



Evaluation and Development of Applied Knowledge Soft Skills in Vocational High Schools in the Machining Engineering Competency Test: A Literature Review

Sugeng Priyanto*, Agus Dudung, Aip Badrujaman, Siti Sahara

Faculty of Engineering, Universitas Negeri Jakarta, Jakarta, Indonesia
Email: SugengPriyanto_9913920010@mhs.unj.ac.id

ABSTRACT

The quality of competence of Vocational High School graduates as providers of labor needs, graduate outputs based on data show theoretical knowledge literacy and poor data. In addition, competency skills show low skills, this condition affects the increase in the number of unemployed and unable to compete for jobs according to the needs of the job market. The method of searching for data information on the number of graduates and the level of employment of vocational high school graduates and information on the quality of labor at relevant national institutions. Review of literature studies in various articles of national and international repute in the field of vocational education. Vocational High School Results and Discuss as graduates and labor providers need to consider the development of applied knowledge-based literacy for competency improvement that is carried out contextually and procedurally for the improvement of the quality of graduates. Conclusion the quality of Vocational High School graduates understanding the literation of applied knowledge and skills is low. Therefore, it is necessary to emphasize the literacy of applied knowledge as a basic concept of thinking, creativity and innovation to improve the quality of process skills according to the quality of the job market.

Keywords: *Competence, Applied Knowledge, Machining Techniques.*

1. INTRODUCTION

The evolution of patterns and directions for the quality of vocational education have changed because of societal advancement. This affects the ability of employees who must be competent and capable of progress. According to Amat Jaedun, the theoretical knowledge competency of Vocational High School graduates is 50% bad, data literacy is good at 25%, and work characteristics and labor force skills are at a moderate level. [1]. Especially welcoming the era of the 21st century is an integral part of the role of graduates of the educational process, towards readiness to face the job market. Rofiq stated that some types of work have now been replaced by applications that have artificial intelligence capabilities. [2]. Christopher DeLuca needs to involve the integration of assessment practice, theory, and skills to support teaching and learning within the framework of standards-based education [30]. In addition, Peter Boehn stated that knowledge improves the basis of skill development in coaching programs [4]. Therefore, the role of Vocational High Schools in

equipping human resources as prospective workers needs to understand the context of development [5]. The main thing is the development of students' self-potential towards job market orientation, if vocational education graduates in Indonesia are not able to keep up with developments, there can be an increase in the number of unemployed which has an impact on increasing the workforce from abroad (6). Wilkins states knowledge and skills as a step of labor market competition participation [7].

Linda Leach proves that it is very important to understand applied science related to work project-based learning programs that are carried out [8]. Keiko Yasukawa stated that the lack of applied scientific literacy affects creativity and productivity [9]. Ann-Marie Bathmaker points out knowledge needs to be considered in depth as part of the quality of qualifications, vocational qualifications that enable advancement in the field of work or into higher levels of education. [10]. Therefore, the evaluation of competency tests that have been carried out and the form of

competency test development for strengthening knowledge skills are obtained several questions such as the following:

1. Whether the competencies possessed by vocational high school graduates have knowledge literacy skills.
2. How is the combination of competency tests and applied knowledge literacy skills carried out.

2. METHODS

The literature review was carried out using structured standards based on national and international vocational education research scientific journals related to affective, cognitive, and psychomotor development at the Vocational High School level. In addition, seeking data information on the output of graduates nationwide to find out the level of unemployment from various levels of education, the emphasis of key information on the unemployment rate of vocational high school graduates. Search for various important papers on vocational education that are forms of application, renewal, change and innovation of vocational education. This is necessary to answer the identification of two problems obtained from the competency test that has been carried out on the external conditions of existing graduates.

3. DISCUSSION

Several things related to the discussion such as the need for manpower from the vocational field, the development of applied scientific literacy skills, knowledge skills in the field of machining, the application of applied knowledge literacy competencies in the field of machining engineering.

