International Journal of Evaluation and Research in Education (IJERE)
Vol. 11, No. 2, June 2022, pp. 596~603
ISSN: 2252-8822, DOI: 10.11591/ijere.v11i2.22258

The maturity levels of the digital technology competence in vocational education

Melinda Astuti[1], Zainal Arifin[2], Muhammad Nurtanto[3], Farid Mutohhari[1], Warju Warju[4]
[1]Postgraduate Program of Technology and Vocational Education, Yogyakarta State University, Yogyakarta, Indonesia
[2]Department of Automotive Engineering Education, Faculty of Engineering, Yogyakarta State University, Yogyakarta, Indonesia
[3]Department of Mechanical Engineering Education, Universitas Sultan Ageng Tirtayasa, Banten, Indonesia
[4]Department of Mechanical Engineering, Universitas Negeri Surabaya, Surabaya, Indonesia

Article Info

Article history:

Received Jul 11, 2021
Revised Feb 27, 2022
Accepted Apr 2, 2022

Keywords:

Digital technology competence
Maturity levels
Vocational students
Vocational teachers

ABSTRACT

This study aimed to analyze the maturity level of teachers and vocational students. It also measured differences in the maturity level of teachers and vocational students in mastering the digital technology competence (DTC) in vocational education. Quantitative research used a design developed by Hoy and Adams. A total of 233 respondents came from public and private schools in vocational schools in Yogyakarta, Indonesia. Data was collected using a Likert scale questionnaire (1-4). The data were analyzed by descriptive statistics and inferential statistics with one-way analysis of variance (ANOVA). The results on the maturity level of vocational teachers obtained a score of 13.16-23.68 in the "Low" category and for vocational students obtained a score of 12.98-22.12 in the "Low" category, and there was no significant difference. Teachers and students in vocational schools must have awareness in improving digital technology capabilities at the criticism technology level.

Corresponding Author:

Zainal Arifin
Department of Automotive Engineering Education, Faculty of Engineering, Yogyakarta State University
Jl. Colombo No.1, Yogyakarta, Indonesia
Email: zainal_arifin@uny.ac.id

1. INTRODUCTION

The pace of digital transformation in the era of industrial revolution 4.0 now has penetrated in almost all areas [1]. The dominance of digital technology based on cyber physical systems is integrated in various types of work in the industry [2]. This technology allows connection between humans and humans, humans and machines, and machines with machines [3]. The integration of these technologies has changed the characteristics and nature of the previous work. The impact of changes in the characteristics and nature of work is the disruption of old jobs with new jobs [4], [5]. Thus, the workers have to perform updates competence to meet the challenges of the presence of new jobs [6].

Vocational education as one of the institutions for developing human resources has an important role in transforming new competencies. Vocational education is required to be adaptive to the industrial revolution 4.0 to become a sustainable development [7]. Revitalization of vocational education must be done to respond to the challenges that exist [8]. The transformation of industrial competency-based learning 4.0 must be pursued by education through learning [9]. Digital technology based on cyber physical systems is very important to be integrated in learning. Massive integration of cyber-based digital technology for learning is one of the characteristics of education as a response to the presence of digital transformation in the industrial era 4.0 [10]–[12].

The success of vocational education in developing industry 4.0-based competencies is influenced by several important factors. Cyber-based digital technology facilities and infrastructure are important to be provided by educational institutions [13], [14]. In addition, the application of learning models and methods must be appropriate to carry out learning that can be oriented to the achievement of industry 4.0 based competencies [15]. However, the maturity of competence in managing learning that is integrated with digital technology is also very important for teachers and students to have [16]. The level of maturity in mastering digital technology is one aspect that plays a role in supporting the transformation of industry 4.0 [17].

Maturity in using digital technology has levels of maturity called digital technological competence (DTC) taxonomy. According to Pavlova [7], there are five levels in the technology competency taxonomy: i) Technological awareness at the first level or at the lowest level whose conditions are only limited to knowing technology; ii) Technological literacy at the second level whose condition has a deep understanding of the uses and benefits of technology; iii) Technological capability at the third level which is competence in using technology appropriately; iv) Technological creativity at the fourth level, which is the ability to find new technologies to solve problems, and; v) Technology critical at the highest level which is the ability to assess and make appropriate and critical decisions regarding a choice of technological findings to be used.

However, the maturity level of digital technology in supporting the achievement of industrial 4.0 competencies has received less serious attention from vocational education [18]. The facts in previous studies revealed that teachers still have a low level of maturity [19]. Based on the description, the focus of the research is to measure the maturity level of teachers and students in vocational education in using the DTC to support the achievement of industry 4.0 in learning. The research questions include: i) What is the level of maturity of vocational education teachers and students in the use of the DTC?; ii) Is there a difference in the maturity level of teachers and students of vocational education in using the DTC?

