicted in path diagrams with empirical data to see correlations between constructs built into path diagrams. The research population was two groups, namely industrial practitioners, and vocational teachers. Researchers found significant positive effects of AI capabilities on CVEM, PVEM, and significant influence of CVEM on PVEM. The vocational education organizational model influenced by OBE accounts for variances related to creativity, and variance in performance. The vocational education organization model provides evidence of a positive relationship between OBE-based AI capabilities with CVEM and PVEM, as well as the very significant positive influence of CVEM on PVEM.

Keywords: Artificial Intelligence (AI), Outcome-Based Education (OBE), Creative Vocational Education Model (CVEM), Performance Vocational Education Model (PVEM)

1. Introduction

1.1 Introduce the Problem

Artificial intelligence (AI) has a major impact on education in supporting school administration (such as class scheduling, staff scheduling, facilities management, finance, cybersecurity, safety, and security). The use of AI to support learning is widely practiced by students and teachers ((Wayne Holmes, 2019).

One of the AI applications developed in education is intelligence tutoring systems (ITS). According to Alkhatlan, A. and Kalita, J. (2019) called ITS is a computer program that uses AI techniques to provide tutorials intelligently.

AI helps to simulate step by step learning materials according to subject topics in a structured and well-defined manner, such as mathematics or physics subjects (Wayne Holmes, 2019).

Educators who are lagging in the use of digital technology and AI, will certainly face problems in preparing their graduates to become the workforce needed in the workforce and industry. OBE (Outcome Based Education) is very important to anticipate the needs of the workforce in Industry 4.0. The role of teachers will look different, but it will always be important its role as a provider of the skilled workforce that the industry needs to ensure it remains globally competitive (News, 2020).

Pastore, F. (2018) states that the industrial revolution 4.0, which is still ongoing, is a process of various aspects that involves several innovation processes in the fields of robotics, artificial intelligence, renewable energy sources, digitization of production and consumption patterns and so on. The consequences of the labor market become important, since most of the existing jobs will be destroyed, robot replaces labor, not only routine work, but also work that requires creativity.

1.2 Explore Importance of the Problem

By 2030, the industrial revolution is likely to demand high-skilled and highly specialized jobs. How will this new skill be acquired? Vocational Education and Training (VET) is an option available. Therefore, VET must include research-based knowledge and the participation of practitioners (worker users). In this way, the academic shift away from VET appears to be two-sided, one side is the knowledge-based process, and the other side is that all types of work require more skills and are constantly updated (Markowitsch & Hefler, 2019).

Jörg Markowitsch (2019) also argues that education is a solution to prepare humans for future changes. Vocational education must step forward to carry out reforms that are appropriate for the future (News, 2020). What is the future reform of vocational education? Is OBE relevant to the vocational education model influenced by the industrial era 4.0? Does AI make a significant contribution to the learning process of OBE-oriented vocational education?

This study analyzes AI indicators in terms of relevant workforce needs in the industry and designs an OBE-based vocational education model.

1.3 Describe Relevant Scholarship

1.3.1 Outcomes Based Education (OBE)

OBE is a process that involves the practice of assessment and evaluation in education to reflect learning achievement and demonstrate mastery in the program area. OBE is oriented towards predetermined tangible results that include knowledge, abilities, and behaviors. OBE involves the restructuring of curriculum, assessment and practice that reflect the learning achievement and mastery level of that accumulated educational process. OBE's focus is on student learning by (1) Using learning outcomes that are known, understood, or carried out by students; (2) Provide learning activities to achieve learning outcomes; and (3) Assess learning outcomes that meet the criteria.

Macayan (2017) in the Educational Measurement and Evaluation Review revealed that the optimal benefits of OBE can be realized if schools seriously implement it as a philosophical foundation of outcomes-based education. Rohman (2018) in his paper sorted OBE in four PDCA-based implementation criteria, namely Criterion 1: Graduate Competency Orientation (Plan), Criterion 2: Implementation of Learning (Do) which includes curriculum, departments/sections, student and academic atmosphere, facilities, and institutional responsibilities. Criterion 3: Assessment of Expected Learning Outcomes (Check) and Criterion 4: Continuous Improvement (Action). Based on these criteria, it was developed into an indicator of OBE achievement in the implementation of education (OBE instrument).

In Prihantoro's research (Prihantoro, 2020) stated that the implementation of OBE in vocational high schools is in accordance with the needs of the workforce in the industrial era 4.0, with a very high category of 94.8%. The trend of utilizing AI is becoming an integral part of the digitization and automation process implemented with internet of think (IoT) facilities.

1.3.2 Artificial Intelligence (AI)

AI is one aspect of modern life that most of us have consciousness with, yet we realize that we have very little knowledge. In fact, for many, AI is synonymous with humanoid robots which are often illustrated with images of robots or digital brains. Meanwhile, robotics is a form of AI that can move and interact physically with the world that has been widely applied in a variety of ways and different contexts.

