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The Relevance of Curriculum for Building Modeling and Information Design in Response to Business and Industry Needs in the Digital Era

Yullyani Sartika Ningsih¹⁾, Fahmi Rizal ²⁾, Faisal Ashar³⁾, M. Giatman⁴⁾

¹⁾ Universitas Negeri Padang, Padang, Indonesia

E-mail: yullyani.sartika@gmail.com

²⁾ Universitas Negeri Padang, Padang, Indonesia

E-mail: fahmi@ft.unp.ac.id

³⁾ Universitas Negeri Padang, Padang, Indonesia

E-mail: faisalashar@ft.unp.ac.id

⁴⁾ Universitas Negeri Padang, Padang, Indonesia

E-mail: giatman@ft.unp.ac.id

 Correspondence Author

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Abstract

In the era of digital transformation, the construction industry increasingly demands professionals who are proficient in digital tools such as Building Information Modeling (BIM), 3D modeling, and virtual simulations. This study aims to evaluate the relevance of the Building Modeling and Information Design curriculum at SMKN 1 Bengkalis to the current needs of the business and industrial world. A mixed-methods approach was employed, combining document analysis of curriculum components with survey data from industry representatives to assess graduates' competencies. The results reveal that while core competencies such as 2D drafting and basic 3D modeling are well-covered and highly relevant, there are significant gaps in the areas of digital project management, advanced BIM proficiency, and the use of innovative tools like VR/AR. Employer feedback indicates moderate satisfaction with graduate readiness, especially in innovation, digital literacy, and collaborative skills. Based on these findings, the study recommends curriculum improvements such as the integration of BIM-based learning modules, incorporation of VR/AR tools, increased collaboration with industry, and the offering of professional certifications. These enhancements are expected to better align vocational education with the evolving technological landscape of the construction sector. In conclusion, while the current curriculum provides a solid technical foundation, continuous updates and strategic partnerships with industry are essential to ensure its relevance in the digital era.

INTRODUCTION

The rapid advancement of digital technology has transformed nearly every sector of the economy, including the construction and design industries (Li, 2024; Wang & Ha-Brookshire, 2018). In this context, digital competencies such as Building Information Modeling (BIM), 3D visualization, and data-based project management have become essential skills for professionals entering the workforce. As a result, vocational education institutions are expected to adapt their curricula to align with the evolving demands of the digital era. Ensuring that students acquire relevant, industry-aligned skills is crucial for improving their employability and for maintaining the competitiveness of the national labor force (Mohamed Hashim et al., 2022; Tao et al., 2019).

Vocational high schools in Indonesia play a strategic role in preparing students to meet the specific needs of various industries. SMKN 1 Bengkalis, with its expertise in Building Modeling and Information Design, is one such institution tasked with equipping students with technical skills in construction design. However, questions remain about the extent to which its curriculum aligns with current digital industry requirements (Qasim & Kharbat, 2020; Southworth et al., 2023; Stoeckli et al., 2018). It is therefore important to assess the curriculum's relevance, particularly in the areas of digital design, BIM application, and modern construction workflows.

The aim of this study is to evaluate the relevance of the Building Modeling and Information Design curriculum at SMKN 1 Bengkalis to the needs of the business and industrial sectors in the digital era. Specifically, this research seeks to identify which curriculum components align with current industry expectations, and which areas require revision or enhancement (Alam & Mohanty, 2022; Pappas et al., 2018). By bridging the gap between vocational training and workplace demands, the quality and effectiveness of vocational education can be significantly improved.

To achieve this objective, the study employed a mixed-methods approach, involving curriculum document analysis and surveys distributed to industry stakeholders (Agarwal & Sambamurthy, 2020; Jalinus et al., 2021). The results are analyzed to determine the strengths and weaknesses of the current curriculum and to provide evidence-based recommendations for curriculum improvement (Brahma et al., 2021; Cantú-Ortiz et al., 2020). It is expected that the findings will offer valuable insights for policymakers, educators, and industry partners seeking to strengthen the connection between vocational education and the digital construction landscape.

METHODS

This study employed a mixed-methods approach to evaluate the relevance of the Building Modeling and Information Design curriculum at SMKN 1 Bengkalis to the needs of the business and industrial sectors in the digital era. The research combined qualitative content analysis of the existing curriculum documents with quantitative data collected through structured questionnaires distributed to selected industry practitioners and employers. The curriculum analysis focused on identifying technical competencies taught in the program and comparing them with skills demanded by modern construction and design industries. The survey assessed employer satisfaction with graduate competencies in areas such as BIM, digital design tools, communication, and innovation. Data were analyzed descriptively to identify gaps and alignment between the school's curriculum and industry expectations.

RESULT AND DISCUSSION

To evaluate the alignment between the Building Modeling and Information Design curriculum at SMKN 1 Bengkalis and the demands of the digital-era business and industrial sectors, a comprehensive analysis was conducted. This analysis focused on three key aspects: the relevance of curriculum content to industry-required competencies, employer feedback on graduate performance, and strategic recommendations for curriculum improvement. The data were collected through curriculum document reviews and surveys distributed to selected industry professionals. The following tables present a summary of the curriculum-industry alignment, stakeholder perceptions of graduate readiness, and proposed curriculum development strategies based on the research findings.