2. RESEARCH METHOD

This study was a quantitative study with a design developed by Hoy and Adams [20]. This study aimed to measure the level of maturity of teachers and students in using the DTC. The study was conducted in four vocational schools (public schools and private schools) in Sleman, Yogyakarta, Indonesia. A total of 326 people (teachers and students) were the population of this study. Sampling was using simple probabilistic random sampling technique, which means that all have the same opportunity to be a sample [21]. The sample in this study obtained 233 people as respondents. The characteristic of respondent is shown in Table 1.

Table 1. Distribution of respondents' characteristics

Respondents' characteristics	Public school		Private school	
	Male (%)	Female (%)	Male (%)	Female (%)
Teachers				
1. Civil servant	4 (7.69)	4 (7.69)	2 (3.85)	3 (5.77)
2. Permanent teacher	4 (7.69)	4 (7.69)	2 (3.85)	2 (3.85)
3. Non-permanent teacher	3 (5.77)	2 (3.85)	4 (7.69)	4 (7.69)
4. Honorary	3 (5.77)	2 (3.85)	5 (9.62)	4 (7.69)
Students				
5. Grade X	17 (9.39)	14 (7.73)	13 (7.18)	8 (4.42
6. Grade XI	18 (9.94)	20 (11)	18 (9.94)	20 (11)
7. Grade XII	13 (7.18)	12 (6.63)	14 (7.73)	14 (7.73)

Data collection techniques were carried out using a questionnaire sheet containing statements related to the maturity level of teachers or students in using the DTC. The questionnaire used a Likert scale design that is 1 (strongly disagree) to 4 (strongly agree). The conceptual framework for the maturity level questionnaire in using the DTC is shown in Figure 1.

The collected data was then analyzed using descriptive and inferential statistics with a quantitative approach. Descriptive analysis is used to describe the average and percentage of each level of maturity in teachers and students. Hence, the inferential analysis was carried out using the one-way analysis of variance (ANOVA) test and the independent sample t-test to measure differences between aspects of competence. The maturity level of each level determined based on the criteria in the specified category by adopting the arguments of Mardapi [22].