3.1. Vocational Labor Needs Map

Increasing competence requires absolutely facing the demands of the task as well as to answer current and future challenges [11]. In addition, Jaipal declared a range of new knowledge, skills and technical abilities in the future that are flexible and readiness for often unexpected changes in the job market [2]. Another thing, Stofkova states that education is a systematic process of changing the behavior, knowledge and motivation of human resources for the improvement of competency requirements and their characteristics [13]. Sarah M. Van den He stated that vocational education was established against the background of the industrial need for professional labor [14] Michael Young & Jim Horern the development of useful curricula needs to be able to facilitate long-term educational partnerships but also to appreciate the co-existence of formal knowledge educating valuable vocational education [15].

Graduate competences must be digitally savvy and future employees must be prepared with respectable attitudes, knowledge, and skills based on job

requirements if they are to meet the expectations of the 21st century and the Industrial Revolution (4.0). Amat Jaedun stated that the digital understanding of vocational high school graduates in the good category is 25%, medium 50% and bad 25% [1]. This, Dinavence Arinaitwe shows the need for identification and strategies to improve the quality of learning in the process of preparing graduates of prospective workers who are proficient in knowledge, skills and contextual understanding [16].

In addition, Ace Suryadi is caused because the types of expertise programs, educational materials, teaching methods, learning media, evaluation and certification are more dominantly determined by the Government. Therefore, Vocational High School education programs are less flexible to changing job market needs. Indonesia's Central Statistics Agency (BPS) shows the number of unemployed in Indonesia by education level in 2022, vocational education graduates are among the 2nd highest number of unemployed 24% seen in the following figure 1 [17].

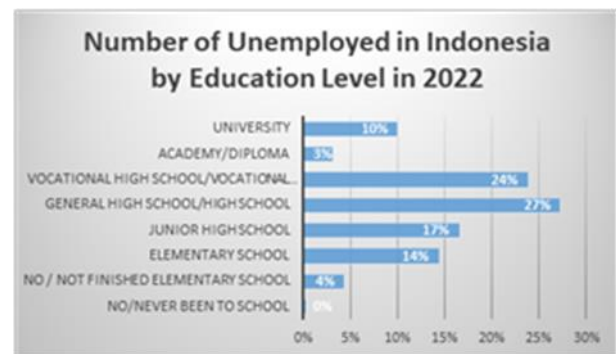


Figure 1. Data from the Indonesian Central Statistics Agency in 2022.

The condition of the skill level of the workforce in Indonesia according to the Ministry of National Development Planning of the Republic of Indonesia (Bappenas 2022) that the manufacturing sector is categorized into 3 levels, namely 4.09% skilled, 6.61% semi-skilled, and 89.30% low skilled. Data ini menunjukkan 4,09% tenaga kerja bidang manufaktur yang siap bersaing untuk bekerja. Achmad Arifin stated that the number of skilled workers is not able to meet domestic needs, making it very possible to increase the flow of foreign workers entering Indonesia [18].

Zainun Misbah This condition requires a special strategy to ensure vocational education graduates can enter the job market. In addition, Samsul HADI improved the vocational education evaluation system that focuses on skills needing applied knowledge literacy in the field of machining engineering. Su Jung Choi Applied knowledge-based literacy plays an important role in defining various theoretical and skill improvements [19]. In this case, Parkinson stated the application of applied

knowledge-based literacy, students are able to interpret and represent physical objects through the use of diagrams and the development of complex ideas in technology [20].

In addition, Hilde Hiim pointed out that improving the quality of vocational education governance needs to improve the overall process of competence, especially applied science. [21]. Literacy objectives have abilities that include knowledge and understanding, exploration and discovery, creativity and creativity, attitudes and science, and applications [22]. Therefore, Chiappetta expressed the ability to distinguish scientific values, systematically compose theoretically, relate the developed concepts into experimental diagrams

3.2 Development of Knowledge Literacy Skills

Knowledge plays a very important role for daily work, including technology, equipment, and work activities [23]. Applied knowledge helps to develop ways of thinking to be logical, creative, analytical, critical, develop skills in the application of knowledge, systematic problem solving, make decisions using various information in the form of verifiable evidence [24]. Pat Strauss The application of applied scientific literacy supports the development of innovation and skills to students as the output of future graduates [25]. Asplund concrete steps of various scientific theories are gradually incorporated into the didactic approach of the teaching teacher, in the process over time type teaching [26]. Terry Hyland, the learning process uses a literacy approach as the most appropriate inspiration for attention to increasing understanding and competence that supports work performance [27]. Martončik interventions are built for the practical benefit of the theoretical foundation to the application of working papers aimed at simulating this vocational activity [28]. Karen Nicholas, resources directed at improving literacy and numeracy levels are necessary for holistic change, in learning found a scope that needs to be revised [29].