Artificial intelligence is sometimes considered unhelpful, some researchers prefer enhanced intelligence, which retains the human brain as a source of intelligence, and positions computers and their programs as advanced tools that humans can use to enhance or augment intellectual abilities. In this approach, computers are used to do what humans find more difficult, such as finding patterns in large amounts of data. The debate over augmented intelligence and artificial intelligence is bound to run and with artificial intelligence wins at least on popular use even if augmented intelligence is more accurate or useful.

1.3.3 AI in Education

AI in education includes everything from instructional systems and AI-driven dialogues, it also includes students interacting one-to-one with computers, students using mobile phones outside of the classroom, and many others. The field of AI in education is derivative and innovative. AI generates problems and research questions how can a student be helped to learn? Which teaching interaction styles are effective, and when should they be used? What misconceptions do learners have about AI? (Woolf, 2008).

While AI as a tool in education needs to exemplify certain learning theories (such as "interactionalism" (Gagné, 1985 (4th Revised ed.)). AI in education effectively involves two main complementary parts: developing AI-based tools to support learning and using these tools to help understand learning. In fact, the applications, and approaches of AI in education that deal with the identified old and new problems are being researched, so what AI looks like in education is still undiscovered.

Adopting an alternative approach to AI in education in several fields, it is relatively easy to identify because of the AI devices that are already available. However, before doing so, educators need to understand the function of AI and how AI works in an educational context. Challenge, pragmatic and ethical, from the perspective of AI researchers and developers in education, educators, students, funders, and policymakers, this is the focus of the research to be conducted.

1.3.4 The development of AI in Indonesia.

AI is intelligence added to systems to correctly interpret external data and manage that data and use processed results for specific purposes (Goralski & KeongTan, 2020; Sousa, et al., 2019). Every invention in the form of electronics, technology, and many other disciplines has been influenced by AI. The industry has changed to more mechanical, more sophisticated machinery than ever before. AI is not just about robots, but also about understanding the nature of intelligent thinking and acting using computers as experimental devices. Several studies have shown that Europe and the US are pioneers in the application of AI (Shank & Gott, 2019; Sousa, et al., 2019). Previous research has stated that AI is a system designed to interact with everyone in the world with special abilities and intelligent habits like humans (Goralski & KeongTan, 2020; Shank & Gott, 2019; Sousa, et al., 2019).

In Indonesia, artificial intelligence is widely used in various sectors, namely industry, education, health, services and production. In addition to the manufacturing industry that has applied artificial intelligence to production lines, there are also many schools that have utilized learning outcome assessment systems using artificial intelligence (Nasution, 2012). Government agencies also use artificial intelligence in carrying out their functions as regulators of public services. The positive impact of implementing artificial intelligence is to reduce waiting time and improve the quality of process or service results, while also facing quite a lot of challenges because it reduces employment, in addition to requiring a high investment (Nasution, 2012).

AI in Indonesia is used by, among others, multinational companies, telecommunications companies, startups and the Government. In its development, startups have a strategic role to accelerate the adoption of AI technology in Indonesia. The growth of AI startups will also attract potential talents both domestically and internationally which drives the dynamics of the AI industry ecosystem (Yogaswara, 2019).

1.3.5 Conceptualizing AI

The study by Ransbotham, et al. (2018) found that lack of technological competence is one of the biggest barriers to the application of AI. Their findings highlight the fact that nearly one in five organizations do not understand AI-related data requirements and the technological infrastructure for storing data. AI technology will develop very quickly, just as organizational resources need to be developed to adapt to AI technology. These organizational resources are what is needed to build AI capabilities for enterprises.

There are eight resources that constitute AI capabilities grouped into three categories based on the Grant framework (Grant, 1991). **(A) The primary source** consists of (1) **data**, considered by managers to be one of the possible keys in harnessing the potential of AI (Ransbotham et al. 2018). In recent years a lot has been written about the opportunity to take advantage of big data (Mikalef et al., 2018). (2) **Technology**, a recent report published by McKinsey highlights that the lack of technological infrastructure is one of the main barriers to adopting AI in organizations (Chui, M & Malhotra, S, 2018). Since AI technology requires infrastructure investment at multiple levels, this is proving to be a major obstacle for many organizations, especially those with fewer resources (Y. Dwivedi, et al. 2019). (3) **Resources**, organizations must be able to provide time and financial resources that allow delivering the expected results (Ransbotham et al., 2018). Schryen (2013) in a paper on IS refers to time and financial investments as resources necessary to realize AI programs. Whereas (**B**) **Human Resources** consists of (4) **skills**, previous research on digital capabilities has identified skills as an important pillar of human resources, and (5) **the ability to understand**, research that notes that one of the most important barriers to realizing AI programs is the lack of leadership to support AI (Fountaine et al. 2019), highlights that managers do not understand AI technology. Leadership for AI initiatives ranks as one of the key barriers to adopting AI (Ransbotham et al. 2018). **(C**) I**klim Organizations** essential to building AI, i.e. (6) **internal consolidation** is defined as "a state of high shared values, commitment to achieving common goals, and collaborative behavior" (Souder, 1977). Increasing internal consolidation will make organizations more agile and adaptable in implementing AI applications and understanding employees between different parts will reduce time in deploying AI applications or adapting to them (Appian, 2019), (7) **changeability**, AI applications introduce significant changes to organizations about new activities, tasks, and processes. The ability to plan and manage change in organizations is a means to realize the value of AI investments (Ransbotham et al. 2018), and (8) **risky opportunities**, risky opportunity taking and a proactive attitude, are commonly associated with innovation and higher markets (Hanelt et al., 2021). AI is one of the most exciting, value-added, and competitive parts of opportunity (Ransbotham et al., 2018). Fountaine et al. (Fountaine et al., 2019) argue that organizations should be strategically oriented, not risk-averse, agile, and adaptable.

