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Evaluation of the implementation of the learning program Design Modeling and Building Information SMK Negeri 1 Bengkalis

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Abstract
The growing importance of Building Information Modeling (BIM) in the AEC industry highlights the need for its integration in vocational education. This study evaluates the Design Modeling and Building Information program at SMK Negeri 1 Bengkalis, focusing on planning, implementation, and assessment. Using a quantitative descriptive approach, data were gathered from teachers and students through surveys, observations, and document analysis. The results show that the planning aspect received an average score of 88.8%, categorized as *Good*, with strengths in lesson planning and curriculum structure. The implementation aspect scored 82%, also *Good*, though student engagement and use of technology need improvement. The assessment aspect averaged 85%, with competency achievement rated *Very Good*, yet feedback and follow-up practices remain underdeveloped. In conclusion, the learning program has been generally well implemented, but further enhancement is needed in integrating digital tools, strengthening industry relevance, and promoting student-centered learning. These improvements are crucial for aligning vocational education with evolving AEC industry demands.

INTRODUCTION

Building Information Modeling has become a revolutionary tool in the fields of architecture, engineering, and construction, facilitating the visualization and integration of design, planning, and construction processes into a unified digital model. Its adoption continues to grow globally, not only as a modeling tool but also as a strategy for enhancing efficiency and collaboration across disciplines (Azhar et al., 2015; Khosrowshahi & Arayici, 2017). In Indonesia, the integration of

BIM into educational systems, particularly in vocational schools, is still in its early stages despite its potential to equip students with highly sought-after competencies (Putra & Supriadi, 2020; Yuliana & Nugroho, 2021). As construction projects increasingly demand BIM-literate workers, educational institutions are under pressure to adapt their curricula to align with these industry standards (Purnomo & Arief, 2022; Sucipto et al., 2023).

Vocational high schools are essential in preparing skilled labor aligned with industrial and technological advancements. However, most still rely on conventional teaching methods, which are insufficient for developing students' digital and project-based competencies (Hasibuan, 2021; Wardani & Setiawan, 2019). The Indonesian government has promoted the "Link and Match" program between education and industry to address this issue, yet implementation gaps persist (Rahmawati et al., 2022; Prasetyo et al., 2021). Furthermore, limited infrastructure, lack of trained teachers, and minimal access to BIM software tools remain significant challenges in vocational education (Wulandari & Subekti, 2020; Hartono & Susilawati, 2018). Therefore, evaluating the effectiveness of BIM-oriented learning programs in vocational schools becomes a strategic step toward curriculum reform.

To implement BIM effectively in vocational education, several aspects must be evaluated: planning, implementation, and assessment. Curriculum planning should consider industry alignment, instructional strategies, and resource availability (Latifah & Rachman, 2022; Pranoto & Yulianti, 2021). Implementation must involve active learning strategies such as project-based learning and real-world simulations to enhance student engagement and practical competence (Sudjimat et al., 2021; Kurniawan & Sari, 2023). Moreover, assessments must reflect both technical knowledge and performance-based outcomes, ensuring students are not only theoretically capable but also ready for industry tasks (Arifin et al., 2020; Fatmawati & Sari, 2021). These elements form the basis for an effective vocational BIM curriculum that can meet the expectations of the AEC industry.

This study aims to evaluate the implementation of the *Design Modeling and Building Information* learning program at SMK Negeri 1 Bengkalis through the lens of planning, implementation, and assessment. Previous studies have emphasized the importance of evaluating vocational programs using comprehensive instruments to ensure they meet expected competency standards (Rosyidah & Munir, 2019; Puspitasari et al., 2021). By analyzing these three aspects, the study seeks to identify strengths, limitations, and potential improvements in the program. Ultimately, the findings will contribute to enhancing the quality of vocational education in Indonesia and preparing students to adapt to the increasingly digitalized construction industry (Liana et al., 2024; Ramadhani & Yusuf, 2023; Maulidina & Azzahra, 2023).