3.3. Correlation Analysis

The most effective approach of enabling citizens to create sustainable national development, boost employment, improve quality of life, reduce poverty, minimize the occurrence of social crime owing to unemployment, and build a culture of peace, freedom, and democracy is through vocational education. (30). Skill is the ability and capacity to carry out complicated actions or job functions that engage concepts (cognitive skills), things (technical skills), and/or people through a purposeful, methodical, and ongoing effort (interpersonal skills).

Additionally, according to Sasso, the capacity for knowledge enables people to use current technology more effectively and to produce new ideas as a result,

which encourages innovation and technical development. [31]. Gleeson shown cognitive abilities in the subject of machining engineering, which included job analysis and work procedures. [32]. The level of competence developed and presented contextually and procedurally in Behrent's competency process serves as evidence that competence involves theoretical understanding [33]. Moana Monnier also outlines a work-specific strategy that exemplifies competency-defined performance-related values. [34]. The stages of procedure proposed by Stephen Billett demonstrate the relevance of knowing requirements for improving the delivery of vocational education and training. [35]. Vocational education places great emphasis on technical skills for its learners [36]. Therefore, technical abilities are very important to have, especially for vocational education graduates in the field of machining engineering. The learner competence exam is a method of evaluating a person's proficiency in a certain certification through pertinent verification. [37]. Formal vocational education is a school setting that equips its graduates with the skills necessary to compete successfully on the labor market. Additionally, Kuntoro claimed that the lower ability of many graduates of vocational schools to compete with the abilities they possess is what is causing the unemployment rate to rise. [38]. Rosala Cascón-Pereira noted that in order to create knowledge and skills that are focused on the context of the labor market and industry, the competency process needs to improve. [39]. According to Baartman, there are a number of requirements for creating a framework that includes elements of knowledge, attitudes, and skills [40]. As a concern, some conventions Wenja T displays The degree of understanding needed to respect to procedural rules is referred to as an aspect of knowledge and attitude. [41]. In addition, Wibisono said the skill aspect is the level of understanding to carry out concepts and theories through concrete actions [42]. The ability to perform using information, skills, and attitudes interwoven in the development of individual competence, according to Viola Deutscher [43].

This, Handoyono explains, can be shown in students who are unable to apply the knowledge and techniques they have learned on the worksheets [44]. In addition, it can be said that there are still many students who have not fully mastered the theory of the field of competence studied [45]. Therefore, the implementation of the competency test needs to integrate in terms of knowledge ability and technical ability [46]

3.4 Utilizing Knowledge Literacy Skills in the Field of Machining Engineering

A person's work attitude has the power to support their achievement in chosen field. [47]. As a result, when selecting employees, it frequently favors work attitudes over technical and cognitive abilities [48]. Today's industry exhibits the traits of automation and integration.

[49]. This involves a complex system to face problems and challenges that need to be solved [50].

To address difficulties at work and create beneficial scientific products, Fakhriyah emphasized that each person must be able to make decisions based on scientific facts. This emphasis derives from applied science literacy. [51]. Irene Eegdeman shows the need for identification data to determine the requirement for scientific expertise relevant to the established program. [52]. Gulpepe supports the idea that scientific knowledge is the cornerstone of daily activities. [53]. On this scenario, learning in cognitive aspects is necessary to help pupils enhance their thinking and process skills. Applied scientific disciplines (vocational) and knowledge literacy are strongly intertwined, particularly in the fields of engineering and machining technology. [54]. Vocational education cannot be without the dimension of applied knowledge literacy in procedural and contextual processes. A person's capacity to apply science to the context of their profession demonstrates their application of applied scientific literacy, which goes beyond simply speaking about science as a subject.