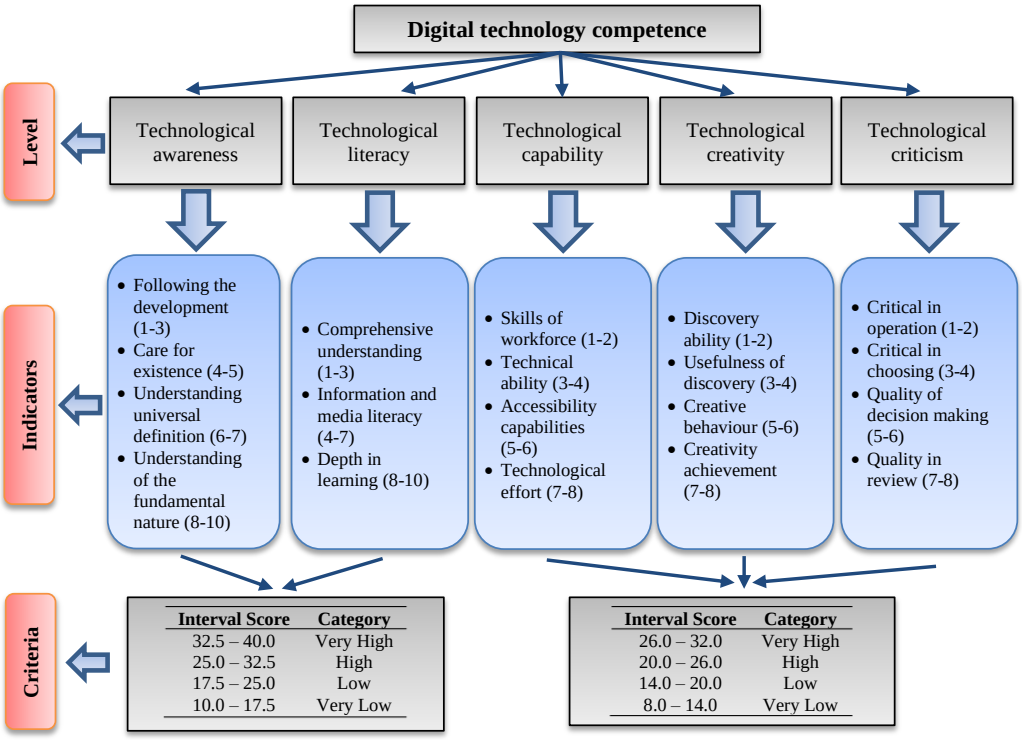

Figure 1. Conceptual framework of the DTC

3. RESULTS AND DISCUSSION

3.1. The maturity levels of the DTC on vocational teachers

Data on the maturity level of the DTC of vocational teachers were obtained from 52 respondents. The number of teachers who became respondents was divided into several characteristics, ranging from gender, civil servant teachers, permanent teachers, temporary teachers, and honorary teachers in vocational education. Data were obtained from several 44 statement items in a closed questionnaire using a Likert scale. The results of the respondent's data analysis are presented in the form of a description of the data related to central tendency and variability. In addition, the results of data analysis are also presented in the description of the analysis of differences between aspects of competence. The results of the descriptive analysis related to the maturity level of the DTC possessed by teachers are presented in Table 2.

Table 2. The maturity levels of the DTC on teachers

Maturity level aspects	Mean	Percentage	Median	Mode	Std. Dev	Min	Max	Category
Digital technology awareness	23.68	59.20%	22.00	20	3.686	15	30	Low
Digital technology literacy	22.74	56.85%	20.00	20	2.986	15	27	Low
Digital technology capability	15.98	49.94%	13.00	13	1.705	10	24	Low
Digital technology creativity	13.67	42.72%	12.00	12	1.525	8	18	Very low
Digital technology criticism	13.19	41.22%	10.00	10	1.231	8	16	Very low

Digital technology awareness is an aspect of competence possessed by teachers with the highest maturity level among all other aspects. The maturity level of teacher competence in the aspect of digital technology awareness has an average value of 23.68 and a percentage of 59.20% with a low category. Meanwhile, digital technology criticism is an aspect of competence possessed by teachers with the lowest maturity level among all other aspects. The maturity level of teacher competence in the critical aspects of digital technology has an average value of 13.19 and a percentage of 41.22% with a very low category. Thus, these results provide information that all aspects of the DTC possessed by teachers have a low level of maturity.

The aspect of digital technology awareness is the basis of the DTC, so this is what causes the highest level of maturity of the digital technology awareness aspect [23]. This aspect becomes an important foundation in constructing other aspects of digital competence. In the context of learning, teachers as managers and learning facilitators must be active in responding to the development of digital technology

which has the potential to support the current learning process [24]. The higher the teacher's awareness of the importance of digital technology in learning, the higher the capital that can be used to increase maturity in the next aspect [25]. However, even though this aspect occupies the highest level of maturity among other aspects, awareness of digital technology really needs to be improved, considering that the maturity level of teachers in this aspect is still low. Teacher awareness of digital technology which is very important to be applied in learning is still very minimal and must be grown by teachers [26]. Being active in following the development of digital technology is an important key in increasing teacher awareness of the importance of digital technology in learning [27].

Meanwhile, the criticism aspect of teacher digital technology which occupies the lowest level of maturity indicates that teachers are still very reluctant to be able to distinguish and choose digital technology correctly [25]. High complexity in critical thinking to select and review digital technology is a fundamental factor in the very low critical competence of digital technology teachers [28]. Critical in choosing and using digital technology is very important, especially when it will be integrated in learning [29]. The accuracy of integrated digital technology greatly affects the process and learning outcomes later [30]. The low level of teacher criticality in choosing and determining digital technology must be improved. The role of all elements of education is important to improve these aspects of competence in teachers, through various trainings and intensive assistance [31]. In addition, the provision of infrastructure and digital literature is also very important in increasing teacher awareness of the development of digital technology [32].

After obtaining further data on the development of digital competence in teachers, the results obtained were analyzed using one-way ANOVA to determine the difference in competency levels between aspects of the DTC for teachers. One-way ANOVA test results on the maturity level of the DTC, namely df (51), F-values 4.398 (Sig. 0.018<0.050) with decision is significant. Furthermore, to find out what aspects of the DTC have different levels of maturity, a post hoc test is carried out in one-way ANOVA analysis using the Tukey method. The results of post hoc test with Tukey method are shown in Table 3. The results obtained information that the maturity level of teacher competence in the awareness and literacy aspects of digital technology has a significant difference with the creative and critical aspects of digital technology. Meanwhile, there are no significant differences between other aspects of the DTC.

