The Relevance of the Merdeka Curriculum Vocational School to the Competency Needs in the Construction Field in the Industry

Anisah[1] [*], Tuti Iriani[1], M. Agphin Ramadhan[1], Yusrina Luthfiana[2]

[1] Building Engineering Education Study Program, Faculty of Engineering, Universitas Negeri Jakarta
Jl. Rawamangun Muka Raya, No. 11, Pulo Gadung, Jakarta Timur, DKI Jakarta, Indonesia-13220

[2] Higher Education Manajement Study Program, Faculty of Administrative Sciences, Universitas Brawijaya
Jl. MT. Haryono, No. 163, Lowokwaru, Kota Malang, Jawa Timur, Indonesia-65145

*Corresponding author: anisah_mt@unj.ac.id   Doi: https://doi.org/10.24036/invotek.v23i3.1161

Abstract

The issue of curriculum relevance in vocational education is a crucial issue of all time. The relevance of the curriculum has two blades, whether it will be the biggest strength or even the biggest weakness in vocational education. Relevance will link the existing employment potential and the graduate's ability to fulfill the job requirements. This research aims to determine the relevance of the independent vocational school learning curriculum, especially in the field of construction, with the competencies needed in the world of work. This research uses a qualitative approach with participants being teachers in the field of study, especially construction and leaders/heads/managers in companies. Data collection was carried out through a Focus Group Discussion (FGD). The questions in the FGD consisted of open-ended questions to find out participants' answers in detail. The research results show that there is relevance between the Merdeka Curriculum and the needs of industry, especially in the building construction sector. Vocational school graduates generally have opportunities in small-scale construction industry services and efforts to increase relevance between schools and industry are to increase cooperation and increase teacher competence.

Keywords: Relevance, Merdeka Curriculum, Competency, Industry, Construction Sector.

1. Introduction

The Merdeka Curriculum creates challenges for schools, teachers, and students who play an important role in implementing the learning process. In facing this challenge, various efforts are needed to understand the role of each element or subject of education. According to Indarta et al. [1], the Merdeka Curriculum positions teachers in designing flexible learning. The true meaning of independence in learning is giving freedom to teachers in the learning process [2]. The role of teachers in the Merdeka Curriculum is apart from teaching according to students' achievements and development, they can also work on the Merdeka learning platform. Apart from that, we can also increase our value as teachers by learning independently through the Merdeka teaching platform.

Regarding the presence of a Merdeka Curriculum, the question will always arise, is the curriculum relevant to the industrial world? According to Oloruntegbe et al. [3] designing a relevant curriculum in vocational school is a task that must be continuously carried out in line with changing times. The relevance of the curriculum has two blades, whether it will be the biggest strength or even the biggest weakness in vocational schools. Relevance will link the existing employment potential and the graduate's ability to fulfill the job requirements. If graduates from vocational schools cannot meet the requirements and needs set by the job market, then vocational schools are considered to have "failed" [4]–[6]. Very rapid changes in the world of work mean that the curriculum needs to be constantly

reviewed to see whether there is still a match between what is taught in school and the needs of the world of work.

The issue of the relevance of vocational schools to industrial needs has always been an interesting theme ahead of changes in education policy carried out by the government. The mismatch between the knowledge and skills taught in vocational schools and the needs in the world of work is considered to be the main cause of the relatively high unemployment rate for vocational school graduates. BPS data as of August 2023 [7] states that based on education level, the open unemployment rate for vocational school graduates is the highest, namely 9.31% compared to other education levels. Meanwhile, vocational schools have the main goal of preparing their students to enter the workforce. Students who graduate from vocational schools are expected to become ready-to-use workers, in other words, vocational schools produce graduates who are ready to work. Apart from that, Law No. 20 of 2003 Article 15 concerning National Education Units [8], states that vocational schools has the aim of preparing students, especially to work in certain fields.

