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Eka Daryanto 
Universitas Negeri Medan, Indonesia

Batumahadi Siregar 
Universitas Negeri Medan, Indonesia

Sapitri Januariyansah 
Universitas Negeri Medan, Indonesia

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A Meta-Analysis of the E-Learning Influence on Vocational Education and Training (VET): Preliminary Study of Virtual to Actualization

Eka Daryanto, Batumahadi Siregar, Sapitri Januariyansah

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Abstract

This study aims to analyze the effect of e-learning on VET learning, the factors that support the success of e-learning, and the role of e-learning in practical learning performance. This type of research was a quantitative study with a meta-analysis approach. A total of 18 articles on e-learning in VET learning were selected as samples. The 18 articles were taken from the journal of Sinta accredited (the national index in Indonesia). The data is analyzed by determining the effect size value. The main finding of this study indicates that e-learning has a significant influence on VET learning. This result is obtained by measuring the average effect size value of 18 articles which is $0.344 > 0.25$, categorized as a significant effect category. Another interesting finding is that the effect of e-learning in VET learning is only on the learning outcomes of particular theoretical and performance learning, increased motivation, and increased interest. For performance learning, not all can be accommodated by e-learning, only practical learning using computer and internet media such as digital simulation learning and WEB programming. Whereas in conventional performance/practical learning, e-learning cannot be used as the primary form of learning. The limitation of this study is the low number of studies on the use of e-learning in VET learning. As a result, this study provides a less broad representation. A meta-analysis on the effect of e-learning on VET learning is undoubtedly an exciting study. The reason is that almost all forms of VET learning are performance learning (practical learning). Therefore, e-learning in VET practical learning is a new study that can be developed.

Introduction

The use of e-learning has become a hot topic in Indonesia recently. At the University of Indonesia, e-learning became the priority of choice because of the COVID-19 pandemic, which is required social distancing (Shehzadi et al., 2020). E-learning has become an alternative solution to make education run well. Furthermore, e-learning has become a hot topic to be discussed. Most of the research on e-learning discusses its activity as learning media (Acharya, 2019). E-learning is assumed as media that can improve students' skills and even

learning performance, and its uses are supported by the social environment (Aqilah et al., 2018; Mehta et al., 2019). The use of e-learning that can improve and enhance learning effectiveness has been done by universities globally (Salloum et al., 2019). The empowerment of e-learning usage is caused by the usefulness, easiness, and kindness of e-learning (Al- Emran & Teo, 2020). That is why e-learning in education has become an everyday thing, especially in Vocational Education and Training (VET).

VET is one of the education types supposed to prepare labor candidates. Vocational education can give better results in the job market (Marks, 2017). Vocational education is considered to produce good results in the job market. This assumption is not unfounded but a form of VET that provides graduates with practical skills according to the job market's needs (Hanushek, 2017). VET learning is mostly performance/practical learning (Rahdiyanta, 2019). Performance learning requires real media for learning, e.g., the Mechanical Engineering Diploma III program requires a lathe, a milling machine, and a welding machine to acquire mechanical engineering skills. Therefore, VET learning has different characteristics from other learning.

Based on the previous study above, there is a gap between e-learning and VET learning characteristics. The gap occurs mainly in practice or performance using direct media, which can be done through e-learning. E-learning is virtual online learning using a computer or smartphone as the media, and it shows that e-learning and practical learning are very different. Hence, it is vital to see the effectiveness of e-learning in VET learning which has not been studied until now.

This paper presents at least three contributions to e-learning in VET learning. Firstly, this study will analyze the effect of e-learning in VET learning on various learning types: theory, practice, and internship. Secondly, a researcher will highlight types of VET learning suitable for using complete e-learning to provide recommendations for the development of e-learning in VET learning. Third, this paper will examine the effectiveness of e-learning in practical learning based on previous studies.

Literature Review

E-learning

E-learning is an internet technology-based service to convey educational information in online and distance learning (Akugizibwe & Ahn, 2020). E-learning is a form of online learning. Among other terms, e-learning can be Internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer-assisted learning, web-based learning, and distance teaching (Dağ & Geçer, 2009). Concisely, e-learning is online learning that utilizes the internet and computers.