According to Zulyusri, psychomotor aspects cannot be isolated from the effects of cognitive and affective components when applying Rina Fitriani's applied knowledge literacy. [56]. According to Mohamad Yafuz Bil Amri and Ani Rusilowati, students' practical skills demonstrate their applied knowledge literacy in the psychomotor domain. [57]. Additionally, according to Nugraha, it is possible to draw the conclusion that in psychomotor assessment, teachers are only focused on the practicum's outcomes rather than observing how the process is used to comprehend it. [58].

4. CONCLUSION

According to the study, there is a good 25% comprehension of digital literacy, which is more middling and bad levels. This gives an idea of the level of literacy ability of knowledge of low categories. The data acquired indicates that there are more low-skilled and medium-skilled individuals who are 4.09% good skill capable, which has an impact on the impact of skill field abilities. Accordingly, to promote process skills, programs, and techniques for improving applied knowledge skills are required.

In the process of practical training, it is necessary to familiarize yourself with the understanding of applied knowledge first, in each practical material task linking the theory of applied knowledge on the worksheet to get consideration in understanding applied knowledge in the implementation of practice activities procedurally. This is applied knowledge science as a basic concept of thought, which helps to use the response process of adapting knowledge and a new work environment.

SUGGESTION

The learning process for improving competence, applied knowledge skills and job market competitiveness needs program planning such as:

1. Aspects of the learning process of theory emphasize the understanding of applied knowledge literacy in synergy with the practice of process skills.
2. Development of an integrated competency test evaluation of applied knowledge literacy proficiency tests and competency practice tests

REFERENCES

- [1] A. Jaedun, M. K. Omar, B. Kartowagiran and E. Istiyono, A Precedence Evaluation of Demand and Supply Between Vocational High School Graduates and Workforce Requirement in Indonesia, *Journal of Chemical Information and Modeling*, vol. 24 (1), 2020, pp. 24-27. DOI: <https://doi.org/10.21831/pep.v24i1.29580>.
- [2] Z. Rofiq, S. Suro, M. B. Triyono and B. S. H. Purwoko, Developing the Standard Competencies for Vocational Teacher Candidates of Mechanical Engineering, *Journal of Physics: Conference, Series1273*, 2019. DOI: 10.1088/1742-6596/1273/1/012032.
- [3] C. DeLuca and A. Bellara, The Current State of Assessment Education: Aligning Policy, Standards, and Teacher Education Curriculum, *Journal of Teacher Education*, vol. 64, 2013, pp.56–72. DOI: 10.1177/0022487113488144.
- [4] P. Boahin and A. Hofman, A Disciplinary Perspective of Competency-based Training on the Acquisition of Employability Skills, *Journal of Vocational Education and Training*, vol. 65, 2013, pp. 385–401. DOI: <http://dx.doi.org/10.1080/13636820.2013.834954>.
- [5] F. N. Mahmudah and B. Santosa, Vocational School Alignment Based-on Industry Needs, *JOVES (Journal of Vocational Education Studies)*, vol. 4 (1), 2021, pp. 36–45. DOI: <https://doi.org/10.12928/joves.v4i1.3611>.
- [6] A. Syamsuddin, W. E. Prasetyo and T. Kuart, The Implementation of the Competence Certification for Professional Welders at SMK N 2 Wonosari and SMK N 2 Pengasih, *JOVES (Journal of Vocational Education Studies)*, vol. 4 (1), 2021, pp. 99–111. DOI: <https://doi.org/10.12928/joves.v4i1.4024>.
- [7] S. Wilkins, Human resource development through vocational education in the united arab emirates: The case of dubai polytechnic, *Journal of Vocational Education and Training*, vol. 54 (1),

