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# Development of the MyLathe Application Based on Discovery Learning to Improve Student Learning Outcomes in Lathe Machining at Vocational High Schools

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**Abstract**
This study aims to develop a learning application called MyLathe for eleventh-grade students in the Mechanical Engineering program at vocational high schools (SMK). The application is designed to support the discovery learning model and can be accessed via smartphones, laptops, and web platforms, enabling flexible and user-friendly learning experiences. The research employs the ADDIE development model, consisting of five phases: Analysis, Design, Development, Implementation, and Evaluation. The feasibility of MyLathe was evaluated through expert validation. Media expert validation yielded an Aiken's V value of 0.93, while content validation scored 0.96, both indicating high validity. The reliability coefficients for both media and content exceeded 0.40, meeting acceptable standards. The effectiveness of the application was measured using an independent sample t-test, which yielded a t-value of 11.561, exceeding the critical t-table value of 1.999. This indicates a statistically significant improvement in student learning outcomes. Additionally, the N-Gain analysis showed an increase in the average pre-test score from 46.06 to a post-test score of 62.67 in the experimental class, with a comparable pre-test average of 46.84 in the control class. Practicality testing involving both teachers and students yielded a score of 92%, classified as "highly practical." These findings suggest that the MyLathe application is a valid, reliable, effective, and practical digital learning tool for enhancing learning in machining subjects at vocational high schools.

**Keywords**: learning application, vocational education, discovery learning, ADDIE model, MyLathe, machining, digital education tool

## INTRODUCTION

Education is a fundamental pillar in the development of a nation, particularly in preparing human resources who are adaptive, innovative, and capable of responding to global challenges (Rosienkiewicz et al., 2024). In the context of vocational education, its purpose extends beyond the mere transmission of knowledge; it also encompasses the development of practical skills aligned with dynamic industrial demands (Poschauko et al., 2024). The rapid advancement of information and communication technologies has brought significant transformation across various sectors, including the education system. Consequently, vocational education must undergo a comprehensive transformation to produce graduates who are not only technically proficient and digitally literate, but also equipped to navigate the evolving demands of Industry 4.0 and the emerging Society 5.0 paradigm, which emphasizes the integration of technological advancement with human-centered values (Shahidi Hamedani et al., 2024).

The quality of learning is a critical indicator in achieving educational goals. As stated by Al Mardhiyyah et al. (2021), the quality of instruction delivered significantly influences changes in students' behavior across cognitive, affective, and psychomotor domains. In vocational education, learning success is measured not only by how well students understand theoretical concepts but also by how effectively they can apply them in real-world work contexts. Therefore, instructional design must be integrated and consider students' characteristics, learning content, instructional models, and the media employed in the learning process.

In the current digital era, teachers are expected to serve not only as instructors but also as instructional designers (Rigopouli, K., Kotsifakos, D., & Psaromiligkos, Y., 2025). Educators must be capable of designing learning strategies that are engaging, interactive, and aligned with the needs of the digital generation (Kiryakova, G., & Kozhuharova, D., 2024). As technology continues to advance, students are increasingly familiar with digital devices such as smartphones, laptops, and tablets (Pellas, N., 2024; Ametordzi, S., &

Olalere, F., 2024). Consequently, the integration of technology into the learning process has become inevitable. Anisa et al. (2021) emphasize that the use of digital technology in education holds great potential for enhancing students' comprehension of learning materials and boosting their motivation to learn.

One of the major challenges in teaching machining techniques at vocational high schools (SMK) lies in the complexity of the subject matter, particularly in the area of lathe machining. This subject requires not only conceptual understanding but also high levels of precision in practical skills. However, limited access to practical equipment, restricted instructional time, and the continued use of conventional teaching methods often hinder the achievement of optimal learning outcomes. According to a study by Purwoko et al. (2020), the use of digital media in machining instruction can provide clear and engaging visualizations of machine operations, thereby helping students to better grasp the material prior to engaging in hands-on practice.

The conventional instructional model, which remains predominant in machining instruction, is often teacher-centered, relying heavily on lectures and limited demonstrations. This approach tends to reduce students' active participation and limits opportunities for developing critical thinking skills. According to Wulandari et al. (2024), addressing this issue requires a shift toward more participatory and contextual learning models. One such relevant approach is the *discovery learning* model, which positions students as active agents in the learning process, directly engaging in the exploration and discovery of knowledge.