The literature on the capabilities of AI states that for human tasks that perform repetitive processes, it does not require creativity, are not complex, it can be replaced with automated machines. Humans can be diverted to tasks that require creativity and their innovation capacity (Ågerfalk, 2020). AI technology drives human abilities, by improving cognitive, skills and interacting with others will improve the ability to carry out more complex tasks to achieve organizational goals (Wilson & Daugherty, 2018).

1.4 State Hypotheses and Their Correspondence to Research Design

Recent literature in the capability's domain of IT-enabled organizations states that the use of different IT can lead to certain generational capabilities (Liu et al., 2020). Basically, the use of IT often has an indirect effect on key performance indicators, by enabling specific organizational capabilities. Following the same logic, researchers argue that AI capabilities can have an indirect effect on the performance of vocational education organizations, through their effect on the creativity of vocational education organizations. Some performance indicators depend on creative solutions that emerge in vocational education organizations.

Based on the above arguments, it can make the following hypothesis:
H1: AI capabilities will have a positive effect on CVEM.
H2: AI capabilities will have a positive effect on PVEM.
Y. Liu et al. (2020), suggest that AI capabilities can help generate knowledge within organizational boundaries, which can then be leveraged to improve performance. Thus, the hypothesis proposed is as follows:
H3: CVEM will have a positive effect on PVEM.

2. Method

This research is descriptive quantitative research of causality. The purpose of this descriptive research is to draw the facts, properties, and relationships systematically, factually, and accurately between the phenomena under study. Research of causality in addition to measuring the relationship between two or more variables, also shows the direction of the relationship between free variables and bound variables (making cause and effect problems).

2.1 Identify Subsections

Variable research is everything that is set by the researcher to be researched so that information is obtained which is then drawn conclusions. Thereare three exogenous variables, namely the main source, human resources and organizational climate, four endogenous variables, namely graduate competency orientation, learning implementation, assessment of expected learning outcomes, and continuous improvement.

2.2 Participant (Subject) Characteristics

The target population is two groups, namely practitioners and vocational teachers in DKI Jakarta. Practitioner respondents are practitioners in the industry with the formation of manager, supervisor/technician/operator, and other positions, which are 15 people. There were 32 respondents of Vocational High School teachers in DKI Jakarta who taught engineering.

2.3 Sampling Procedures

The sample is a portion of the population studied. The representation of the population by the sample in the study is an important condition for generalization. In connection with the use of Structural Equation Model (SEM), that if the sample size is too large, the model becomes very sensitive so that it is difficult to get a good goodness of fit, then with PLS SEM it is enough to use a small sample size. Research conducted by Chin and Newsted (1999) proved that using only 20 data they can use SEM correctly.

2.3.1 Sample Size, Power, and Precision

In this study, because the population was relatively small, the research used the total sampling method. With this method of taking, it is hoped that the results obtained tend to be closer to the actual value and are expected to minimize the occurrence of deviations from the population value.

2.3.2 Measures and Covariates

Model testing in this study used SEM analysis technique, which is a statistical technique that allows testing a series of relationships simultaneously.

Modeling research through SEM allows a researcher to answer research questions that are regressive or dimensional, identify the dimensions of a concept or construct, and measure the influence of the relationship of factors that can be identified as dimensions.

Model development uses SEM to confirm theoretical models with empirical data. A theoretical model is depicted in a path diagram to see the causality relationship being tested. The correlation between constructs is built into a path diagram such as Figure 1.

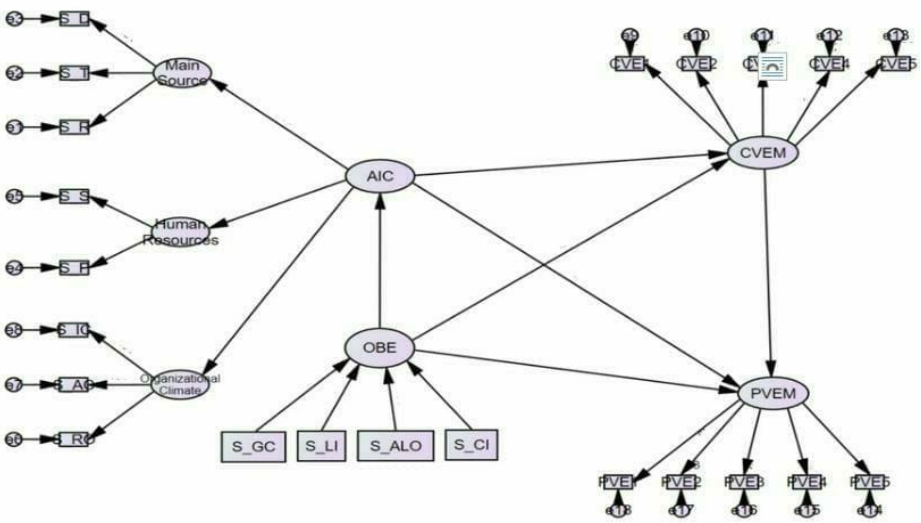

Figure 1: Path Structure Diagram

2.3.3 Research Design

In accordance with the purpose and benefits of This study, the design of this study uses a quantitative type that aims to analyze the causality relationship between one variable and another through hypothesis testing. Overall flow of the operational framework of the analysis carried out in the study, shown in Figure 2.