Table 3. Test result of the DTC maturity levels on teachers

Maturity level aspects		Mean Diff	Sig	Decision
Digital technology awareness	Digital technology literacy	0.940	0.734	No different
	Digital technology capability	7.700	0.055	No different
	Digital technology creativity	10.010	0.012	Different
	Digital technology criticism	10.490	0.009	Different
Digital technology literacy	Digital technology awareness	-0.940	0.856	No different
	Digital technology capability	6.760	0.084	No different
	Digital technology creativity	9.070	0.024	Different
	Digital technology criticism	9.550	0.017	Different
Digital technology capability	Digital technology awareness	-7.700	0.055	No different
	Digital technology literacy	-6.760	0.084	No different
	Digital technology creativity	2.310	0.498	No different
	Digital technology criticism	2.790	0.416	No different
Digital technology creativity	Digital technology awareness	-10.010	0.012	Different
	Digital technology literacy	-9.070	0.024	Different
	Digital technology capability	-2.310	0.498	No different
	Digital technology criticism	0.480	0.856	No different
Digital technology criticism	Digital technology awareness	-10.490	0.009	Different
	Digital technology literacy	-9.550	0.017	Different
	Digital technology capability	-2.790	0.416	No different
	Digital technology creativity	-0.480	0.856	No different

3.2. The maturity levels of the DTC on vocational students

Data on the maturity level of the DTC in vocational education students were obtained from 181 respondents. The number of students who became respondents was divided into several characteristics, ranging from gender, class X, class XI, and class XII in vocational education. The results of the data analysis of respondents are presented in a description of the data related to the central tendency and variability. In addition, the results of data analysis are also presented in the description of the analysis of differences between aspects of competence. The results of a descriptive analysis related to the maturity level of digital technology competencies possessed by students is shown in Table 4.

The level of maturity in aspects of the DTC in students has the same case that occurs in teachers. Awareness of digital technology is an aspect of competence possessed by students with the highest maturity level among all other aspects. The maturity level of students' competence in the aspect of digital technology

awareness has an average value of 22.12 and a percentage of 55.30% with a low category. Digital technology criticism is an aspect of competence possessed by students with the lowest maturity level among all other aspects. The maturity level of student competence in the critical aspects of digital technology has an average value of 12.98 and a percentage of 40.56% with a very low category.

Table 4. The maturity level of digital technology on student

Maturity level aspects	Mean	Percentage	Median	Mode	Std. Dev	Min	Max	Category
Digital technology awareness	22.12	55.30%	20.00	20	2.438	13	29	Low
Digital technology literacy	15.76	49.25%	13.00	13	1.632	12	21	Very low
Digital technology capability	15.98	49.94%	13.00	13	1.705	10	24	Low
Digital technology creativity	13.02	40.69%	13.00	13	1.608	8	16	Very low
Digital technology criticism	12.98	40.56%	10.00	10	1.224	8	16	Very low

The same case that happened to students and teachers at the maturity level of the DTC indicates that students are still limited to imitating what is taught by the teacher. The very low level of maturity of digital technology competencies possessed by students provides evidence that the problems in learning are very broad [33]. Student learning creativity is still very low, so the maturity level of the DTC cannot be increased [34]. In addition, the role of teachers who are still fully involved in learning is an important factor that affects students' competence in mastering digital technology [35].

This problem seems to have been going on for a long time which shows serious problems related to the DTC in learning. This was revealed by previous research that obtained information that a serious problem in vocational education teachers is the low ability to use digital technology. The level of acceptance of vocational education teachers is still in the low category, both in terms of digital literacy, digital technology capabilities and creativity in using digital technology [19], [36]. In addition, learning in vocational education in Indonesia still relies on student-centered learning. The passivity of students was found to greatly affect the creativity of students in seeking information and opening up insights related to the development of science and technology that occurred [37]. This is what causes the maturity level of students' digital technology competencies is very low. Various learning innovations are very important to be applied to overcome these problems, starting from the development of models, media and learning resources [38].

After obtaining descriptive data on the maturity level of the DTC in teachers, then the results obtained were analyzed using one-way ANOVA to determine differences in maturity levels between aspects of the DTC in students. The results of the one-way ANOVA test obtained the value of df (180), F-values 4.362 (Sig. 0.032<0.050) with decision is significant. Furthermore, to find out what aspects of the DTC have different levels of maturity, a post hoc test is carried out in one-way ANOVA analysis using the Tukey method. The results of the test post hoc using the Tukey method shown in Table 5 obtained information that the maturity level of student competence in the awareness and literacy aspects of digital technology has a significant difference with the creative and critical aspects of digital technology. Meanwhile, there are no significant differences between other aspects of the DTC.