Table 1. Curriculum Content and Industry Requirements Alignment

Curriculum Components	Industry Needs in Digital Era	Level of Relevance (High/Moderate/Low)
2D CAD Drafting (AutoCAD)	Digital Drafting & Documentation	High
3D Modeling (SketchUp, Revit)	BIM (Building Information Modeling) Skills	High
Construction Drawing Interpretation	Technical Drawing & Blueprint Reading	High
Manual Drawing Techniques	Less Used in Industry	Low
Project Management Basics	Digital Project Planning & Collaboration Tools	Moderate
Material Estimation	Cost Control with Software Tools (e.g. Excel, BIM)	Moderate
No exposure to VR/AR in Design	Virtual Simulation, Presentation	Low

This table shows the level of alignment between the current curriculum at SMKN 1 Bengkalis and the expectations from the business and industrial sector in the digital era. While digital drafting and BIM-related skills have high relevance, some components such as manual drawing techniques are less aligned with industry trends. Incorporating VR/AR and updated project management tools can enhance the curriculum's relevance.

Table 2. Industry Feedback on Graduate Competence

Competency Area	Employer Satisfaction (%)	Comments from Industry Representatives
Technical Drawing Skills	85%	Graduates are capable but need exposure to more complex projects
BIM Software Proficiency	60%	Basic skills present, but lack of advanced modeling techniques
Communication & Teamwork	75%	Satisfactory, but improvement in presentation skills is needed
Project Planning and Management	50%	Insufficient familiarity with digital project management tools
Innovation and Digital Literacy	45%	Limited understanding of modern tools like VR/AR, IoT in BIM

The table presents feedback from industry partners regarding the competencies of graduates. It indicates that while graduates perform well in technical drawing and teamwork, there is a noticeable gap in their proficiency with advanced BIM tools and modern digital technologies. This reflects the need for curriculum enhancement in these areas.

Table 3. Suggested Curriculum Enhancement Strategies

Proposed Improvement	Objective	Implementation Priority
Integrate BIM-based Learning Modules	Enhance 3D modeling and digital construction skills	High
Introduce VR/AR and Simulation Tools	Improve design visualization and presentation	Medium
Strengthen Collaboration with Industry Partners	Align training with real-world projects	High
Offer Certifications (e.g., Autodesk, Revit)	Improve graduates' credentials and employability	High
Include Digital Project Management Tools (e.g. MS Project)	Foster real-world project coordination experience	Medium

This table suggests strategies for improving the curriculum to better meet the needs of the digital-driven construction industry. Priority is given to integrating BIM, forging stronger industry linkages, and offering recognized certifications to increase student competitiveness. The adoption of digital project management and VR tools is also recommended to prepare students for future trends.

Discussion

The analysis of the curriculum components of the Building Modeling and Information Design program at SMKN 1 Bengkalis reveals a strong alignment with some core competencies required in the digital-era construction industry, particularly in 2D drafting and 3D modeling using software such as AutoCAD and Revit. These technical skills are highly relevant and valued by industry partners, as they form the foundation for modern Building Information Modeling (BIM) processes. However, there are components within the curriculum such as manual drafting techniques that are becoming increasingly obsolete due to automation and digital transformation in construction design practices (Dziubaniuk et al., 2023; Meyer & Norman, 2020).

Feedback gathered from employers indicates that while graduates possess solid technical drawing skills and demonstrate good teamwork, there is a notable gap in their familiarity with advanced digital tools and project management software. Specifically, only 60% of industry representatives were satisfied with graduates' BIM proficiency, and less than half acknowledged adequate innovation and digital literacy among graduates. This gap suggests that the curriculum has yet to fully integrate the latest technologies and practices used in professional settings, such as the use of VR/AR for design simulation or cloud-based collaboration tools (Ellahi et al., 2019; Jiao et al., 2021).

To address these issues, several improvement strategies have been proposed. High-priority recommendations include the integration of BIM-based modules, enhancement of collaboration with industry partners, and the inclusion of internationally recognized certifications such as Autodesk or Revit. These initiatives are expected to bridge the gap between classroom learning and industrial practice, thus enhancing the employability of students and their adaptability to workplace

demands. Furthermore, exposing students to real projects through internships or guest lectures from industry professionals can contextualize learning and provide practical insights (Fleaca & Stanciu, 2019; Reaves, 2019).

In addition to strengthening technical competencies, it is equally important to focus on digital innovation and future-ready skills. The incorporation of VR/AR tools for design visualization and the use of digital project management platforms can significantly improve the quality and relevance of student training (Abdullah & Hassanpour, 2021; Laovisutthichai et al., 2023). As the construction and design industries become more integrated with smart technology and data-driven processes, the curriculum must evolve accordingly. By continuously updating the content and teaching methods to align with technological advancements, vocational schools like SMKN 1 Bengkalis can ensure that their graduates remain competitive and responsive to industry developments in the digital era.

CONCLUSIONS

Based on the findings, it can be concluded that while the Building Modeling and Information Design curriculum at SMKN 1 Bengkalis provides a strong foundation in fundamental technical skills such as 2D drafting and basic 3D modeling, it does not yet fully meet the evolving needs of the business and industrial sectors in the digital era. Key areas such as advanced BIM proficiency, digital project management, and the integration of innovative technologies like VR/AR remain underdeveloped. Therefore, curriculum enhancement through the integration of modern digital tools, industry-recognized certifications, and stronger collaboration with industry stakeholders is essential to ensure that graduates are better prepared for the demands of the current and future construction industry.

CONFLICTS OF INTEREST STATEMENT

Regarding this study, the author declares that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Study concept and design: Yullyani Sartika Ningsih. Acquisition of data: Fahmi Rizal. Analysis and interpretation of data: Faisal Ashar. Drafting the manuscript: Yullyani Sartika Ningsih. Critical revision of the manuscript for important intellectual content: M. Giatman. Statistical analysis: Yullyani Sartika Ningsih.

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