E-learning is also defined as electronic media and ICT in learning both synchronously and asynchronously, called virtual online learning (El Mhouti et al., 2018). This statement shows that the characteristics of e-learning are virtual online learning that can be done in different places between educators and students. E-learning-based learning can also be done at the same time and also at different times. Educators and students meet in an online conference simultaneously but in different places. Different times mean that educators and students learn at

different times and places. For example, educators make videos and then upload them to the e-learning platform then students access them at any time.

Another characteristic, e-learning provides chat content, group discussions, and material sharing in files, videos, presentation slides, and online evaluations and assessments that are easily accessible, cheap, flexible, and convenient at times and places (Aqilah et al., 2018). E-learning provides many features that make learning more accessible, especially distance learning. On the other hand, e-learning also provides various learning media so that students are more enthusiastic about learning. Another thing e-learning does not only provides convenience in the learning process but also provides convenience in learning management. The reason is that e-learning provides a service of a learning management system (LMS) or learning content management system (LCMS) (Ghavifekr, 2015). So that educators can control the learning process. However, based on this study, e-learning can only carry out learning using electronic media such as simulation programs, files in PPT, Word, PDF, and tutorial videos. However, it cannot accommodate conventional learning that uses media (practical learning) as a machine tool.

Vocational Education and Training (VET)

VET is defined as a collection of learning experiences in the form of skills appropriate to the job market obtained from educational institutions or workplaces. In its implementation, students must update and adapt the work skills they acquire with the work skills they will do in the actual work environment (Catts et al., 2011). Therefore, VET has a characteristic of education that prepares a workforce ready to work because VET equips its graduates more with technical skills (Sulaiman & Ambotang, 2017), so VET graduates are easier to find jobs (Guo & Wang, 2020). In Indonesia, formal VET is implemented at two levels, namely the secondary school level, and the higher education level. Vocational high schools hold the secondary school level with specialized programs such as mechanical engineering, automotive engineering, civil engineering, and electrical engineering. Meanwhile, VET is organized by universities, polytechnics, Diploma programs, and others (Suharno, 2020). VET learning is carried out in schools and workplaces where through this environment; students acquire various types of knowledge, attitudes, and skills (Schaap et al., 2012). Combining various types of knowledge, attitudes, and skills will form job competencies. VET provides a significant advantage in the labor market, especially VET, organized with industry internships (Choi et al., 2019). VET learning in the workplace provides students with hands-on experience with jobs. However, classroom learning needs to be linked to the type of work that VET graduates will do in the workplace by putting knowledge into practice (Morselli, 2018). Through practical activities, students will be able to gain experiences that are relatively the same as what they would do while working. The integration of competencies needed in the world of work needs to be simulated in schools. VET learning also needs to link theoretical concepts to practical situations in the workplace through real-world practice and similar tools in the workplace. As an amplifier, VET activity must represent all aspects of VET practice (Boersma et al., 2016).

Based on the studies above, several research questions can be formulated: (1) how is the influence of e-learning on VET learning? (2) What is the position of e-learning in conventional VET practical learning? (3) what types

of VET learning are effective for using e-learning? and (4) what are the factors for the success of implementing e-learning in VET learning?

Method

This research is a quantitative study where the research data will be spelled out in numbers. The research approach uses a meta-analysis approach to analyze and evaluate the effect of e-learning on VET learning. The meta-analysis selection is based on a comprehensive evaluation study using statistics from quantitative data.

Data collection was carried out by collecting local articles in the coverage of the Indonesian territory of Sinta accredited. This selection was focused on examining the use of e-learning in VET learning in the local context. The articles selected are articles published in the last six years. Finally, the articles selected had a statistical value of r^2 (determination) and t (difference test) as a measure of influence.

Based on the data collection results, 18 articles about the effect of e-learning on VET learning were obtained. From the search results, coding was carried out to sample information related to the researcher's name, the year of the article, the subject, the independent and dependent variable; Statistical data regarding the values of r^2 , t value, n_1 , and n_2 . The data analysis technique is intended to find the effect size value (to measure the strength and direction of the relationship) from each selected article.