The discovery learning model is an instructional approach that emphasizes learning through direct experience, observation, analysis, and conclusion-drawing by the learners themselves. According to Bruner (as cited in Ritonga, 2021), learning becomes more meaningful when students are directly involved in the process of discovering concepts. This model is considered highly suitable for complex subject matter such as machining, as it trains students to deeply understand concepts, solve real-world problems, and develop higher-order thinking skills. Previous studies by Kawuri et al. (2020), Izabella et al. (2021), and Hulu & Telaumbanua (2022) have shown that discovery learning can improve learning outcomes, student engagement, and learning autonomy. However, to optimize the implementation of the discovery learning model, instructional media that support interactivity and flexibility are essential. In this regard, the use of digital learning applications presents a highly promising alternative. Well-designed learning applications not only deliver content but also offer exploratory activities, simulations, and interactive assessments. Such applications enable learning to take place beyond the physical classroom, expanding students' learning experiences across time and space.

Based on these needs, the development of the *MyLathe* application represents a strategic step in supporting lathe machining instruction in vocational high schools. The application was developed using the Smart Apps Creator platform, which facilitates the creation of interactive content for both mobile and web-based learning. *MyLathe* is designed to allow students to access instructional materials, view animated demonstrations of lathe machine operations, engage with digital simulations, and conduct self-assessments. One of its main advantages is its accessibility across multiple devices—including Android smartphones, laptops, and web browsers—providing flexibility for use in various instructional settings. The development of *MyLathe* followed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), a systematic and adaptable framework for instructional media development. In the analysis phase, the learning needs, student characteristics, and instructional context were thoroughly identified. During the design and development phases, the application was constructed based on the analysis results and aligned with learning objectives and the pedagogical principles of discovery learning. The implementation and evaluation phases were conducted to examine the validity, practicality, and effectiveness of the product in improving student learning outcomes.

Validation of the application was conducted by subject matter experts and media experts using a validity assessment instrument analyzed through Aiken's V index. The results indicated a very high level of validity for the application. In addition, the practicality test was carried out through questionnaires administered to teachers and students, focusing on ease of use, visual design, and the application's perceived usefulness in the learning process. Effectiveness testing involved comparing pre-test and post-test results between the control and experimental groups, using statistical analysis through independent sample t-tests and N-Gain scores to evaluate learning improvement. In the context of vocational education, where graduates are expected to be job-ready and adaptable to the latest industrial technologies, the development of instructional media such as *MyLathe* plays a crucial role in learning transformation. This application not only supports effective learning in lathe machining but also fosters 21st-century skills such as problem-solving, creativity, collaboration, and digital literacy. By integrating technology with discovery-based pedagogy, *MyLathe* offers an innovative learning media model that is highly applicable for other vocational subjects as well.

Accordingly, this study aims to develop the *MyLathe* application using Smart Apps Creator and a discovery learning approach to enhance student learning outcomes in lathe machining. The study also seeks to evaluate the feasibility of the media in terms of its validity and reliability, as well as assess its effectiveness and practicality in instructional use. The findings of this study are expected to contribute meaningfully to the advancement of digital learning innovation in vocational education and serve as a reference for developing similar media in technical and vocational learning contexts in Indonesia.

## RESEARCH METHOD

### Analysis

The analysis stage involved conducting a needs assessment to identify problems in the teaching and learning process of lathe machining in vocational high schools (SMK), particularly related to the lack of engaging, interactive learning media that support active learning approaches. This analysis was carried out through literature review, field observations, and discussions with vocational subject teachers.

### Design

Based on the analysis results, the *MyLathe* application was designed to include structured content, user interface layout, interactive features, and integration with the discovery learning model. The application design was developed using the Smart Apps Creator platform, considering interactivity principles, ease of access, and alignment with the curriculum.

### Development

At this stage, the initial *MyLathe* prototype was developed based on the design specifications. The development process was carried out in stages and included limited trials to identify both technical and pedagogical shortcomings. The product was then revised based on feedback and input from expert validators.

### Implementation

The developed application was implemented in the learning process for Grade XI students in the lathe machining subject at vocational high schools. Implementation was carried out through direct instruction, where the application was used during several learning sessions designed using the discovery learning approach.

### Evaluation

The evaluation stage aimed to measure the feasibility, practicality, and effectiveness of the *MyLathe* application in improving student learning outcomes. Evaluation was conducted using expert judgment instruments, user feedback, and assessments of student learning achievements.