- 2002, pp. 2-26. DOI: 10.1080/13636820100200185.
- [8] L. Leach and N. Zepke, Literacy in the Workplace: An Example of Industry-University Collaboration, *Journal of Vocational Education and Training*, vol. 57, 2005, pp. 203–218. DOI: 10.1080/13636820500200283.
- [9] K. Yasukawa, T. Brown and S. Black, Production Workers' Literacy and Numeracy Practices: Using Cultural-Historical Activity Theory (CHAT) as an Analytical Tool, *Journal of Vocational Education and Training*, vol. 65, 2005, pp. 369–384, DOI: 10.1080/13636820.2013.820214.
- [10] A. M. Bathmaker, Defining “Knowledge” in Vocational Education Qualifications in England: An Analysis of Key Stakeholders and their Constructions of Knowledge, Purposes, and Content, *Journal of Vocational Education and Training*, vol. 65, 2006, pp. 87–107. DOI: 10.1080/13636820.2012.755210.
- [11] R. Alexandro, The Effect of Quality of Human Resources on The Performance of Bandiklat Central Kalimantan Province, *International Journal of Community Service Learning*, vol. 4 (2), 2020, pp. 150–158. DOI: 10.1080/13636820.2012.755210.
- [12] F. B. Nivlouei, Electronic Human Resource Management System: The Main Element in Capacitating Globalization Paradigm, *International Journal of Business and Social Science*, vol. 5 (2), 2014, pp. 147–59.
- [13] Z. Stofkova and V. Sukalova V, Sustainable Development of Human Resources in Globalization Period, *Sustainability Journal*, vol. 12 (18), 2020, pp. 1–14. DOI: <https://doi.org/10.3390/su12187681>.
- [14] M. Younga and J. Hordern, Does the Vocational Curriculum have a Future?, *Journal of Vocational Education and Training*, Vol. 74 (1), 2022, pp. 68-88. DOI: <https://doi.org/10.1080/13636820.2020.1833078>.
- [15] D. Arinaitwe, Practices and strategies for enhancing learning through collaboration between vocational teacher training institutions and workplaces, *Empirical Research in Vocational Education and Training*, vol. 13, 2021, pp. 1-22 DOI: <https://doi.org/10.1186/s40461-021-00117-z>.
- [16] Anonymous, Pengangguran Terbuka Menurut Pendidikan Tertinggi yang Ditamatkan, Badan Pusat Statistik, 2020.
- [17] A. S. Arifin, Analisis Kompetensi Tenaga Kerja Terampil Bidang Pemesinan Presisi, *Prosiding Seminar Nasional Jurusan Pendidikan Teknik Mesin*, 2017, pp. 92–101.
- [18] J. Parkinson and J. Mackay, The Literacy Practices of Vocational Training in Carpentry and Automotive Technology, *Journal of Vocational Education and Training*, vol. 68, 2016, pp. 33–50. DOI: <https://doi.org/10.1080/13636820.2015.1104714>.
- [19] A. Pamungkas, B. Subali and S. Linuwih, Implementasi Model Pembelajaran IPA Berbasis Kearifan Lokal untuk Meningkatkan Kreativitas dan Hasil Belajar Siswa, *Jurnal Inovasi Pendidikan IPA*, vol. 3 (2), 2017. DOI: 10.21831/jipi.v3i2.14562.
- [20] L. Udompong and S. Wongwanich, Diagnosis of the Scientific Literacy Characteristics, *Procedia-Social and Behavioral Sciences*, vol. 116, 2014, pp. 5091–5096. DOI: 10.1016/j.sbspro.2014.01.1079.
- [21] Anonymous, The Basic Education Core Curriculum, Ministry of Education Thailand, 2008.
- [22] P. Strauss and S. Mooney, Painting the Bigger Picture: Academic Literacy in Postgraduate Vocational Education, *Journal of Vocational Education and Training*, vol. 63, 2011, pp. 539–50. DOI: 10.1080/13636820.2011.572174.
- [23] S. B. Asplund and N. Kilbrink, Lessons from the Welding Booth: Theories in Practice in Vocational Education, *Empirical Research in Vocational Education and Training*, vol. 12, 2020. DOI: 10.1186/s40461-020-0087-x.
- [24] T. Hyland, Embodied Learning in Vocational Education and Training, *Journal of Vocational Education and Training*, vol. 71, 2019, pp. 449–463. DOI: 10.1080/13636820.2018.1517129.
- [25] A. M. Martončík, K. Nicholas, J. Fletcher and N. Davis, Raising Numeracy and Literacy to Improve Vocational Opportunities, *Journal of Vocational Education and Training*, vol. 64, 2012, pp. 433–451. DOI: 10.1080/13636820.2012.727850.
- [26] P. Okwelle, Chijioke, Y. Beako, Tombari and M. P. Ajie, Technical Skills Needed by Motor Vehicle Mechanic Apprentice to Establish Standard Motor Mechanic Enterprise in Port Harcourt Metropolis, *Rivers State*, vol. 5, 2017, pp. 27–34.
- [27] S. Sasso and J. Ritzen, Sectoral Cognitive Skills, R&D and Productivity: a Cross-Country Cross-Sector Analysis, *Education Economics*, vol. 27, 2019, pp. 35–51. DOI: <https://doi.org/10.1080/09645292.2018.1515309>.