Results and Discussion

Research data constitutes secondary data in articles about the effect of using e-learning in vocational learning/VET. The use of e-learning includes a variety of VET subjects in the form of theory and practice. Based on Table 1, it can be explained that the article year was from 2014 to 2020 (the last six years). The effect of e-learning on learning outcomes was 14 articles (77.8%), student motivation was three articles (16.7%), and learning activities and skills were 1 article (5.5%). The form of theoretical learning was 11 articles (61.1%), while practical learning was seven articles (38.9%). The research location of vocational high schools is 11 articles (61.1%), while colleges are seven articles (38.9%). The index of Sinta's articles was 14 articles (77.8%), and Garuda/Scholar was four articles (22.2%). Then the amount of the effect size value calculation can be seen in Table 1.

Based on Table 1, the average effect size value is 0.344 greater than 0.25, which means that e-learning has a large effect on VET learning. The finding obtained is the distribution of the varying magnitude effects of each article. In detail, three articles had a low effect size (16.7%), four articles had a medium effect size (22.2%) and 11 articles had a large effect size (61.1%).

The results show that e-learning has a great influence on VET learning. E-learning has a good influence on VET learning in theory and practice. However, for practice type, e-learning can only be used in practical learning that utilizes computer learning media such as digital simulations and web development. This case shows that e-learning cannot be used in all types of practical learning.

Table 1. The Result of the Effect Size Value Calculation

Researcher's Name/Year	n	n1	n2	r ²	t value	η^2	Description
Wirda et al., 2014	50	25	25	-	1.886	0.069	Small Effect
Machril & Darwin; 2015	66	33	33	-	2.263	0.074	Small Effect
Irwanto; 2020	64	32	32	-	2.16	0.070	Small Effect
Budiana et al., 2019	70	35	35	-	3.001	0.117	Medium Effect
Taslim et al., 2017	55	-	-	0.221	-	0.221	Medium Effect
Ayuningtyas et al., 2017	50	25	25	-	3.747	0.226	Medium Effect
Warso et al., 2019	58	29	29	-	3.285	0.161	Medium Effect
Joshua et al., 2016	40	-	-	0.533	-	0.533	Large Effect
Astiti et al., 2019	55	27	28	-	4.519	0.278	Large Effect
Sulisworo & Agustin; 2017	-	30	36	0.999	-	0.999	Large Effect
Aurora & Effendi; 2019	69	-	-	0.391	-	0.391	Large Effect
Hanum et al., 2015	72	-	-	0.549	-	0.549	Large Effect
Nasrullo; 2015	38	-	-	0.449	-	0.449	Large Effect
Sulistyawati et al., 2019	70	36	34	-	7.191	0.432	Large Effect
Kusumantara et al; 2017	72	36	36	-	5.225	0.280	Large Effect
Hoerunnisa et al., 2019	63	31	33	-	6.075	0.332	Large Effect
Islamiyah & Widayanti; 2016	27	14	13	-	3.516	0.331	Large Effect
Widiyanto; 2014	40	30	10	-	8.88	0.674	Large Effect
Mean value of η^2						0.344	Large Effect

The main findings in the study of this article indicate that e-learning has a significant influence on VET learning. The influence of e-learning occurs in both theoretical and practical learning. Especially in practical learning, e-learning only affects practical learning using computer media. However, e-learning is considered unable to accommodate conventional practical learning using machine tools. Thus, e-learning in conventional learning is only enrichment (Tabakova, 2020). E-learning tends to be used to accommodate distance learning. However, e-learning can be presented in the classroom. The form of e-learning implementation can be web-based and computer-based learning, learning that takes advantage of virtual classrooms or mixed learning that combines virtual/digital learning with face-to-face learning (Klašnja-Milićević et al., 2017). This study shows that e-learning can only accommodate learning using digital media such as computers and the internet.

The use of e-learning in the context of VET certainly needs to consider many aspects, especially aspects of the VET characteristics themselves. There are two types of education, namely vocational education/VET and general education. These two types of education have different characteristics where vocational education equips graduates with technical skills that need the job market, while general education equips graduates with flexible academic skills (Torun & Tumen, 2019). However, technical skill from vocational education is usually only applicable to industries requiring appropriate skills and cannot be used by other institutions requiring different skills (Chong, 2014) because the vocational education system teaches specific skills. For example, an automotive vocational education program would acquire skills related to a mechanic's job, and these skills will

not be used in other programs such as marketing (Muja et al., 2019).