In the context of vocational schools in the field of Construction and Building Technology abbreviated as TKB, ordinary knowledge and skills are not enough to adapt to the needs of the construction industry. Technological developments in the Industrial Revolution 4.0 era have caused the construction industry to also adapt, which is known as Construction 4.0 [9]. Advanced technologies such as Building Information Modeling (BIM), Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), drones, and the use of the Internet of Things (IoT) make work methods in the construction industry change and adapt. For example, one of the five vocational schools' expertise programs in TKB field, namely the Building Modeling and Information Design (DPIB) expertise program, needs to be responsive and anticipatory to advances in drawing software relevant to the construction industry [10]. Thus, the five skills programs from Vocational Schools in the TKB field are based on the Merdeka Curriculum [11], namely: 1) Building Maintenance Engineering, 2) Construction and Maintenance of Civil Buildings. 3) Construction and Housing Engineering (TKP), 4) Building Modeling and Information Design (DPIB), and 5) Furniture Engineering needs to immediately adapt to the latest developments in construction technology applied in the construction industry both on a small, medium, and large scale.

However, the problems that have occurred in vocational schools in the TKB field are not only caused by the vocational schools' lack of anticipation of technological developments in the construction industry. Another factor that causes the gap is a mismatch of competencies. This is supported by several research results. According to Jatmoko [12], the low absorption of graduates is caused by the industry's reluctance to employ vocational school graduates in the TKB field due to the mismatch between the available competencies and those required by the construction services industry. The results of research conducted by Mulyana [13] stated that the weaknesses of vocational school graduates in facing the world of business and industry are that they do not have the competencies required or needed for work, lack self-confidence so they are unable to work independently, and are not ready to face the work culture in industry or the job market. others. According to Wati et al. [14] in the construction and housing industry, the competencies required by the industry are specific and include the ability to interpret drawings, estimate costs, conduct surveys, and manage administrative tasks effectively. However, the competency of vocational school graduates in the TKB field is not yet in line with these requirements, resulting in a mismatch between skills in the industry needs. According to Putranto [15], the discrepancy between vocational schools and industry is also caused by several things, namely some vocational schools have not been able to produce graduates who can easily adapt to the environment and conditions (adaptive) in the industry, the lack of practical facilities such as workshops or adequate work laboratories, and the lack of cooperation ties with the industry that are needed. Apart from that, from the perspective of teaching staff, namely vocational school teachers, they are left behind with the latest skills information which is currently popular in the current era of development, so this has an impact on learning in vocational schools which is carried out haphazardly, meaning that learning in vocational schools is only aimed at producing vocational graduates or alumni without having the skills or competencies. Therefore, the learning plans or programs offered at the vocational school level are not yet effective and efficient.

Several studies have identified the relevance of vocational school graduate competencies to competency needs in the construction industry. The construction services industry which operates in the field of supervision consultants stated that all the competencies of vocational school graduates with 81.52% TKP expertise programs are very much needed [16]. However, another study states that

vocational school graduates' competency skills in Construction and Property Business (2018 curriculum) are not yet relevant to the needs of the industry [17]. Another study regarding the relevance of competency in drawing subjects using AutoCAD software concluded that the competency taught in vocational schools is very relevant to the required competency of drafters in the construction services industry [18]. It can be concluded that the competencies possessed by vocational schools must be relevant to the competencies required by the industry so that graduates can be well-absorbed and become skilled workers. The presence of the Merdeka Curriculum provides schools with the opportunity to manage and develop curriculum and learning under the characteristics of the educational unit and students [19]. In line with the Merdeka Curriculum that has been implemented in vocational schools, this study will highlight learning outcomes, which is a term in the Merdeka Curriculum that is the main indicator to show the competencies possessed by graduates of a study program. The preparation of learning outcomes must refer to the competencies required by graduate users (the industry). According to Warnandes et al. [20], obtaining this data can be done by conducting field surveys or gathering construction service industry players and preparing the curriculum so that it meets the aim of producing good graduate profiles according to existing needs.