- [28] F. Gleeson, P. Coughlan, L. Goodman, A. Newell and V. Hargaden, Improving Manufacturing Productivity by Combining Cognitive Engineering and Lean-six Sigma Methods, *Procedia CIRP*, vol. 81, 2019, pp. 641–646. DOI: [10.1016/j.procir.2019.03.169](https://doi.org/10.1016/j.procir.2019.03.169).
- [29] S. Behrendt, E. Dammann, F. Ștefănică, B. Markert and R. Nickolaus, Physical-technical Prior Competencies of Engineering Students, *Empirical Research in Vocational Education and Training*, vol. 7, 2015. DOI: [10.1186/s40461-015-0013-9](https://doi.org/10.1186/s40461-015-0013-9).
- [30] M. Monnier, T. Tschöpe, C. Srbeny and A. Dietzen, Occupation-specific Social Competences in Vocational Education and Training (VET): The Example of a Technology-based Assessment, vol. 8, *Empirical Research in Vocational Education and Training*, 2016. DOI [10.1186/s40461-016-0036-x](https://doi.org/10.1186/s40461-016-0036-x).
- [31] S. Billett, Perspectives on Enhancing the Standing of Vocational Education and the Occupations it Serves, *Journal of Vocational Education and Training*, vol. 72, 2020, pp. 161–169, DOI: [10.1080/13636820.2020.1749483](https://doi.org/10.1080/13636820.2020.1749483).
- [32] M. A. Mahbub, English Teaching in Vocational High School: A Need Analysis, *Jeels (Journal of English Education and Linguistics Studies)*, vol. 5, 2018, pp. 229–258.
- [33] A. R. Saepulloh, N. Sumarna and T. Permana, Studi Tentang Ketercapaian Standar Uji Kompetensi Siswa dalam Mata Pelajaran Pemeliharaan Kelistrikan di SMK, *Journal of Mechanical Engineering Education*, vol. 3, 2016.
- [34] T. Kuntoro, I. M. Sudana and S. Anis, The Implementation of Competency Certification Test for Vocational Students of Light Vehicle Engineering Program by LSP-P3 in Banyumas, *Journal of Vocational and Career Education*, vol. 4, 2019, pp. 74–82.
- [35] R. Cascón-Pereira, J. D. Moral-Martín and I. B. Icart, An Exploration of the Meanings of Innovation Held by Students, Teachers and SMEs in Spain, *Journal of Vocational Education and Training*, vol. 71, 2019, pp. 623–644. DOI: <https://doi.org/10.1080/13636820.2019.157>.
- [36] L. K. J. Baartman and E. D-Bruijn, Integrating Knowledge, Skills and Attitudes: Conceptualising Learning Processes Towards Vocational Competence, *Educational Research Review*, vol. 6, 2011, pp. 125–134. DOI: <https://doi.org/10.1016/j.edurev.2011.03.001>.
- [37] W. T. Heusdens, L. K. J. Baartman and E. de-Bruijn, Knowing Everything from Soup to Dessert: an Exploratory Study to Describe What Characterises Students' Vocational Knowledge, *Journal of Vocational Education and Training*, vol. 70, 2018, pp. 435–454. DOI: <https://doi.org/10.1080/13636820.2018.1437065>.
- [38] G. Wibisono, B. S. Wijanarka and H. Theophile, The Link and Match between the Competency of Vocational High Schools Graduates and the Industry on CAD/CAM and CNC, *Jurnal Pendidikan Teknologi dan Kejuruan (STEKDIKTI)*, vol. 26, 2020, pp. 26–34. DOI: <https://doi.org/10.21831/jptk.v26i1.27932>.
- [39] V. Deutscher and E. Winther, *Handbook of Vocational Education and Training*, Springer: 2018.
- [40] N. A. Handoyono, D. Rabiman and S. Purnomo, The Development of Charging System Job Sheet Oriented Higher-Order Thinking Skill (HOTS) for Vocational Education To cite this article: Job Sheet Oriented Higher-Order Thinking Skill (HOTS) for Vocational Education. In D. S. The Development of Cha International Conference on Technology, Education and Sciences, 2019, pp. 78–85.
- [41] B. Budiyanto and W. Suyanto, The Evaluation of Competency Certification Program Through the LSP P-1 at Vocational High School, *Jurnal Pendidikan Vokasi*, vol. 10, 2020, pp. 44–55.
- [42] I. Fahmi, W. Wardaya and P. Purnawan, Kontribusi Hasil Uji Kompetensi Teori Kejuruan Terhadap Hasil Uji Kompetensi Praktik Kejuruan Bidang Kompetensi Teknik Pemesinan Pesawat Udara di SMK, *Journal of Mechanical Engineering Education*, vol. 1, 2016, pp. 84-94.
- [43] M. Johnson, G. I. Umoh and A. Edwinah, Training and Employee Work Attitudes of Selected Manufacturing Firms in Port Harcourt, *International Journal of Novel Research in Humanity and Social Sciences*, vol. 3, 2016, pp. 101–112.
- [44] E. Keep and S. James, Recruitment and Selection – the Great Neglected Topic ESRC Funded Centre on Skills, Knowledge and Organisational Performance, Cardiff and Oxford Universities SKOPE, 2010.
- [45] L. Xu, L. Cai, S. Zhao and B. Ge, Editorial: Inaugural Issue, vol. 1, *Journal of Industrial Integration and Management*, 2007, pp. 1-6. DOI: <https://doi.org/10.1080/10420150500468024>.
- [46] L. Xu-Da, The contribution of systems science to Industry 4.0 Systems, *Research and Behavioral Science*, vol. 37, 2020, pp. 618–631.