Through previous arguments about the role of AI in education, the role of technology makes educational organizations more creative and improves their performance. The development of a vocational education model in this research through a conceptual research model presented in Figure 2.

In fact, there are several documented cases in various industries where the AI applications used have resulted in an increase in organizational creativity (Amabile, 2020). AI can also automate many manual processes that require considerable time and human capital. If human resources are potentially involved in the creative process, then educational organizations can innovate using AI technology for organizational purposes, thus allowing managers to gain insights into understanding data and uncovering patterns and relationships (Raisch & Krakowski, 2021; Paschen et al., 2020). AI has a direct effect on different performance indicators, which can reduce costs, increase time to respond, cut production time and costs, and improve customer service to achieve an organization's vision and goals.

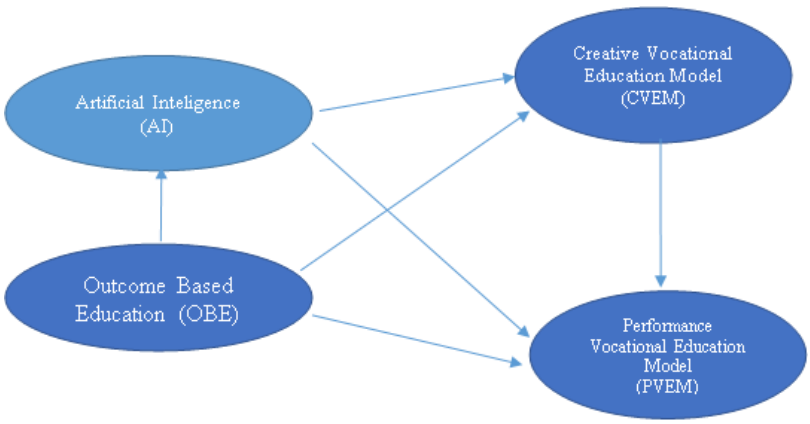

Figure 2: Model Preparation Research Paradigm

Preliminary studies have documented that a structured approach to applying AI can result in improved performance for organizations, even AI automation methods have the potential to result in improved performance for vocational education organizations. Indicators that affect the creativity and performance of vocational education organizations are by measuring the performance of vocational education.

2.3.4 Experimental Manipulations or Interventions

2.3.4.1 Measurement models

As part of the validity assessment, researchers introduced two performance models to capture the effects that AI capabilities have on the level of vocational education organizations. Therefore, researcher created two organizational models, namely the CVEM and the PVEM which are influenced by OBE (Figure 2). The creative vocational education model is seen based on the steps of OBE implementation, while the performance vocational education model is operationalized based on the results obtained in the implementation of OBE. Both of vocational education models were validated after being linked to the use of AI technology in the implementation of OBE-based education. Researchers examine reliability and validity at the construct level and examine inter-correlations between latent variables (Table 1).

2.3.4.2 Structural models

After establishing AI capabilities, researchers proceed to examine the validity of the construction of AI capabilities and their relationship to CVEM and PVEM. Researchers define the CVEM as a model that is able to generate new and constructive ideas in OBE-based vocational education. AI also has an impact on organizational activities, therefore, researchers consider the PVEM appropriate to be tested for the influence of AI capabilities, to test two hypothetical relationships, researchers use SEM analysis, in which variance is explained endogenous variable (R2). The researcher verified the structural model by examining the value of the coefficient of determination (R2) (Figure 3).

Researchers found significant positive effects of AI capabilities on the CVEM (R2=0.573), the PVEM (R2=0.50), and the significant influence of CVEM on the PVEM (R2=0.294). The vocational education model influenced by OBE accounts for variances related to creativity (R2 = 0.30), and variance to performance (R2 = 0.561). All values are greater than the thresholds of 0.15 and 0.35, so researchers can conclude that vocational education models have a medium to high effect size.