METHODS

This study employed a quantitative descriptive research design aimed at evaluating the implementation of the *Design Modeling and Building Information* learning program at SMK Negeri 1 Bengkalis. The evaluation focused on three main aspects: planning, implementation, and assessment. The research instruments included structured questionnaires**,** observation sheets**,** and document analysis**.** Respondents consisted of subject teachers involved in the program and students participating in the Design Modeling and Building Information learning activities. The instruments were developed based on standard indicators of vocational learning quality and were validated through expert judgment to ensure content relevance and clarity.

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Data collection was carried out over a four-week period during the second semester of the academic year. The collected data were then quantitatively analyzed using descriptive statistics, calculating percentage scores for each indicator to determine the effectiveness level within each aspect. The interpretation of the results was guided by classification criteria (Very Good, Good, Fair, and Poor) commonly used in educational evaluations. To strengthen the findings, triangulation was conducted by comparing questionnaire responses with observational notes and documentation, such as lesson plans and student work samples. This method ensured a comprehensive understanding of the strengths and weaknesses in the current implementation of the learning program.

RESULT AND DISCUSSION

The evaluation of the learning program *Design Modeling and Building Information* at SMK Negeri 1 Bengkalis was conducted by analyzing three key aspects: planning, implementation, and assessment. Data were collected through questionnaires, observations, and documentation, then analyzed to determine the effectiveness of the program in achieving its educational objectives. The evaluation aimed to identify strengths and areas needing improvement to support students' competency development in line with industry demands. The results are presented in the following tables along with detailed discussions for each aspect.

Table 1: Evaluation of Planning Aspect of the Learning Program

Indicator	Score (%)	Category
Availability of lesson plans (RPP)	92%	Very Good
Suitability with curriculum standards	89%	Good
Learning objective clarity	91%	Very Good
Availability of teaching materials	87%	Good
Integration of industrial needs	85%	Good
Average	88.8%	Good

The planning aspect shows a strong performance with an average score of 88.8%, which falls under the "Good" category. The highest indicator is the availability of lesson plans (92%), indicating that teachers consistently prepare their learning tools. The integration of industry needs is slightly lower (85%), showing room for improvement in aligning the curriculum with the latest trends in design modeling and building information.

Table 2: Evaluation of Implementation Aspect of the Learning Program

Indicator	Score (%)	Category
Use of interactive learning methods	86%	Good
Application of project-based learning	82%	Good
Utilization of technology in learning	80%	Good
Student engagement and participation	78%	Fair
Supervision during practicum	84%	Good
Average	82%	Good

The implementation aspect receives an average score of 82%, categorized as "Good." While most components such as learning methods and supervision are well executed, student engagement (78%) remains relatively low, suggesting a need for more active learning strategies or motivational

efforts. Technology integration (80%) is adequate but should be improved to meet the digital demands of the building information sector.

Table 3: Evaluation of Assessment and Outcome Aspect

Indicator	Score (%)	Category
Variety of assessment methods	85%	Good
Feedback provided to students	83%	Good
Alignment with learning objectives	87%	Good
Student competency achievement	88%	Very Good
Follow-up on learning outcomes	82%	Good
Average	85%	Good

The assessment and outcome evaluation averaged 85%, categorized as "Good." Students generally achieve the competencies targeted in the curriculum (88%), reflecting effective instruction. However, feedback and follow-up mechanisms (83% and 82%) could be further strengthened to ensure continuous improvement and personal development of students. Implementing more reflective or portfolio-based assessments could support this need.

General Conclusion:

The evaluation of the Design Modeling and Building Information learning program at SMK Negeri 1 Bengkalis shows that the program is generally well implemented. All aspects Planning, Implementation, and Assessment—fall into the Good category with opportunities for enhancement, particularly in student engagement, technology integration, and alignment with industry developments. Strengthening partnerships with industry and adopting more innovative teaching approaches could elevate the program to an "Excellent" category.