Table 5. Test result of the DTC maturity levels on students

Maturity levels		Mean Diff	Sig	Decision
Digital technology awareness	Digital technology literacy	0.040	0.968	No different
	Digital technology capability	6.360	0.110	No different
	Digital technology creativity	9.100	0.023	Different
	Digital technology criticism	9.140	0.022	Different
Digital technology literacy	Digital technology awareness	-0.040	0.968	No different
	Digital technology capability	6.320	0.108	No different
	Digital technology creativity	9.060	0.028	Different
	Digital technology criticism	9.100	0.023	Different
Digital technology capability	Digital technology awareness	-6.360	0.110	No different
	Digital technology literacy	6.320	0.108	No different
	Digital technology creativity	2.740	0.414	No different
	Digital technology criticism	2.780	0.392	No different
Digital technology creativity	Digital technology awareness	-9.100	0.023	Different
	Digital technology literacy	-9.060	0.028	Different
	Digital technology capability	-2.740	0.414	No different
	Digital technology criticism	0.040	0.968	No different
Digital technology criticism	Digital technology awareness	-9.140	0.022	Different
	Digital technology literacy	-9.100	0.023	Different
	Digital technology capability	-3.000	0.376	No different
	Digital technology creativity	-0.040	0.968	No different

3.3. Comparison of maturity level of the DTC between teachers and students

After knowing the description of the maturity level data of each aspect of the DTC possessed by teachers and students, the results of the analysis of differences in maturity levels presented in each aspect. The analysis was carried out by using an independent sample t-test which had previously been carried out to fulfill the prerequisite analysis tests, namely data normality and homogeneity of variance. The analysis of the difference in the maturity level of the DTC between teachers and students are shown in Table 6.

The results of the independent sample t-test obtained a significance value in all aspects of the DTC 0.050. These results mean that the level of maturity in all aspects of digital technology competencies possessed by teachers and students does not have a significant difference. The difference of the DTC between teachers and students is shown in Figure 2. The flow of digital technology maturity levels owned by teachers and students is described from the level of digital technology care to digital technology critical. The flow explains that the higher the level of mastery of digital technology, the lower the level of maturity possessed by teachers and students. Thus, the maturity of teachers and students in mastering digital technology is sequential from the first level to the last level.

Awareness for digital technology to meet the competency needs of the 21st century and industry 4.0 is the lowest level. Caring about technology is the basis for shaping digital literacy [39]. Without awareness for digital technology, digital literacy will not be formed [7]. Meanwhile, digital literacy, which is a comprehensive understanding of digital technology, acts as a foundation in building one's digital technology capabilities [40]. Furthermore, without sufficient capability in mastering digital technology, one's creativity in using the technology will be lacking [41]. Likewise, the latter emphasizes that to achieve a critical level in using technology, creativity is needed in using the DTC [19].

Table 6. Differences in the maturity level of digital technology competencies of teachers and students

The DTC aspects	Mean Diff	df	t-values	t-table	Sig.	Decision
Digital technology awareness	1.560	231	1.756	1.9631	0.092	No different
Digital technology literacy	0.660	231	1.056	1.9631	0.368	No different
Digital technology capability	0.220	231	0.787	1.9631	0.511	No different
Digital technology creativity	0.650	231	0.899	1.9631	0.426	No different
Digital technology criticism	0.210	231	0.810	1.9631	0.485	No different

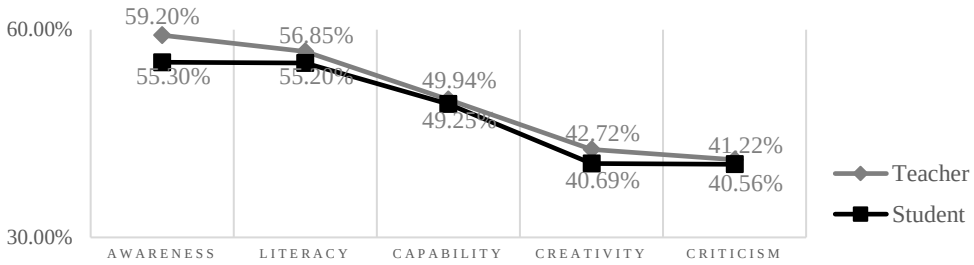

Figure 2. Percentage of the DTC maturity level

4. CONCLUSION

The digital transformation that occurs in the 21st century demands a maturity level of the DTC for teacher and student in learning. However, the facts reveal that the maturity level of the DTC for teacher is still low and the maturity level for student is still very low. Both teacher and student have a maturity level of the DTC that is not significantly different. Meanwhile, the distribution of the maturity level of the DTC in the aspect of digital technology awareness and literacy among teacher and student is uneven or still significantly different. This problem must be resolved immediately to support the learning process during the ongoing digital transformation. Training and learning innovations that are relevant with digital technology mastery competencies are required. Future research is highly expected to create and develop learning innovations to overcome this problem.