This study aims to determine the relevance of the Merdeka Curriculum in Vocational Schools in TKB field with the competencies needed in the industry. This study will answer whether learning achievements in vocational schools are relevant to competency needs in the industry. What competencies does the industry need in the construction sector? What efforts are being made to ensure that learning achievements are aligned with construction competency needs in the industry? Different from several previous studies, this research brought together vocational school teachers in the TKB field and construction company managers in a Focus Group Discussion (FGD). This allows for discussion between teachers and practitioners. In addition, the scope of the study is not limited to one of the vocational school expertise programs in the TKB area of expertise so that the study results presented are more comprehensive to perfect the curriculum, especially regarding learning outcomes competencies and the needs of the industry.

2. Methods

The study was carried out at the Building Engineering Education Study Program, Universitas Negeri Jakarta. Study activities were carried out from August to September 2023. This study collected information about the elements and learning outcomes contained in the Merdeka Curriculum, especially in the TKB field and competency needs in the construction sector industry. In this study, observation, in-depth interviews, and documentation studies were used to collect data. Researchers conducted in-depth and open interviews through Focus Group Discussions. Researchers used documentation methods to search for information in the form of notes, archival materials, and journals. The data analysis process in this study was carried out from the research design period until the time of data collection. Next, the data that had been collected will be analyzed using the Miles and Huberman model, which is carried out during data collection and after completing data collection within a certain period. For data validity, this research only uses three types of data validity, namely adding observations, triangulation by looking for booster data from other sources, and checking the process of checking the data obtained by the researcher with the data provider.

3. Result and Discussion

3.1 Learning Achievements in the Merdeka Curriculum and Industrial Competency Requirements

Competency is the ability to carry out tasks and work following requirements based on knowledge, skills, and work attitudes [21]. Competence also involves the ability to meet complex demands by drawing on and mobilizing psychological resources including attitudes in a particular context. This means that competence includes the ability to do something, not just passive knowledge. Competencies in the Merdeka Curriculum are stated in learning outcomes. Learning outcomes in the Merdeka Curriculum can be used as the main indicator to show the competencies possessed by graduates of a study program. The preparation of learning outcomes must refer to the competencies required by graduate users (the industry). This data can be collected by conducting field surveys or gathering

construction service industry players and preparing a curriculum so that it meets the aim of producing good graduate profiles according to existing needs [20]. To find out the relevance between learning outcomes in Building Modeling and Information Design in the Merdeka curriculum and the competencies in the construction field required by industry, the two are compared in Table 1.

Table 1. Learning Outcomes for Building Modeling and Information Design and Competencies Required by the Construction Industry

Learning Objectives/Outcomes for Building Modeling and Information Design	Competencies Required by the Construction Industry
Students can draw 3D and 2D structures, architecture, interiors, and exteriors of buildings. Students utilize Building Information Modeling (BIM) technology to produce informative design animation visualizations (planning, modeling techniques, and drawings of simple and multi-story structures). Students can draw 2D and 3D road and bridge construction, as well as generate relevant design animation visualizations, utilizing Building Information Modeling (BIM) technology in modeling and building information design. Students can plan and draw 2D and 3D construction of building utilities (clean water and dirty water installations, sanitary installations, electrical installations, and fire system installations) utilizing Building Information Modeling (BIM) technology.	Capable of preparing technical drawings and building material standards.
Students can estimate actual costs in building planning by creating Cost Budget Plans, time schedules, and S curves utilizing Building Information Modeling (BIM) technology.	Setting labor and material schedules, as well as assessing work outcomes. Create a schedule for distributing the volume of work to the appropriate units. Give technical recommendations for work and resolve any issues that occur.