## RESULT AND DISCUSSION

At the analysis stage, several problems were identified in the teaching and learning process of lathe machining, including: (1) the existing learning media failed to capture students' attention; (2) students found the existing materials difficult to understand; (3) there is a need for learning media that enables students to learn independently; (4) students require flexible media that can be accessed anytime and anywhere without external assistance; (5) there is a need for more practical, user-friendly media for students; (6) an effective learning medium is needed to improve students' achievement in lathe machining.

These findings highlight the urgent need for innovation in the delivery of lathe machining instruction in vocational education. The first issue—students' lack of engagement with existing learning media—suggests that current instructional tools fail to provide the visual, interactive, and contextual experiences required by today's learners, particularly in technical subjects that demand concrete understanding. When students perceive learning materials as uninteresting or irrelevant, their motivation and retention tend to decrease significantly.

The second issue relates to the cognitive accessibility of the learning content. If the materials are overly abstract or presented in a way that is not aligned with students' prior knowledge and learning styles, comprehension becomes difficult. This is particularly problematic in subjects like machining, where a strong conceptual understanding is foundational for successful hands-on application.

The third and fourth issues reflect students' growing need for autonomy and flexibility in learning. In the digital era, students are increasingly accustomed to learning through self-paced digital platforms that are accessible beyond classroom walls. Therefore, the absence of media that supports independent learning and is accessible anytime, anywhere, presents a major gap in the current instructional approach.

The fifth issue—the lack of practical, user-friendly tools—underscores the importance of designing learning media that is intuitive and easily navigable, especially for vocational students who may prioritize usability and efficiency over complexity. Lastly, the sixth finding reaffirms the central goal of this development project: the creation of a digital learning medium that not only addresses the aforementioned issues but also leads to measurable improvements in student learning outcomes, particularly in mastering technical competencies in lathe machining.

In sum, these six challenges collectively point to a clear need for a new kind of instructional tool—one that is visually engaging, cognitively accessible, flexible, easy to use, and demonstrably effective. The MyLathe application is designed as a direct response to these needs, aiming to fill the existing gaps and enhance the quality of learning in vocational machining education.

Based on the identified problems at the analysis stage, it became clear that the development of a responsive and student-centered learning application was essential to address the instructional gaps in lathe machining education. These findings informed the direction and focus of the next phase—namely, the design stage—where instructional and technical aspects of the application were carefully planned. The design process was carried out by considering the specific learning needs of vocational students, the characteristics of lathe machining content, and the pedagogical foundation of discovery learning. The goal was to create a learning environment that is not only visually appealing and interactive, but also accessible, flexible, and aligned with the principles of effective vocational instruction.

At the design stage, the following instructional and technical designs were developed:

Figure 1. Aplikasi MyLathe Home Menu

Figure 2. Aplikasi MyLathe Material

At the development stage, as a continuation of the design process, the final version of the *MyLathe* application was refined based on suggestions and feedback from media and content experts. Revisions were made to address the expert recommendations, ensuring improvements in both pedagogical and technical aspects of the application. During the implementation stage, the MyLathe learning application was applied within the instructional context of the Mechanical Engineering expertise concentration. The implementation was carried out at two vocational schools: SMK Muhammadiyah 1 Klaten Utara served as the experimental group, while SMK Batur Jaya 1 Ceper functioned as the control group.

The final stage of the R&D method using the ADDIE approach is the evaluation phase. This phase involved assessing all previously completed development stages—Analysis, Design, Development, and Implementation—by evaluating three key dimensions: the feasibility of the MyLathe application, its effectiveness in improving learning outcomes, and its practicality in classroom use. The feasibility study was based on expert judgment collected through evaluation sheets completed by media and content experts, each holding a master's-level qualification in their respective fields.

To ensure the quality of the developed product, a validity test was conducted, based on the criteria established by Aiken (1985), to confirm the content validity of the application. In addition, a reliability test was carried out, following the procedures outlined by Zaki (2017), to determine the internal consistency and stability of the media. The results of both tests indicated that the MyLathe learning application is both valid and reliable, confirming its eligibility for use as an effective instructional tool in vocational machining education.