REFERENCES

[1] D. Ivanov, A. Dolgui, and B. Sokolov, "The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics," *International Journal of Production Research*, vol. 57, no. 3, pp. 829–846, 2019, doi: 10.1080/00207543.2018.1488086.

[2] C. Llopis-Albert, F. Rubio, and F. Valero, "Impact of digital transformation on the automotive industry," *Technological Forecasting and Social Change*, vol. 162, no. 1, pp. 1–9, 2021, doi: 10.1016/j.techfore.2020.120343.

[3] K. Schwab, "The fourth industrial revolution," *Information Technology and Libraries*, vol. 40, no. 1, 2021, doi: 10.6017/ITAL.V40I1.13193.
[4] M. Xu, J. M. David, and S. H. Kim, "The fourth industrial revolution: Opportunities and challenges," *International Journal of Financial Research*, vol. 9, no. 2, pp. 90–95, 2018, doi: 10.5430/ijfr.v9n2p90.
[5] S. Kergroach, "Industry 4.0: New challenges and opportunities for the labour market," *Foresight and STI Governance*, vol. 11, no. 4, pp. 6–8, 2017, doi: 10.17323/2500-2597.2017.4.6.8.
[6] C. V. Guzmán-Ortiz, N. G. Navarro-Acosta, W. Florez-Garcia, and W. Vicente-Ramos, "Impact of digital transformation on the individual job performance of insurance companies in peru," *International Journal of Data and Network Science*, vol. 4, no. 4, pp. 337–346, 2020, doi: 10.5267/j.ijdns.2020.9.005.
[7] M. Pavlova, "Technology and Vocational Education for Sustainable Development," in *Technical and Vocational Education and Training: Issues, Concerns and Prospects*. Springer, Dordrecht, 2009, doi: 10.1007/978-1-4020-5279-8.
[8] I. Made Sudana, D. Apriyani, and S. Nurmasitah, "Revitalization of vocational high school roadmap to encounter the 4.0 industrial revolution," *Journal of Social Sciences Research*, vol. 5, no. 2, pp. 338–342, 2019, doi: 10.32861/jssr.52.338.342.
[9] B. Van Hong and D. Van Dung, "Development of Vietnamese Vocational Education Teachers to adapt the Industrial Revolution 4.0," *Asian Journal of Interdisciplinary Research*, vol. 2, no. 4, pp. 1–7, 2019, doi: 10.34256/ajir1941.
[10] A. Hussin, "Education 4.0 Made Simple: Ideas For Teaching," *International Journal of Education and Literacy Studies*, vol. 6, no. 3, p. 92, 2018, doi: 10.7575/aiac.ijels.v.6n.3p.92.
[11] M. Devi, M. A. R. Annamalai, and S. P. Veeramuthu, "Literature education and industrial revolution 4.0," *Universal Journal of Educational Research*, vol. 8, no. 3, pp. 1027–1036, 2020, doi: 10.13189/ujer.2020.080337.
[12] N. Muhammad, P. Sudira, N. Kholifah, A. Samsudin, and W. Warju, "Vocational Teachers' Perceptions and Perspectives in the Implementation of STEM Learning in the 21st Century," *TEM Journal*, vol. 9, no. 4, pp. 1665–1680, 2020, doi: 10.18421/TEM94-46.
[13] R. Apriansyah, Z. Fransinatra, and D. Ririen, "The Influence of Instructors Competency and Facilities on the Quality of Education and Training Center (ETC) Graduates in Facing the Industrial Revolution 4.0," *Jurnal Manajemen dan Bisnis*, vol. 9, no. 2, pp. 13–25, 2020, doi: 10.34006/jmbi.v9i2.223.
[14] N. W. A. Majid, S. Fuada, M. K. Fajri, M. Nurtanto, and R. Akbar, "Progress report of cyber society v1.0 development as a learning media for Indonesian society to support EFA," *International Journal of Engineering Pedagogy*, vol. 10, no. 4, pp. 133–145, 2020, doi: 10.3991/ijep.v10i4.13085.
[15] A. A. Shahroom and N. Hussin, "Industrial Revolution 4.0 and Education," *International Journal of Academic Research in Business and Social Sciences*, vol. 8, no. 9, 2018, doi: 10.6007/ijarbss/v8-i9/4593.
[16] W. I. W. Adnan, N. A. Wahid, N. A. Majid, F. W. Jaafar, N. A. Ismail, and N. A. Wahab, "Do We Need You?: The Roles of Teacher Supervisor in Embracing Industrial Revolution 4.0," *Journal of Physics: Conference Series*, vol. 1529, no. 4, p. 042046, 2020, doi: 10.1088/1742-6596/1529/4/042046.