Discussion

The findings from the planning aspect show that the learning program at SMK Negeri 1 Bengkalis is well-structured and aligns with educational standards. The high score in the availability of lesson plans and clarity of objectives reflects effective instructional design and preparation by the teachers. This result is consistent with prior studies emphasizing the role of detailed lesson planning in achieving learning success in vocational schools (Sutarto, 2017; Putra & Ningsih, 2018). Furthermore, the integration of industrial needs, although adequate, still requires better alignment with current building and modeling technologies, as emphasized by researchers who note that vocational education must adapt to rapid technological advancement (Yulianti et al., 2020; Kurniawan & Iskandar, 2022). Proper planning helps ensure that curriculum design meets the competencies required by the job market, a view supported by recent findings on competency-based curriculum development (Nugroho, 2019; Fatmawati & Sari, 2021).

The implementation aspect also demonstrates good performance, especially in the application of interactive and project-based learning methods. These strategies have been shown to significantly improve student motivation and practical skills, particularly in technical and design-related fields (Rahmawati & Huda, 2019; Wardani et al., 2022). However, student engagement and the use of technology in instruction still show limitations. This aligns with studies reporting that vocational teachers often face challenges in maintaining student interest and integrating digital tools effectively

into learning (Susanto & Lestari, 2021; Hasanah et al., 2023). As supported by Pranoto and Suryani (2020), incorporating real-world projects and industry-standard software in classroom activities can enhance learning relevance and engagement. Moreover, active student participation is essential in vocational settings, as supported by Wahyuni et al. (2018) and Irawan & Dewi (2022), who argue that experiential learning is more effective than traditional approaches.

Assessment and learning outcomes are also rated positively, indicating that the program effectively measures students' competencies. The use of diverse assessment methods and the alignment of assessments with learning objectives reflect best practices in vocational education (Fitriyani & Sukmawati, 2017; Arifin et al., 2020). However, the slightly lower scores in feedback and follow-up suggest a gap in formative assessment practices, which are critical for student improvement. Several studies argue that consistent and constructive feedback significantly contributes to skill mastery and self-evaluation among vocational students (Rosyidah & Munir, 2019; Puspitasari et al., 2021). Moreover, as noted by Saputra & Wulandari (2022) and Latifah et al. (2023), follow-up actions such as remediation or enrichment programs are essential in ensuring that all students meet the required competency levels. These practices are particularly crucial in preparing students for industry certifications or internships.

Overall, the results suggest that the *Design Modeling and Building Information* learning program has been implemented effectively, though improvements are still needed to maximize its impact. The moderate scores in technology use and student engagement reflect national trends, where many vocational schools struggle to fully integrate digital tools and learner-centered strategies (Handayani & Subekti, 2016; Wicaksono & Anjani, 2021). Strengthening partnerships with industry stakeholders and adopting innovative learning models such as blended learning or augmented reality can provide a more immersive and up-to-date learning experience (Maulidina et al., 2022; Azzahra & Nurhayati, 2023). Additionally, empowering teachers through professional development in instructional technology is a key strategy suggested by multiple scholars (Hartono & Susilawati, 2018; Liana et al., 2024; Ramadhani & Yusuf, 2023). Future research and program revisions should focus on integrating emerging technologies, increasing student-centered approaches, and deepening industry collaboration.

CONCLUSIONS

Based on the findings, it can be concluded that the implementation of the *Design Modeling and Building Information* learning program at SMK Negeri 1 Bengkalis has been generally effective across the aspects of planning, implementation, and assessment. The planning aspect demonstrates well-structured lesson preparation and alignment with curriculum standards, while the implementation aspect reflects the application of interactive methods despite challenges in student engagement and technology integration. Assessment practices show that students largely achieve the expected competencies, although formative feedback and follow-up mechanisms require improvement. Overall, the program meets a good level of effectiveness but still needs enhancement in digital integration and industry-based learning strategies to fully align with the evolving demands of the Architecture, Engineering, and Construction (AEC) industry.

CONFLICTS OF INTEREST STATEMENT

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

AUTHOR CONTRIBUTIONS

Study concept and design: Septia Rahman. Acquisition of data: Ari Syaiful Rahman Arifin. Analysis and interpretation of data: Fahmi Rizal. Drafting the manuscript: Septia Rahman. Critical revision of the manuscript for important intellectual content: M. Giatman. Statistical analysis: Septia Rahman.

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