Table 1 explains the learning objectives/outcomes for Building Modeling and Information Design based on elements in the Merdeka Curriculum [22]. Meanwhile the construction competency required by the industry is in line with the Building Construction Engineer Registration No. INA 5231.213.01 [23] and the Construction Engineer Registration No. TM 045 [24], that the cognitive competencies required are: 1) understanding of preparing technical drawings and standards for using building materials; 2) how to setting labor and material schedules, as well as measuring work results; 3) how to setting schedule for delivering work volumes to related units; and 4) how to make technical recommendations for work and solve obstacles that occur.

Based on Table 1, shows the learning achievements with the competency requirements in the construction sector in the industry, showing relevance. This means that there is a match between the competencies that must be achieved by vocational school graduates and the competency requirements of industry, especially in the field of construction expertise, which is described in Figure 1 below.

The construction services industry is divided into several qualifications, namely small, medium, and large. The existence of these qualifications constitutes a Business Entity Certificate in the construction sector. This is based on an assessment of whether or not the construction service business entity's documents are appropriate.

Based on Table 2, the results showed that each of the small, medium, and large-scale construction service industries has dominant factors in different competency needs. This level of competency needs varies indicating that the level of work on each industrial scale has its classification. The needs of the construction service industry in three aspects of competence, namely cognitive, psychomotor, and affective, are relevant to what has been taught by the school per the curriculum applied.

Table 2. Required Competencies by Construction Industry for Vocational Schools' Graduates

Construction Industry Scale	Required Competencies	Vocational Schools' Graduate Competencies
Small-scale	Skilled in drawing, preparation and finishing work	Skilled in drawing construction, inspecting concrete mixture materials, and carrying out preparation to finishing work.
Medium-scale	Skilled in preparation, drawing, volume calculation, and execution of structural work	Skilled in drawing of concrete structure, calculating volumes, and carrying out work on the site including preparation of material to the implementation of structural work.
Large-scale	Skilled in the installation of scaffolding, calculation, and execution of construction work	Skilled in fieldwork ranging from the installation of scaffolding, the implementation of construction using the required equipment or technology, and volume calculations with the use of software or manuals.

In the small-scale construction service industry, the dominant factors needed are drawing skills, preparation work, and finishing. This factor explains that the needs of the small-scale construction service industry for vocational school graduates tend to have competence skills in construction drawings, an inspection of concrete mixture materials, and carrying out preparation work to finishing. In the medium-scale construction service industry, the dominant factors needed are the preparation skills, drawings, volume calculations, and implementation of structural work. This factor explains that the needs of the medium-scale construction service industry for vocational school graduates tend to have the competence of concrete construction drawing skills, volume calculations and implementation of work in the site including the preparation of material needs to the implementation of structural work. In the large-scale construction service industry, the dominant factors needed are scaffolding installation skills, calculations, and implementation of construction work. This factor explains that the needs of the large-scale construction service industry for vocational school graduates tend to have the competence of fieldwork skills starting from the installation of scaffolding, the implementation of construction using the required equipment or technology, and volume calculations with the use of software or manuals. Considering from the most dominant competencies needed by the construction service industry both small, medium, and large scale, namely the competence of skills in the implementation of work in the field ranging from preparation, structural work, and material checking to finishing.
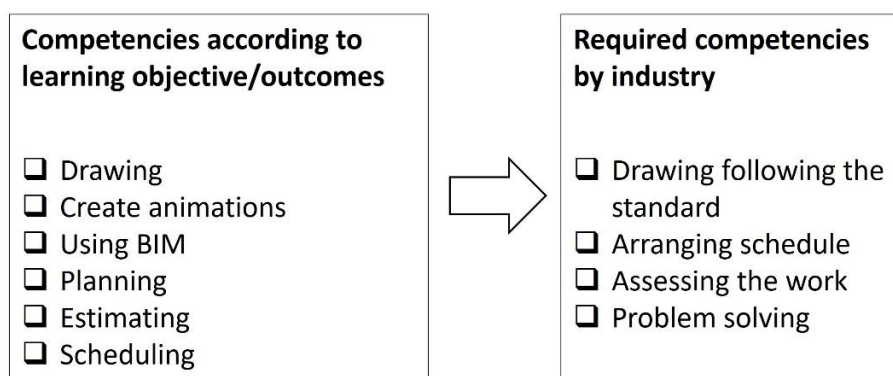