[17] D. R. Rizaldi, E. Nurhayati, and Z. Fatimah, "The Correlation of Digital Literation and STEM Integration to Improve Indonesian Students' Skills in 21st Century," *International Journal of Asian Education*, vol. 1, no. 2, pp. 73–80, 2020, doi: 10.46966/ijae.v1i2.36.
[18] N. Ronzhina, I. Kondyurina, A. Voronina, K. Igishev, and N. Loginova, "Digitalization of Modern Education: Problems and Solutions," *International Journal of Emerging Technologies in Learning*, vol. 16, no. 4, pp. 122–135, 2021, doi: 10.3991/ijet.v16i04.18203.
[19] F. Mutohhari, H. Sofyan, and M. Nurtanto, "Technological Competencies: A Study on the Acceptance of Digital Technology on Vocational Teachers in Indonesia," *Proceedings of the 1st International Conference on Law, Social Science, Economics, and Education, ICLSSEE 2021*, 2021, pp. 1–11, doi: 10.4108/eai.6-3-2021.2305971.
[20] W. Hoy, *Quantitative Research in Education: A Primer*. SAGE Publications, Inc., 2010, doi: 10.4135/9781452272061.
[21] J. W. Creswell, "Qualitative, quantitative, and mixed methods approaches," in *Research design*, 2nd Ed. Thousand Oaks, CA: Sage Publications, 2013, pp. 1–26.
[22] D. Mardapi, *Measurement, Assessment, and Evaluation of education*. Yogyakarta: Mitra Cendekia Press (in Indonesian), 2012.
[23] S. Sudha, "Understanding the relationship between rural government school teachers perceptions, technological knowledge and ICT awareness on technological pedagogical knowledge," *Indian Journal of Public Health Research and Development*, vol. 9, no. 2, pp. 251–256, 2018, doi: 10.5958/0976-5506.2018.00128.6.
[24] Z. Arifin, M. Nurtanto, W. Warju, R. Rabiman, and N. Kholifah, "The tawock conceptual model at content knowledge for professional teaching in vocational education," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 3, pp. 697–703, 2020, doi: 10.11591/ijere.v9i3.20561.
[25] R. Barragán-Sánchez, M. C. Corujo-Vélez, A. Palacios-Rodríguez, and P. Román-Graván, "Teaching digital competence and eco-responsible use of technologies: Development and validation of a scale," *Sustainability (Switzerland)*, vol. 12, no. 18, pp. 1–13, 2020, doi: 10.3390/su12187721.
[26] O. V. Yureva, L. A. Burganova, O. Y. Kukushkina, G. P. Myagkov, and D. V. Syradoev, "Digital transformation and its risks in higher education: Students' and teachers' attitude," *Universal Journal of Educational Research*, vol. 8, no. 11 B, pp. 5965–5971, 2020, doi: 10.13189/ujer.2020.082232.
[27] O. Swidan and M. Fried, "Focuses of awareness in the process of learning the fundamental theorem of calculus with digital technologies," *Journal of Mathematical Behavior*, vol. 62, no. 8, pp. 1–12, 2021, doi: 10.1016/j.jmathb.2021.100847.
[28] W. R. Malatji, R. van Eck, and T. Zuva, "Understanding the usage, modifications, limitations and criticisms of technology acceptance model (TAM)," *Advances in Science, Technology and Engineering Systems*, vol. 5, no. 6, pp. 113–117, 2020, doi: 10.25046/aj050612.
[29] J. Fletcher, J. Everatt, J. Mackey, and L. H. Fickel, "Digital Technologies and Innovative Learning Environments in Schooling: A New Zealand Experience," *New Zealand Journal of Educational Studies*, vol. 55, no. 1, pp. 91–112, 2020, doi: 10.1007/s40841-020-00156-2.
[30] M. Masterson, "An exploration of the potential role of digital technologies for promoting learning in foreign language classrooms: Lessons for a pandemic," *International Journal of Emerging Technologies in Learning*, vol. 15, no. 14, pp. 83–96, 2020, doi: 10.3991/ijet.v15i14.13297.
[31] İ. Reisoğlu, "How Does Digital Competence Training Affect Teachers' Professional Development and Activities?" *Technology, Knowledge and Learning*, vol. 4, no. 2, pp. 1–14, 2021, doi: 10.1007/s10758-021-09501-w.
[32] O. Smolyaninova and E. Bezyzvestnykh, "Implementing teachers' training technologies at a Federal University: E-portfolio, digital laboratory, PROLog module system," *International Journal of Online and Biomedical Engineering*, vol. 15, no. 4, pp. 69–87, 2019, doi: 10.3991/ijoe.v15i04.9288.