The following finding shows that an increase in facilities and development of management ability of e-learning is needed to get the maximum usage of e-learning (Eze et al., 2018). The effectiveness of using e-learning requires 21st-century skills by students, and technology skills in 21st-century skills to be a key factor. To get satisfactory results in e-learning, several countries in Asia have prepared supporting aspects of e-learning. Singapore has a focus on developing a community of teachers in the use of e-learning, Hong Kong has a focus on establishing student-centered learning through the development of wireless network-aided digital classrooms, Taiwan has a focus on shaping the 21st-century skills of students through daily learning activities, and Beijing has a focus on providing e-books and digital resources that refer to an agreed curriculum (Kong et al., 2014).

Besides that, other factors that influence e-learning are the technology that is easy to use; the position of learners should be focused on pedagogic; and there is collaboration and communication between students and teachers (Regmi & Jones, 2020). Learning content is another crucial factor in the successful use of e-learning. In addition, the success of the e-learning system is greatly influenced by user satisfaction (C. R. Choi & Jeong, 2019). In Thailand, e-learning is used by young people who can use smartphone technology and are accustomed to using social media (Ngampornchai & Adams, 2016). However, age is not a factor that affects the desire to use e-learning (Fleming et al., 2017). On the other hand, the factors that affect the readiness of students to use e-learning are compatibility and complexity, adequacy of computer facilities, and good management (Mirabolghasemi et al., 2019). Another opinion is that a learning environment fits needs, creativity in the form of a platform, a collaborative, safe, and comfortable environment, and good organization is an established form of learning in good e-learning preparation (San-Martín et al., 2020).

VET has the characteristics of work-based learning, which can be done through the apprenticeship system or the school system with additional on-the-job training (Rintala & Nokelainen, 2020). A solid and appropriate vocational education system is a dual system (Deutscher & Winther, 2017). VET becomes one of the primary education caused by VET being considered to be able to develop the economy and professionals through increasing the qualifications of the workforce by developing knowledge, attitudes, skills, creativity, communication skills, and the ability to use technology (Mouzakitis, 2010). Vocational learning, which is mostly performance learning, has its advantages. People who receive vocational education will acquire technical abilities that will continue to develop over the length of the learning time taken. Therefore, students who have pre-tertiary vocational qualifications if dropping out of school will still be able to work using these qualifications (Scholten & Tieben, 2017).

Vocational education has the nature of competency-based learning caused by vocational education/VET, which has a focus on developing professional graduates, who have good competence, can adapt to contemporary society, and can adapt to changing work practices in the industry through a comprehensive approach that combines knowledge, attitudes, and skills (Sturing et al., 2011). In Indonesia, competency-based education in VET has long been used. All the principles of competency-based education are quoted in every education policy (Misbah et al., 2019).

This research implies that e-learning cannot be fully used in VET learning, especially in conventional practical learning. However, e-learning can be combined to support practical VET learning, which is expected to be effective due to the complementary combination. Another consideration of previous research shows the positive effect of e-learning in all VET learning. Based on the study above, VET learning can use a type of virtual/e-learning that provides many innovative learning features such as video tutorials which are estimated to be effective when combined with performance learning. This concept can be called virtual actualization, where students will be able to actualize their learning outcomes in virtual form into concrete projects.

This study has limitations on the number of study sources in VET learning. The studies on the application of e-learning in VET learning can provide a less broad picture of the effectiveness of using e-learning. However, researchers believe the results of this study can contribute to the use of e-learning in the context of vocational learning so that it can be considered in the study of future vocational learning. The study of virtual learning combined with practical learning by considering the existing generation's characteristics can be considered a future study. The presence of a new generation familiar with technology will require different requirements in VET learning.

Conclusion

E-learning in education has become central, including in Vocational Education and Training. E-learning has a significant influence on VET learning outcomes. The type of theoretical learning becomes the right target in using e-learning. E-learning can only accommodate learning using computer and internet media such as simulation learning for practical learning. Meanwhile, conventional practice learning such as welding, painting, and others that use conventional machine media has not been accommodated by e-learning. VET, which equips its graduates with technical skills, will organize many practical lessons.