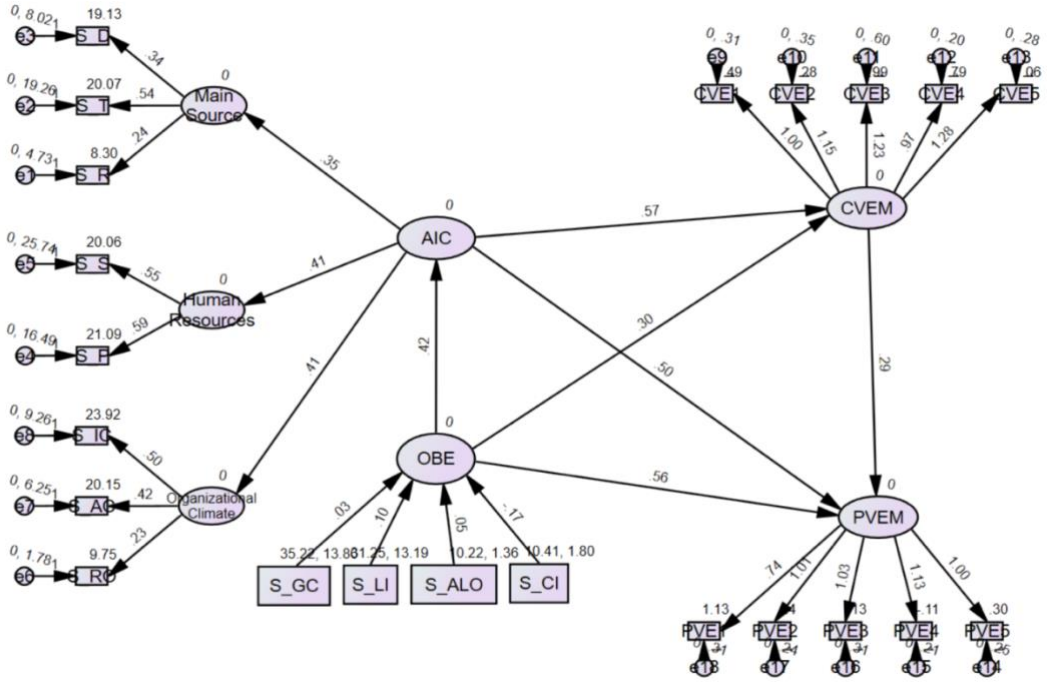

Figure 3: Structural model of SEM analysis

Table 1: Direct Effects

	OBE	AIC	S_CVEM	S_PVEM
OBE	0	0	0	0
AC	0,421	0	0	0
S_CVEM	-0,133	0,573	0	0
S_PVEM	0,561	-1,158	0,294	0

3. Results

These results show that the interpretation disruptor i.e., OBE was not a problem in this study. Some recent studies including the research of Wu et al. (2015) and Gupta and George (2016) have used this method to validate formative constructs in their studies.

The two models described earlier, namely CVEM and PVEM are used as the base model. Therefore, the researchers proceeded to examine two things, namely (1) comparing the correlations of the three measures of the AI capability construct and the five measures of organizational creativity on the CVEM, and (2) comparing the correlations of the three AI measures with the five measures of organizational performance on the PVEM. In contrast to the correlation between measures of AI capabilities, (i.e.: primary sources, human resources, and organizational climate) and measures of CVEM and PVEM across the base model, researchers found scores close to zero as depicted in Table 2 and Table 3. Thus, the problem of weakened external consistency can be overlooked in the study.

3.1 Statistics and Data Analysis

The results of the vocational education models provide strong evidence, a positive relationship between OBE-based AI capabilities and the creativity and performance of vocational education models, as well as a very significant positive influence of the CVEM on the PVEM.

There are two AI capability paths that researchers propose, namely CVEM and PVEM, the model is as depicted in Figure 4 and Figure 5. Thus, the creativity model of the CVEM and the PVEM as dependent variables.