Figure 1. Relevancy Between Competencies of Merdeka Curriculum and Required Competencies by the Industry

3.2 Efforts are Made to Ensure that Learning Outcomes are in Line with the Needs of Construction Competency in the Industry

Based on discussions with panelist, it was agreed that efforts were made so that learning achievements were in line with the needs of construction competencies in the industry. The competencies possessed by vocational school must be relevant to the competencies needed by the industry so that graduates can be well absorbed and become a skilled workforce. To meet the competency needs of the construction service industry, it needs to be pursued by improving the competence of its workforce, both through Construction Services Development Agency (LPJK), through Labor Education Institute (LPTK), as well as through cooperation between the school and the construction service industry. Thus, construction service companies can improve the quality of their projects with a competent workforce.

The school and the construction service industry must be able to foster cooperation with the school to conduct training for students related to the field of construction work to facilitate the recruitment of professional workers following industry needs. Vocational education carried out by vocational schools must have a strategic role and is expected not only to be able to produce middle workers but also as a center of excellence development and strengthening the ability of national human resources and science and technology. Therefore, the design of expertise education in vocational schools must be relevant and lead to expertise education that can produce professionals who have the competence and skills to meet the demands of the industry.

The era of the Industrial Revolution 4.0 is marked by the high level of manufacturing digitalization pioneered by several factors including capabilities, analytics, business intelligence, increasing data volume, computerization, connectivity, robotics, 3D printing, and interaction between humans and machines [25]. Factors that affect the readiness of vocational teachers and that need to be mastered by vocational teachers are mastering knowledge about data, knowledge about technology, and knowledge about humans, so that teachers must have self-awareness and willingness to continue learning. The school can also develop teaching materials by incorporating elements of renewability concerning concrete material classification materials and management of construction work and facility provisions such as practice rooms, construction equipment, and Occupational Health and Safety (OHS) need to be improved. For the construction service industry to be able to foster cooperation with TKB field in vocational schools to conduct training for students related to the field of work to facilitate the recruitment of professional workers following industry needs.

According to Sanjaya [26], the relevance of the curriculum is interpreted as the adaptive curriculum or has a function as an adjustment. The meaning of adjustment is that the curriculum must have the ability to adapt to the development of society, science, technology, and the needs of the world of work. The development of the world of work is dynamic and changes rapidly following the development of science and technology. Relevance will link between the potential of existing jobs and the ability of graduates to meet the requirements of those jobs.

4. Conclusion

Vocational school is an education at the secondary level that prioritizes the development of student skills. The skills possessed are the result of learning in school and industry. The industry plays an important role in the learning process in vocational schools, namely by collaborating in the implementation of industrial practices. Learning outcomes with the needs of competence in the field of construction in the industry show relevance This means that there is a match between the competencies that must be achieved by vocational school graduates with the needs of industrial competencies, especially in the field of construction expertise. The construction service industry is divided into small, medium, and large scales have dominant factors in different competency needs. This level of competency needs varies indicating that the level of work on each industrial scale has its own classification. Vocational school graduates generally work in small-scale industries Several efforts are made so that learning outcomes are in line with the needs of construction competencies in the industry, namely: cooperation between schools and industry must be further improved, and increasing teacher competence in technology is very important.

References

[1] Y. Indarta, N. Jalinus, W. Waskito, A. D. Samala, A. R. Riyanda, and N. H. Adi, "Relevansi Kurikulum Merdeka Belajar dengan Model Pembelajaran Abad 21 dalam Perkembangan Era Society 5.0," *EDUKATIF J. ILMU Pendidik.*, vol. 4, no. 2, pp. 3011–3024, Mar. 2022, doi: 10.31004/edukatif.v4i2.2589.