Notes

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References

- Acharya, S. (2019). Beyond Learning Outcomes: Impact of Organizational Flexibility on Strategic Performance Measures of Commercial E-Learning Providers. *Global Journal of Flexible Systems Management*, 20(1), 31–41. <https://doi.org/10.1007/s40171-018-0199-3>
- Akugizibwe, E., & Ahn, J. Y. (2020). Perspectives for effective integration of e-learning tools in university mathematics instruction for developing countries. *Education and Information Technologies*, 25(2), 889–903. <https://doi.org/10.1007/s10639-019-09995-z>
- Al-Emran, M., & Teo, T. (2020). Do knowledge acquisition and knowledge sharing really affect e-learning adoption? An empirical study. *Education and Information Technologies*, 25(3), 1983–1998.

- <https://doi.org/10.1007/s10639-019-10062-w>
- Aqilah, A. N., Pg Abu Bakar, D. N. N., Lajim, N. D. A., Haji Kamarulzaman, N. H. S., Haji Karim, S. N. F., & Almunawar, M. N. (2018). E-learning services acceptance in higher educational institutes: A case study in Brunei. *Education and Information Technologies*, 23(6), 2341–2361. <https://doi.org/10.1007/s10639-018-9720-8>
- Astiti, W., Agustini, K., & Santyadiputra, G. S. (2019). The Effect of Project-Based Learning Oriented Moodle e-Learning on Student Achievement (Case Study: Class X Visual Communication Design in Sketch Subjects at SMK Negeri 1 Sukasada). *Collection of Informatics Engineering Education Student Articles (KARMAPATI)*, 8(2), 172–185. <https://doi.org/10.23887/karmapati.v8i2.18111>
- Aurora, A., & Effendi, H. (2019). The Influence of the Use of E-learning Learning Media on Student Learning Motivation at Padang State University. *Journal of Electrical and Vocational Engineering*, 5(2), 11–16. <http://ejournal.unp.ac.id/index.php/jtev/index>
- Ayuningtyas, V. U., Munoto, M., & Sumbawati, M. S. (2017). Development of E-Learning-Based Learning Media for Management Information System Courses for Madiun Regency State Community Academy Students. *Jupiter (Journal of Electrical Engineering Education)*, 2(1), 13–20. <https://doi.org/10.25273/jupiter.v2i1.1737>
- Boersma, A., Ten Dam, G., Wardekker, W., & Volman, M. (2016). Designing innovative learning environments to foster communities of learners for students in initial vocational education. *Learning Environments Research*, 19(1), 107–131. <https://doi.org/10.1007/s10984-015-9203-4>
- Budiana, K. A., Agustini, K., & Santyadiputra, G. S. (2019). The Effect of the Adeles2tp E-learning System with Blended Learning Model on Student Learning Outcomes (Case Study: Class X Accounting in Simulation and Digital Communication Subjects at SMK Negeri 1 Seririt). *Collection of Informatics Engineering Education Student Articles (KARMAPATI)*, 8(2), 437–445. <https://doi.org/10.23887/karmapati.v8i2.18705>
- Catts, R., Falk, I., & Wallace, R. (2011). Learning in Working Life: Identity and Workplace Learning. In *Vocational Learning* (14th ed.). Springer Dordrecht. https://doi.org/10.1007/978-94-007-1539-4_15
- Choi, C. R., & Jeong, H. Y. (2019). Quality evaluation for multimedia contents of e-learning systems using the ANP approach on high speed network. *Multimedia Tools and Applications*, 78, 28853–28875. <https://doi.org/10.1007/s11042-019-7351-8>
- Choi, S. J., Jeong, J. C., & Kim, S. N. (2019). Impact of vocational education and training on adult skills and employment: An applied multilevel analysis. *International Journal of Educational Development*, 66, 129–138. <https://doi.org/10.1016/j.ijedudev.2018.09.007>
- Chong, T. (2014). Vocational education in Singapore: meritocracy and hidden narratives. *Discourse: Studies in the Cultural Politics of Education*, 35(5), 637–648. <https://doi.org/10.1080/01596306.2014.927165>
- Dağ, F., & Geçer, A. (2009). Relations between online learning and learning styles. *Procedia-Social and Behavioral Sciences*, 1(1), 862–871. <https://doi.org/10.1016/j.sbspro.2009.01.155>
- Deutscher, V., & Winter, E. (2017). Instructional sensitivity in vocational education. *Learning and Instruction*, 1–13. <https://doi.org/10.1016/j.learninstruc.2017.07.004>
- Ampera, D., Iskandar, Y., Tabieh, A. A. S., & Soomro, Z. A. (2021). The Role of Visuals in Cultural Learning in the EFL Classroom. *Asian ESP Journal*, 17(3).