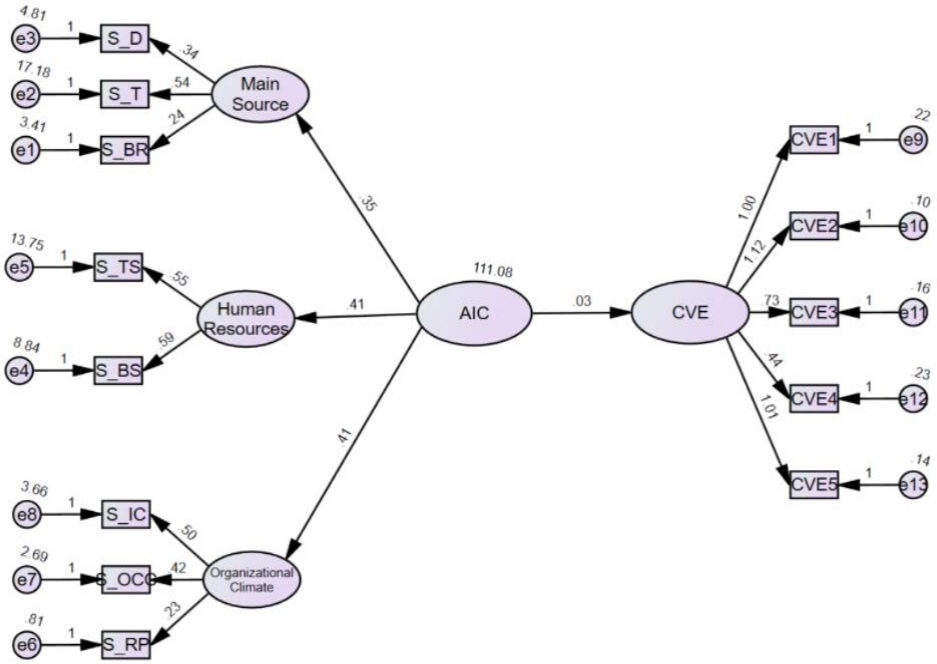

Figure 4: Creative Vocational Education Model Structure

Table 2: Factor Score Weights

	CVE5	CVE4	CVE3	CVE2	CVE1	S_IC	S_OCC	S_RP	S_TS	S_BS	S_D	S_T	S_BR
Ar_Int	2,67	0,702	1,602	3,938	1,634	0,643	0,728	1,316	0,186	0,313	0,284	0,124	0,273
CVE	0,084	0,022	0,05	0,123	0,051	0,02	0,023	0,041	0,006	0,01	0,009	0,004	0,009
Org_Climate	1,087	0,286	0,652	1,603	0,665	0,262	0,296	0,536	0,076	0,127	0,115	0,05	0,111
Human__Resources	1,095	0,288	0,657	1,615	0,67	0,264	0,298	0,54	0,076	0,128	0,116	0,051	0,112
MainSource	0,924	0,243	0,554	1,363	0,565	0,222	0,252	0,455	0,064	0,108	0,098	0,043	0,094

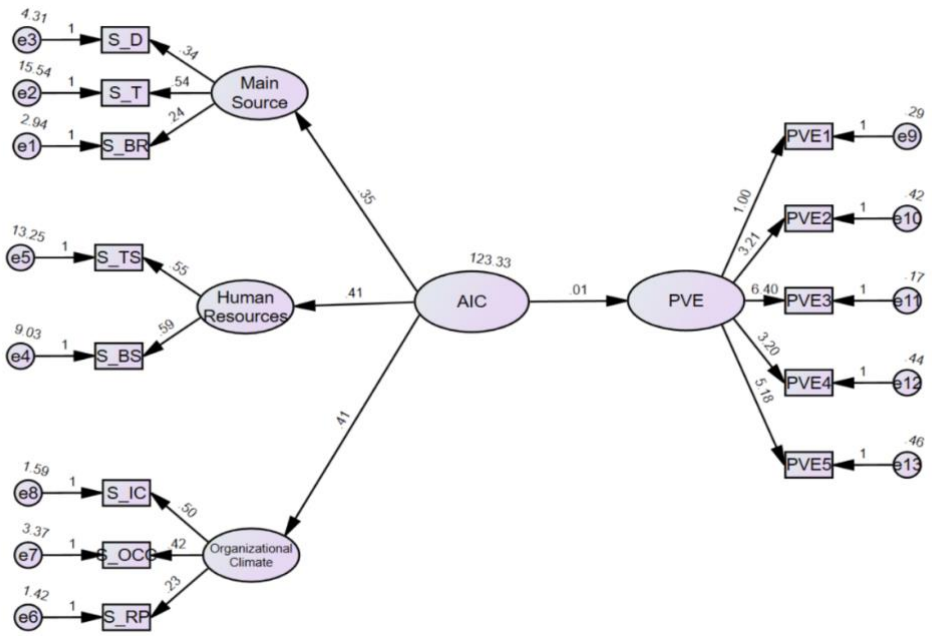

Figure 5: Performance Vocational Education Model Structure

Table 3: Factor Score Weights

	PVE5	PVE4	PVE3	PVE2	PVE1	S_IC	S_OCC	S_RP	S_TS	S_BS	S_D	S_T	S_BR
Ar_Int	0,976	0,626	3,179	0,669	0,303	1,484	0,583	0,757	0,194	0,307	0,318	0,137	0,318
PVE	0,007	0,005	0,024	0,005	0,002	0,011	0,004	0,006	0,001	0,002	0,002	0,001	0,002
Org_Climate	0,397	0,255	1,294	0,272	0,123	0,604	0,237	0,308	0,079	0,125	0,129	0,056	0,129
Human_Resources	0,4	0,257	1,303	0,274	0,124	0,608	0,239	0,31	0,08	0,126	0,13	0,056	0,13
MainSource	0,338	0,217	1,1	0,232	0,105	0,513	0,202	0,262	0,067	0,106	0,11	0,047	0,11

4. Discussion

This research was motivated by a surge in interest in the AI phenomenon by practitioners (industry) and academics (educators). Literature from practitioners has been widely published, but in an educational environment there has not been much research focused on AI. As a result, there has been a lot of discussion about AI, without clearly defining what AI means in the context of Information Systems (IS), and there is no illustrated impact of AI on the educational environment. This research takes insights into the use of AI in educational organizations, especially vocational education that implements OBE-based learning. Researcher develops and validates the conceptualization of AI capabilities in vocational education organizations that apply AI and OBE as modeling indicators of vocational education organizations. Finally, this study developed an instrument to measure AI capabilities in vocational education organizations that implement OBE, which empirically once validated, shows that by developing AI capabilities, OBE-based vocational education organizational models can realize excellence in organizational model creative and performance.