Table 1: Results of Independent Sample Test Pretest Calculation

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| Result Pretest TPB | Equal variances assumed | 2,570 | ,114 | ,432 | 62 | ,667 | ,778 | 1,800 |
| | Equal variances not assumed | | | ,429 | 56,500 | ,670 | ,778 | 1,814 |

The results of the effectiveness analysis revealed that the pre-test scores, when analyzed using an independent sample t-test, yielded a t-value of 0.432 and a significance value of 0.667. Since the significance value is greater than 0.05, it can be concluded that there was no statistically significant difference in the initial abilities of students in the control and experimental groups. This indicates that both groups had comparable baseline competencies before the intervention.

Normality testing was conducted using the Kolmogorov-Smirnov method. The control group produced a statistic of 0.129 with a significance value of 0.178, while the experimental group yielded a statistic of 0.144 with a significance value of 0.098. As both significance values are greater than 0.05, the data for both groups can be considered normally distributed. The next assumption test was for homogeneity of variance. The homogeneity test produced a significance value of 0.242. Since this value exceeds the 0.05 threshold, it can be concluded that the variance between the control and experimental groups is homogeneous, indicating that the two groups had equal variance in their post-test scores.

Table 2 Results of the Independent Sample Test Potentiation

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| Result TPB | Equal variances assumed | 1,241 | ,270 | 11,561 | 62 | ,000 | 20,817 | 1,801 |
| | Equal variances not assumed | | | 11,627 | 61,195 | ,000 | 20,817 | 1,790 |

The post-test scores were analyzed using an independent sample t-test, resulting in a calculated t-value of 11.561, which exceeds the critical t-table value of 1.999. Since the t-value is significantly greater than the critical threshold, it can be concluded that there is a statistically significant improvement in student learning outcomes. This indicates that the use of the *MyLathe* application, integrated with the discovery learning model, had a positive and meaningful impact on students' mastery of lathe machining concepts.

Table 3: Results of N-gain Calculation

| Class | Average Pree-test | Average Post-Test | N-Gain | Criteria |
|---|---|---|---|---|
| Experimental | 46,84 | 83,48 | 68% | High |
| Control | 46,06 | 62,67 | 30% | Medium |

The N-Gain analysis revealed that the control group had an average pre-test score of 46.06 and a post-test score of 62.67, resulting in an N-Gain of 30%, categorized as a moderate level of improvement. Meanwhile, the experimental group achieved an average pre-test score of 46.84 and a post-test score of 83.48, yielding an N-Gain of 68%, which falls into the high improvement category. These results indicate that the experimental group experienced a more substantial gain in learning outcomes, supporting the effectiveness of the *MyLathe* application combined with the discovery learning model.

The practicality test involved 24 participants teachers and students, who acted as practitioners and partial users of the *MyLathe* application. The practicality evaluation showed that the application received an average score of 92% from users, classified as "highly practical." This reflects the application's ease of use, clarity of content, and alignment with users' expectations in vocational learning environments.

Overall, *MyLathe* has demonstrated its potential to be used effectively by both teachers and students in the teaching and learning process of lathe machining. Given its high validity, effective instructional impact, and practical usability, it can be concluded that the development of the *MyLathe* application, integrated with the discovery learning model, significantly enhances student learning outcomes in lathe machining instruction.

## CONCLUSION

This study aimed to develop the MyLathe learning application based on the discovery learning model to improve student learning outcomes in the subject of lathe machining at vocational high schools. The development process followed the ADDIE model, consisting of analysis, design, development, implementation, and evaluation stages. The validation results indicated that the application met the standards of feasibility in terms of both content quality and media design, making it a suitable tool to support the learning process.

The implementation of the MyLathe application demonstrated a positive impact on students' understanding and engagement. Learners demonstrated greater activity, motivation, and curiosity during the learning activities, as the interactive features of the application encouraged exploration and independent discovery, aligning with the principles of discovery learning. The learning process became more dynamic and student-centered, allowing learners to construct their knowledge through contextual and meaningful experiences.

In addition to improving conceptual understanding, the application was found to be user-friendly and practical for both teachers and students. Feedback from users indicated that the application was easy to navigate, visually engaging, and effectively supported flexible learning, whether used individually or in group settings. Overall, the development of the MyLathe application represents an innovative step in enhancing vocational education, particularly in machining subjects. The application has proven to be valid, practical, and effective in improving learning outcomes and is well-aligned with the demands of digital transformation and active learning approaches in technical and vocational education.

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