[2] A. T. Daga, "Makna Merdeka Belajar dan Penguatan Peran Guru di Sekolah Dasar," *J. Educ. FKIP UNMA*, vol. 7, no. 3, pp. 1075–1090, Aug. 2021, doi: 10.31949/educatio.v7i3.1279.

[3] K. O. Oloruntegbe, J. O. Agbayewa, S. O. Adodo, D. Adare, and A. M. Laleye, "Reconceptualization of African Vocational and Technological Education for Emergent Globalization, Relevance and Suistainable Economic Developtment," *Int. J. Vocat. Tech. Educ.*, vol. 2, no. 4, pp. 55–61, 2010, doi: 10.5897/IJVTE.9000027

[4] B. Canavan and R. Doherty, "Technical education in Scotland: Fit for purpose?," *Int. J. Technol. Des. Educ.*, vol. 17, no. 3, pp. 291–304, Sep. 2007, doi: 10.1007/s10798-007-9031-7.

[5] K. A. Hodge and J. L. Lear, "Employment Skills for 21st Century Workplace: The Gap Between Faculty and Student Perceptions," *J. Career Tech. Educ.*, vol. 26, no. 2, pp. 28–41, 2011, doi: 10.21061/jcte.v26i2.523

[6] M. D. Miller, *Principles and a Philosophy for Vocational Education. Special Publication Series No. 48.* Oklahoma: Oklahoma State University, 1984.

[7] Badan Pusat Statistik (BPS), "Keadaan Pekerja di Indonesia," Jakarta, 2023.

[8] Presiden Republik Indonesia, *UU No. 20 Tahun 2003 tentang Sistem Pendidikan Nasional*. Indonesia, 2003, p. 57.

[9] E. Forcael, I. Ferrari, and A. Opazo-vega, "Construction 4.0 : A Literature Review," *Sustainability*, vol. 12, no. 22, pp. 1–28, 2020, doi: 10.3390/su12229755.

[10] M. Bruri Triyono, T. Köhler, and L. Trianingsih, "Technical working skills of vocational high school students at the interface between digital workplaces and school. An empirical study about construction engineering drawings in Indonesia.," in *Communities in New Media: Research on Knowledge Communities in Science, Business, Education and Public Administration - Proceedings of 21th Conference GeNeMe*, 2018, pp. 191–200.

[11] Kepala BKSAM, *Keputusan Kepala BSKAM Kemendikbud Ristek No 024/H/KR/2022 tentang Konsentrasi Keahlian SMK/MAK pada Kurikulum Merdeka*. Indonesia, 2022.

[12] D. Jatmoko, "Relevansi kurikulum SMK kompetensi keahlian teknik kendaraan ringan terhadap kebutuhan dunia industri di Kabupaten Sleman," *J. Pendidik. Vokasi*, vol. 3, no. 1, pp. 1–13, 2013, doi: http://dx.doi.org/10.21831/jpv.v3i1.1572.

[13] E. Mulyana, "Kesesuaian Kemampuan Lulusan SMK di Dunia Kerja (Studi Kasus pada Kontraktor Listrik di Jawa Barat)," *proceedingfptk*, vol. 436, 2015.

[14] C. W. Wati, R. M. Sugandi, and Isnandar, "Analysis of job competency requirements in the construction services industry for vocational high school of construction and property engineering expertise programs," *Int. J. Innov. Creat. Chang.*, vol. 8, no. 1, pp. 29–38, 2019.

[15] I. Putranto, "PENGEMBANGAN MODEL KERJA SAMA LINK AND MATCH UNTUK MENINGKATKAN KESIAPAN KERJA BAGI LULUSAN SMK KOMPETENSI KEAHLIAN AKUNTANSI DI KOTA SEMARANG," *J. Mandiri Ilmu Pengetahuan, Seni, dan Teknol.*, vol. 1, no. 1, pp. 68–83, Jun. 2017, doi: 10.33753/mandiri.v1i1.10.