At the end of this discussion, the researcher provides suggestions for follow-up of the shortcomings of this research for future research, as follows: First, that vocational education industries and organizations may need resources to be able to invest in AI-enabled tool infrastructure, but vocational education industries and organizations do not use the same AI tools, so there may be other dimensions that need to be added to future research. Second, when researchers identify and explain AI's capabilities about the primary source of human power, and organizational

climate, the researcher does not include elements of the initial process of how AI is initiated by the organization and how the result will be. It is quite possible that organizations differ in policies in deciding to apply AI and experience in the process of facing challenges and obstacles. Influencing the choice of applying AI to achieve organizational goals and internal events in the organization needs to be further researched. Third, the researcher's research used practitioner respondents who worked in industries in the capital of Indonesia. It is possible that vocational education organizations from different regions, some are slow to adopt AI technology in the industry and vocational education organizations, and there are also vocational education organizations that are not OBE-based, will certainly do it in different ways. Surveying industries and vocational education organizations in different regions and at the stage of implementing AI and OBE can uncover new patterns that are effective in utilizing AI for the purposes of vocational education organizations in producing graduates needed by the world of work in the industrial era 4.0.

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References

Ågerfalk, P. J. (2020, Feb 17). Artificial intelligence as digital agency. *European Journal of Information Systems, 29*(1), 1-8. doi:https://doi.org/10.1080/0960085X.2020.1721947

Amabile, T. M. (2020, Oct 29). Creativity, Artificial Intelligence, and a World of Surprises. *Academy of Management Discoveries, 6*(3), -. doi:https://doi.org/10.5465/amd.2019.0075

Appian. (2019). *Why Humans, AI Systems, and Robots Need to Get Along at Work – And Why it's So Hard to Do Automate More. Code Less. SURVEY CONDUCTED BY IDG. https://www.appian.com/wp-content/uploads/2019/03/idg-future-of-work.* U.K., France, Germany, and Spain: SURVEY CONDUCTED BY IDG. Retrieved from https://www.appian.com/wp-content/uploads/2019/03/idg-future-of-work

Bharadwaj, A. S. (2000, Mar). A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation. *MIS Quarterly, 24*(1), 169-196 (28 pages). doi:https://doi.org/10.2307/3250983

Chin, W. W. (1999). Structural equation modeling analysis with small samples using partial least squares. In W. W. Chin, *Statistical strategies for small sample research* (pp. 307-341). Thousand Oaks: CA: Sage Publications. Retrieved from https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=448254

Chui, Michael & Malhotra, Sankalp. (2018). *AI adoption advances, but foundational barriers remain.* McKinsey Global Institute. San Francisco: McKinsey & Company. Retrieved from Mckinsey and Company. https://www.mckinsey.com/featured-insights/artificial-intelligence/ai-adoption-advances-but-foundational-barriers-remain

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., . . . authors, m. (2019). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 1-47. doi:. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Erik Brynjolfsson, D. R. (2017, November). ARTIFICIAL INTELLIGENCE AND THE MODERN PRODUCTIVITY PARADOX: A CLASH OF EXPECTATIONS AND STATISTICS. *NBER WORKING PAPER SERIES 24001*. Retrieved from http://www.nber.org/papers/w24001

Fountaine, T., McCarthy, B., & Saleh, T. (2019, July-August). AI And Machine Learning: Building the AI-Powered Organization.Technology isn't the biggest challenge. Culture is. pp. 62-73. Retrieved from https://hbr.org/2019/07/building-the-ai-powered-organization

Gagné, R. M. (1985 (4th Revised ed.)). *Conditions of Learning and Theory of Instruction.* Wadsworth Publishing Co. Inc.

Goralski, M. A., & KeongTan, T. (2020, March). Artificial intelligence and sustainable development. *The International Journal of Management Education, 18*(1). doi:https://doi.org/10.1016/j.ijme.2019.100330

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review, 33*(3), 114–135. doi:https://doi.org/10.2307/41166664

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information & Management, 53*(8), 1049-1064. doi:https://doi.org/10.1016/j.im.2016.07.004

Hanelt, A., Firk, S., Hildebrandt, B., & Kolbe, L. M. (2021). Digital M&A, digital innovation, and firm performance: an empirical investigation. *European Journal of Information Systems, 30*(1), 3-26. doi:https://doi.org/10.1080/0960085X.2020.1747365

Kalita, A. A. (2019, March). Intelligent Tutoring Systems: A Comprehensive Historical Survey with Recent Developments. *International Journal of Computer Applications, 181(43)*, 1-20. doi:10.5120/ijca2019918451

Liu, Y., Lee, Y., & Andrew, N. (2020, June). How IT wisdom affects firm performance: An empirical investigation of 15-year US panel data. *Decision Support Systems, 133*, 113300. doi:https://doi.org/10.1016/j.dss.2020.113300

Macayan, J. (2017, July). Implementing Outcome-Based Education (OBE) Framework: Implications for Assessment of Students' Performance. *Educational Measurement and Evaluation Review, 8*(1), 1-10. Retrieved from https://8f776a7a-7f68-4ea2-b4aa-8023d1ecc665.filesusr.com/ugd/0adbde_a17a1676385b4bd0a0db3711c556f2e4.pdf