- El Mhouthi, A., Erradi, M., & Nasseh, A. (2018). Using cloud computing services in e-learning process: Benefits and challenges. *Education and Information Technologies*, 23(2), 893–909. <https://doi.org/10.1007/s10639-017-9642-x>
- Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilization of e-learning facilities in the educational delivery system of Nigeria: a study of M-University. *International Journal of Educational Technology in Higher Education*, 15(1). <https://doi.org/10.1186/s41239-018-0116-z>
- Fleming, J., Becker, K., & Newton, C. (2017). Factors for successful e-learning: does age matter? *Education and Training*, 59(1), 76–89. <https://doi.org/10.1108/ET-07-2015-0057>
- Ghavifekr, S. (2015). Factors affecting use of e-learning platform (SPeCTRUM) among University students in Malaysia. *Education and Information Technologies*, 22(1), 75–100. <https://doi.org/10.1007/s10639-015-9435-z>
- Guo, D., & Wang, A. (2020). Is vocational education a good alternative to low-performing students in China. *International Journal of Educational Development*, 75, 1–9. <https://doi.org/10.1016/j.ijedudev.2020.102187>
- Hanum, F., Slamet, L., & Sriwahyuni, T. (2015). The Contribution of Interest in Learning and E-Learning as Learning Media to the Learning Outcomes of Class X Students in the Department of Computer and Network Engineering at Smk Negeri 1 Air Putih, Batubara Regency, North Sumatra. *Vocational Journal of Electronics and Informatics Engineering*, 3(1), 75–88.
- Hanushek, E. A. (2017). General Education, Vocational Education, and Labor-Market Outcomes over the Lifecycle. *The Journal of Human Resources*, 52(1), 48–86. <https://doi.org/10.3368/jhr.52.1.0415-7074R>
- Hoerunnisa, A., Suryani, N., & Efendi, A. (2019). The Effectiveness of The Use of E-Learning in Multimedia Classes to Improve Vocational Students' Learning Achievement and Motivation. *Journal of Educational Technology*, 7(2), 123–137.
- Irwanto. (2020). Use of E-Learning Models For Lesson Activities on Microcontroller's Eyes to Improve Student Learning Outcomes in Vocational Education in Electrical Engineering Sultan Ageng Tirtayasa University. *VANOS Journal of Mechanical Engineering Education*, 5(1), 81–90.
- Islamiyah, M., & Widayanti, L. (2016). The Effectiveness of Website-Based E-Learning on Learning Outcomes of STMIK Asia Malang Students in Basic Physics Courses. *Asian Journal of Information Technology and Information Technology*, 10(1), 41–46. <https://doi.org/ISSN:0852-730X>
- Joshua, J. N., Swastika, I. P. A., & Estiyanti, N. M. (2016). The Effectiveness of E-Learning Implementation Using Social Learning Network Schoology on Motivation & Learning Achievement. *National Journal of Informatics Engineering Education (JANAPATI)*, 5(1), 28–33. <https://doi.org/10.23887/janapati.v5i1.9914>
- Klašnja-Miličević, A., Vesin, B., Ivanović, M., Budimac, Z., & Jain, L. C. (2017). *E-learning system: intelligent techniques for personalization (1st ed.)*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-41163-7>
- Kong, S. C., Chan, T.-W., Huang, R., & Cheah, H. M. (2014). A review of e-Learning policy in school education in Singapore, Hong Kong, Taiwan, and Beijing: implications for future policy planning. *Journal of Computers in Education*, 1(2–3), 187–212. <https://doi.org/10.1007/s40692-014-0011-0>
- Kusumantara, K. S., Santyadiputra, G. S., & Sugihartini, N. (2017). Effect of e-Learning Schoology on Digital