[16] R. W. Daryono, A. P. Yolando, A. Jaedun, and N. Hidayat, "Competency of vocational schools required by construction industry in consultants' supervisor," *J. Phys. Conf. Ser.*, vol. 1456, no. 1, p. 012057, Jan. 2020, doi: 10.1088/1742-6596/1456/1/012057.

[17] R. A. Tauhid, "Relevansi kompetensi lulusan SMK kompetensi keahlian bisnis konstruksi dan properti SMKN 1 cibinong dengan kompetensi yang diperlukan di dunia kerja," Universitas

Pendidikan Indonesia, 2022. [Online]. Available: http://repository.upi.edu/id/eprint/84375

[18]   N. S. Handriyanti, A. R. Asrib, and B. A. Rauf, "Relevansi Kompetensi Mata Pelajaran Menggambar Menggunakan Program Autocad di SMK Terhadap Kebutuhan Kompetensi Tenaga Drafter pada Jasa Konstruksi di Dunia Industri," Universitas Negeri Makassar, 2019. [Online]. Available: http://eprints.unm.ac.id/id/eprint/14073

[19]   S. Purnomo, E. Djufri, and A. Khaharsyah, "Pendidikan jarak jauh (PJJ) berbasis e-learning edmodo mahasiswa pendidikan vokasional teknik mesin," *J. Taman Vokasi*, vol. 8, no. 2, pp. 73–80, 2020, doi: https://doi.org/10.30738/jtv.v8i2.9053.

[20]   S. Warnandes, L. Hariyanto, and G. N. Indriatno Putra Pratama, "Relevansi Kompetensi Lulusan S1 Pendidikan Teknik Sipil dan Perencanaan Universitas Negeri Yogyakarta dengan Kebutuhan Dunia Industri Jasa Konstruksi Bidang Perencana," *J. Pendidik. Tek. Sipil*, vol. 4, no. 1, pp. 54–61, Jun. 2022, doi: 10.21831/jpts.v4i1.48489.

[21]   C. Yuliana, "Studi Pemahaman dan Penerapan Standar Kompetensi Keterampilan Kerja Tenaga Kerja pada Pelaksanaan Proyek Konstruksi," *J. Keilmuan dan Apl. Tek.*, vol. 10, no. 1, pp. 83–91, 2009, doi: http://dx.doi.org/10.20527/infotek.v10i1.1764.

[22]   Kementerian Pendidikan dan Kebudayaan, "Capaian Pembelajaran dan Alur Tujuan Pembelajaran," *CP & ATP*, 2024. https://guru.kemdikbud.go.id/kurikulum/referensi-penerapan/capaian-pembelajaran/smk/desain-pemodelan-dan-informasi-bangunan/fase-f/ (accessed Mar. 01, 2024).

[23]   Departemen Pekerjaan Umum, *Standar Kompetensi Kerja Nasional Indonesia (SKKNI), Pelaksana Lapangan Pekerjaan Gedung (Building Construction Engineer), Nomor Registrasi: INA 5231.213.01*. Jakarta: Departemen Pekerjaan Umum, 2007.

[24]   Departemen Pekerjaan Umum, *Standar Kompetensi Kerja Nasional Indonesia (SKKNI), Tukang Bekisting dan Perancah (Scafolding and Mold Worker), Nomer Registrasi: INA 5220*. Jakarta: Departemen Pekerjaan Umum, 2007.

[25]   M. Munadi and H. Abdillah, "Pengaruh Resolusi 3D CAD STL Pada Kualitas Geometri dan Dimensi (G&D) Produk Pola Cor 3D Printer," *Infotekmesin*, vol. 11, no. 2, pp. 130–136, Aug. 2020, doi: 10.35970/infotekmesin.v11i2.225.

[26]   W. Sanjaya, *Kurikulum dan Pembelajaran: Teori dan Praktik Pengembangan Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Kencana Prenada, 2011.