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011, June). Construct Measurement and Validation Procedures in MIS and Behavioral Research: Integrating New and Existing Techniques. *MIS Quarterly Vol. 35, No. 2 (June 2011), pp. 293-334. Management Inf, 35*(2), 293-334. doi:https://doi.org/10.2307/23044045

Markowitsch, J., & Hefler, G. (2019). *Future developments in Vocational Education and Training in Europe.* Seville: European Commission. Retrieved from https://ec.europa.eu/jrc/sites/jrcsh/files/jrc117691.pdf

Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018, August). Big data analytics capabilities: a systematic literature review and research agenda. *Information Systems and e-Business Management, 16*(3), 547-578. doi:10.1007/s10257-017-0362-y

Nasution, H. (2012). Implementasi Logika Fuzzy pada Sistem Kecerdasan Buatan. *Jurnal Elkha, 2*. doi:http://dx.doi.org/10.26418/elkha.v4i2.512

News, E. (2020). *AI, Industry 4.0 and disrupting vocational education.* Retrieved from https://www.educationmattersmag.com.au/ai-industry-4-0-and-disrupting-vocational-education/

Paschen, J., Wilson, M., & Ferreira, J. J. (2020). Collaborative Intelligence: How Human and Artificial Intelligence Create Value along the B2B Sales Funnel. *Business Horizons, 63*(3), pp. 403-414. Retrieved from https://ssrn.com/abstract=3697589

Pastore, F. (2018, OCTOBER). New Education Models for the Workforce of the Future. *IZA Policy Paper No. 143*. Retrieved from https://docs.iza.org/pp143.pdf

Prihantoro, C. R. (2020, March). Vocational High School Readiness for Applying Curriculum Outcome Based Education (OBE) in Industrial 4.0 Era. (H. U. Mirici, Ed.) *International Journal of Curriculum and Instruction, 12(1), 251–267., 12*(1), 251-267. Retrieved from http://ijci.wcci-international.org/index.php/IJCI/article/view/323

Raisch, S., & Krakowski, S. (2021, Jan 14). Artificial Intelligence and Management: The Automation–Augmentation Paradox. *Academy of Management Review, 46*(1). doi:https://doi.org/10.5465/amr.2018.0072

Ransbotham, S., Gerbert, P., Reeves, M., Kiron, D., & Spira, M. (September 2018). *Artificial Intelligence in Business Gets Real.* MIT Sloan Management Review and The Boston Consulting Group. Retrieved from https://sloanreview.mit.edu/projects/artificial-intelligence-in-business-gets-real/

ROHMAN, A. S. (2018, Oktober 11). Outcomes Based Curriculum dan IABEE. *Workshop Musyawarah Nasional FORTE*. Batu-Malang, East Java, Indonesia: STEI ITB. Retrieved from https://elektro.ub.ac.id/fortei/wp-content/uploads/2018/10/Workshop-OBE-IABEE-FORTEI-20181.pdf

Schryen, G. (2013). Revisiting IS business value research: what we already know, what we still need to know, and how we can get there. *European Journal of Information System, 22*(2), 139-169. doi:https://doi.org/10.1057/ejis.2012.45

Shank, D. B., & Gott, A. (2019, August). People's self-reported encounters of Perceiving Mind in Artificial Intelligence. *Data in Brief, 25*. doi:https://doi.org/10.1016/j.dib.2019.104220

Souder, W. E. (1977). *An exploratory study of the coordinating mechanisms between R & D and marketing as an influence on the innovation process Unknown Binding.* Pittsburgh: School of Engineering, University of Pittsburgh.

Sousa, W. G., Melo, E. R., De, P. H., Bermejo, S., Farias, R. A., & Gomes, A. O. (2019, October). How and where is artificial intelligence in the public sector going? A literature review and research agenda. *Government Information Quarterly, 36*(4). doi:https://doi.org/10.1016/j.giq.2019.07.004

Wayne Holmes, M. B. (2019). *Artificial Intelligence In Education Promises and Implications for Teaching and Learning.* Boston, Massachusett, 02130, United States of America: The Center for Curriculum Redesign, .

Wilson, H. J., & Daugherty, P. (2018, July 1). Collaborative intelligence: humans and AI are joining forces. *Harvard Business School Publishing, 96*(4), pp. 114-123.

Woolf, B. P. (2008). *Building Intelligent Interactive Tutors: Student-centered strategies for revolutionizing e-learning.* San Francisco, CA, United States: Morgan Kaufmann Publishers Inc.

Wu, S. P.-J., Straub, D. W., & Liang, T.-P. (2015, June). How Information Technology Governance Mechanisms and Strategic Alignment Influence Organizational Performance. *MIS Quarterly, 39*(2). Retrieved from https://www.jstor.org/stable/26628363

Yogaswara, R. D. (2019, September). Artificial Inteligence Sebagai Penggerak Industri 4.0 dan Tantangannya Bagi Sektor Pemerintah dan Swasta. Masyarakat Telematika Dan Informasi. *Masyarakat Telematika Dan Informasi Jurnal Penelitian Teknologi Informasi dan Komunikasi, 10*(1), 68-73. doi:10.17933/mti.v10i1.144