- [47] F. Fakhriyah, S. Masfuah, M. Roysa, A. Rusilowati and E. S. Rahayu, Student's science literacy in the aspect of content science?, *Jurnal Pendidikan IPA Indonesia*, vol. 6, 2017, pp. 81–87, DOI: 10.15294/jpii.v6i1.7245.
- [48] I. Eegdeman, M. Meeter and C. Van-Klaveren, Cognitive Skills, Personality Traits and Dropout in Dutch Vocational Education Empirical, *Research in Vocational Education and Training*, vol. 10 (11), 2018.
- [49] N. Gultepe and Z. Kilic, Effect of Scientific Argumentation on the Development of Scientific Process Skills in the Context of Teaching Chemistry, *International Journal of Environmental and Science Education*, vol. 10, 2015, pp. 111–132. DOI: 10.12973/ijese.2015.234a.
- [50] R. Arthur and D. Daryati, Scientific Literacy of Vocational School Students in Building Construction, *Journal of Physics Conference*, Vol. 1833 (1), 2021. DOI:10.1088/1742-6596/1833/1/012036.
- [51] B. Fischhoff, Individuals with Greater Science Literacy and Education Have More Polarized Beliefs on Controversial Science Topics, *Proceedings of the National Academy of Sciences*, 2018. DOI: 10.1073/pnas.1704882114.
- [52] R. Fitriani and S. Zulyusri, The Effect of Scientific Approach Applied on Scientific Literacy to Student Competency at Class VIII Junior High School 12, *International Journal of Progressive Sciences and Technologies (IJPSAT)*, vol. 7, 2018, pp.97–105.
- [53] M. Y. B. Amri and W. A. Rusilowati, Penerapan Model Pembelajaran Conceptual Understanding Procedures untuk Meningkatkan Kemampuan Literasi Sains Siswa SMP di Kabupaten Tegal, *UPEJ Unnes Physics Education Journal*, vol. 6, 2016, pp. 80–92.
- [54] M. G. Nugraha, S. Utari, D. Saepuzaman, F. N. Solihat and K. H. Kirana, Development of Basic Physics Experiments Based on Science Process Skills (SPS) to Enhance Mastery Concepts of Physics Pre-Service Teachers in Melde's Law, *Journal of Physics: Conference*, vol. 1280, 2019. DOI: 10.1088/1742-6596/1280/5/052075.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