[33] M. Nurtanto, N. Kholifah, A. Masek, P. Sudira, and A. Samsudin, "Crucial problems in arranged the lesson plan of vocational teacher," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 10, no. 1, pp. 345–354, 2021, doi: 10.11591/ijere.v10i1.20604.
[34] I. Jahnke, T. Haertel, and J. Wildt, "Teachers' conceptions of student creativity in higher education," *Innovations in Education and Teaching International*, vol. 54, no. 1, pp. 87–95, 2017, doi: 10.1080/14703297.2015.1088396.
[35] Y. Matsuyama, M. Nakaya, H. Okazaki, A. J. Lebowitz, J. Leppink, and C. Van Der Vleuten, "Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: A qualitative study in a Japanese undergraduate setting," *BMC Medical Education*, vol. 19, no. 1, pp. 1–12, 2019, doi: 10.1186/s12909-019-1550-x.
[36] M. Nurtanto, P. Sudira, H. Sofyan, N. Kholifah, and T. Triyanto, "Professional Identity of Vocational Teachers in the 21st Century in Indonesia," *Journal of Engineering Education Transformations*, vol. 35, no. 3, pp. 30–36, 2022.
[37] K. Smit, C. J. de Brabander, and R. L. Martens, "Student-centred and teacher-centred learning environment in pre-vocational secondary education: Psychological needs, and motivation," *Scandinavian Journal of Educational Research*, vol. 58, no. 6, pp. 695–712, 2014, doi: 10.1080/00313831.2013.821090.
[38] M. Nurtanto, H. Sofyan, P. Pardjono, and S. Suyitno, "Development model for competency improvement and national vocational qualification support frames in automotive technology," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 9, no. 1, pp. 168–176, 2020, doi: 10.11591/ijere.v9i1.20447.
[39] P. Sudira, *The New Paradigm of Vocational Learning in the Industrial Revolution 4.0*. Yogyakarta: UNY PRESS (in Indonesian), 2020.
[40] N. Bergdahl, J. Nouri, and U. Fors, "Disengagement, engagement and digital skills in technology-enhanced learning," *Education and Information Technologies*, vol. 25, no. 2, pp. 957–983, 2020, doi: 10.1007/s10639-019-09998-w.
[41] D. A. Sprenger and A. Schwaninger, "Technology acceptance of four digital learning technologies (classroom response system, classroom chat, e-lectures, and mobile virtual reality) after three months' usage," *International Journal of Educational Technology in Higher Education*, vol. 18, no. 1, pp. 1–17, 2021, doi: 10.1186/s41239-021-00243-4.

BIOGRAPHIES OF AUTHORS

Melinda Astuti is a master's student at the Department of Technology and Vocational Education, Yogyakarta State University, Yogyakarta, Indonesia. Her research interests lie in digital technology, technological competence, and evaluation in vocational education. She can be contacted at email: melinda0054pasca.2020@student.uny.ac.id.

Zainal Arifin is a Senior Associate Professor and Lecturer at the Department of Automotive Engineering Education, Universitas Negeri Yogyakarta, Colombo Street No.1 Yogyakarta, Yogyakarta 55281, Indonesia. His research focuses on Vocational education, Automotive education, Management in vocational learning, Technology for learning and teaching, and fuel consumption. He can be contacted at email: zainal_arifin@uny.ac.id.

Muhammad Nurtanto is an assistant professor in Department of Mechanical Engineering Education, Universitas Sultan Ageng Tirtayasa, Banten, Indonesia. His current research interest includes Professional learning, Teacher emotion, Teacher identity philosophy of education, STEM education, Gamification, and Teacher quality in vocational education. He can be contacted at E-mail: mnurtanto23@untirta.ac.id

Farid Mutohhari is a professional learner with a master's degree at the Department of Technology and Vocational Education, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia. Research interest in the field of Professional learning, Project-based learning, professional teacher, and Learning media. He can be contacted at e-mail: faridmutohhari.2020@student.uny.ac.id or farid.plasa@gmail.com

Warju is received the Ph.D. degree in technical and vocational education from the State University of Yogyakarta (UNY), Indonesia. He has over 16 years of experience as an academician and researcher with the Universitas Negeri Surabaya (UNESA), where he is currently an Associate Professor and the Vice Director of Academic Affair of the Vocational Program, UNESA. His current research interest includes green school, educational media, students' learning and development at various levels and areas of vocational education. He can be contacted at email: warju@unesa.ac.id.