- Simulation Learning Outcomes with Savi Komang Learning Model. *Journal of Technology and Vocational Education*, 14(2), 126–135. Marks, G. N. (2017). University and vocational education, and youth labor market outcomes in Australia. *Journal of Education and Work*, 30(8), 868–880. <https://doi.org/10.1080/1639080.2017.1366648>
- Machril, S. Y., & Darwin. (2015). The Effect of EXE Learning Media (Elearning Xhtml Editor) on Learning Outcomes of Building Construction Competence in Building Drawing Engineering Skills for Class X Students of SMK Negeri 5 Medan. *Journal of Educational Building*, 1(1), 96–104. <https://doi.org/10.24114/eb.v1i2.2825>
- Mehta, A., Morris, N. P., Swinnerton, B., & Homer, M. (2019). The Influence of Values on E-learning Adoption. *Computers and Education*, 141, 1–16. <https://doi.org/10.1016/j.compedu.2019.103617>
- Mirabolghasemi, M., Choshaly, S. H., & Iahad, N. A. (2019). Using the HOT-fit model to predict the determinants of E-learning readiness in higher education: a developing Country's perspective. *Education and Information Technologies*, 24(6), 3555–3576. <https://doi.org/10.1007/s10639-019-09945-9>
- Misbah, Z., Gulikers, J., Dharma, S., & Mulder, M. (2019). Evaluating competence-based vocational education in Indonesia. *Journal of Vocational Education and Training*, 1–29. <https://doi.org/10.1080/1636820.2019.1635634>
- Morselli, D. (2018). How do Italian vocational teachers educate for a sense of initiative and entrepreneurship? Development and initial application of the SIE questionnaire. *Education and Training*, 60(7–8), 800–818. <https://doi.org/10.1108/ET-03-2017-0046>
- Mouzakitis, G. S. (2010). The role of vocational education and training curricula in economic development. *Procedia-Social and Behavioral Sciences*, 2(2), 3914–3920. <https://doi.org/10.1016/j.sbspro.2010.03.616>
- Muja, A., Blommaert, L., Gesthuizen, M., & Wolbers, M. H. J. (2019). The vocational impact of educational programs on youth labor market integration. *Research in Social Stratification and Mobility*, 64, 1–18. <https://doi.org/10.1016/j.rssm.2019.100437>
- Mujahidin, E., Bahrudin, E., & Hartono, R. (2020). The Role of Meeting Applications in Improving Student Productivity and Health Management amid Corona Virus Pandemic. *Yakugaku Zasshi*, 3965–3969.
- Nasrulloh, I. (2015). The Contribution of Online Articulate Based Tutorial Learning to Computer Assembly Activities and Skills. *Journal of Information and Technology Education*, 1(1), 38–51. <https://doi.org/10.31980/jpetik.v1i1.57>
- Ngapornchai, A., & Adams, J. (2016). Students' acceptance and readiness for E-learning in Northeastern Thailand. *International Journal of Educational Technology in Higher Education*, 13(1). <https://doi.org/10.1186/s41239-016-0034-x>
- Rahdiyanta, D. (2019). The Effects of Situational Factors in the Implementation of Work-Based Learning Model on Vocational Education in Indonesia. *International Journal of Instruction*, 12(3), 307–324.
- Regmi, K., & Jones, L. (2020). A systematic review of the factors - Enablers and barriers - Affecting e-learning in health sciences education. *BMC Medical Education*, 20(1), 1–18. <https://doi.org/10.1186/s12909-020-02007-6>
- Rintala, H., & Nokelainen, P. (2020). Vocational Education and Learners' Experienced Workplace Curriculum. *Vocations and Learning*, 13(1), 113–130. <https://doi.org/10.1007/s12186-019-09229-w>
- Salloum, S. A., Al-Emran, M., Shaalan, K., & Tarhini, A. (2019). Factors affecting the E-learning acceptance: A

- case study from UAE. *Education and Information Technologies*, 24(1), 509–530. <https://doi.org/10.1007/s10639-018-9786-3>
- San-Martín, S., Jiménez, N., Rodríguez-Torrico, P., & Piñeiro-Ibarra, I. (2020). The determinants of teachers' continuance commitment to e-learning in higher education. *Education and Information Technologies*, 25(4), 3205–3225. <https://doi.org/10.1007/s10639-020-10117-3>
- Sa'diah, M., Mujahidin, E., & Hartono, R. (2020). The role of government in utilizing information technology to build innovation in student learning at Ibn Khaldun university in the midst of the Covid-19 pandemic. *The Asian ESP Journal*, 19(51), 74-92.
- Schaap, H., Baartman, L., & de Bruijn, E. (2012). Students' Learning Processes during School-Based Learning and Workplace Learning in Vocational Education: A Review. *Vocations and Learning*, 5(2), 99–117. <https://doi.org/10.1007/s12186-011-9069-2>
- Scholten, M., & Tieben, N. (2017). Vocational qualification as safety-net? Education-to-work transitions of higher education dropouts in Germany. *Empirical Research in Vocational Education and Training*, 9(1). <https://doi.org/10.1186/s40461-017-0050-7>
- Shehzadi, S., Nisar, Q. A., Hussain, M. S., Basheer, M. F., Hameed, W. U., & Chaudhry, N. I. (2020). The role of digital learning toward students' satisfaction and university brand image at educational institutes of Pakistan: a post-effect of COVID-19. *Asian Education and Development Studies*. <https://doi.org/10.1108/AEDS-04-2020-0063>
- Sturing, L., Biemans, H. J. A., Mulder, M., & de Bruijn, E. (2011). The Nature of Study Programs in Vocational Education: Evaluation of the Model for Comprehensive Competence-Based Vocational Education in the Netherlands. *Vocations and Learning*, 4(3), 191–210. <https://doi.org/10.1007/s12186-011-9059-4>
- Suharno. (2020). Children and Youth Services Review Vocational education in Indonesia: History, development, opportunities, and challenges. *Children and Youth Services Review*, 115, 105092. <https://doi.org/10.1016/j.chilyouth.2020.105092>
- Sulaiman, G., & Ambotang, A. S. (2017). The Role of Basic Vocational Education Towards Students Employability. *International Journal of Vocational Education and Training Research*, 3(1), 1–6. <https://doi.org/10.11648/j.ijvetr.20170301.11>
- Sulistiyawati, C., Agustini, K., & Pradnyana, G. A. (2019). Effect of E-Learning Schoology on Student Learning Outcomes of Web and Mobile Programming Devices (Case Study: Class XI RPL at SMK Negeri 1 Negara). *Journal of Technological And Vocational Education*, 16(2), 191–201. <https://doi.org/10.23887/jptk-undiksha.v16i2.17939>
- Sulisworo, D., & Agustin, S. P. (2017). The Impact of E-Learning on Motivation on the Impact of E-Learning on Motivation in Physics Teaching At Vocational Schools. *Indonesian Physics Periodic*, 9(1), 1–7.
- Tabakova, V. (2020). E-learning – from first experiences in medical physics and engineering to its role in times of crisis. *Health and Technology*, 10(6), 1385-1390. <https://doi.org/10.1007/s12553-020-00474-x>
- Taslim, T., Toresa, D., & Syahtriatna, S. (2017). The Influence of E-learning Applications on Learning Outcomes (Case Study: Computer Security Student, Fasilkom Unilak). *INOVTEK Polbeng-Series Informatics*, 2(2), 182–188. <https://doi.org/10.35314/isi.v2i2.205>
- Torun, H., & Tumen, S. (2019). Do vocational high school graduates have better employment outcomes than general high school graduates? *International Journal of Manpower*, 40(8), 1364-1388.


<https://doi.org/10.1108/IJM-11-2017-0314>

Warso, R. D., Situmorang, J., & Mursid, R. (2019). Development of E-Learning Using Schoology in Energy Conversion Machine Subjects. *Journal of ICT in Education*, 6(2), 182–192.

Widiyanto, W. T., Burhan, A., & Machinery, P. T. (2014). The Effect of Moodle-Based E-Learning on the Results of the Mechanical Engineering Education Study Program, FKIP UNSRI. *Journal of Mechanical Engineering Education*, 1(2), 185–201.

Author Information

Eka Daryanto

 <https://orcid.org/0000-0001-6998-0690>

Department of Mechanical Engineering Education


Faculty of Engineering

Universitas Negeri Medan

Indonesia

Contact e-mail: ekadaryanto@unimed.ac.id

Batumahadi Siregar

 <https://orcid.org/0000-0003-1185-7272>


Department of Mechanical Engineering Education

Faculty of Engineering

Universitas Negeri Medan

Indonesia

Sapitri Januariyansah

 <https://orcid.org/0000-0003-3394-2179>

Department of Mechanical Engineering Education

Faculty of Engineering

Universitas Negeri Medan

Indonesia
