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MINI REVIEW: ANALYSIS OF THE APPLICATION OF GAME-BASED LEARNING IN VOCATIONAL EDUCATION OF LATHE MACHINING

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Abstract

This article examines the application of the Game-Based Learning (GBL) model in learning lathe machining techniques in Vocational High Schools (SMK). Lathe machining techniques are machining processes to produce cylindrical machine parts that are machined using a lathe with a rotating workpiece subjected to a single-point cutting tool that is parallel to the axis of the workpiece at a certain distance. Efforts to improve learning lathe machining techniques require an effective learning model, namely the game-based learning model. This research method uses the Systematic Literature Review (SLR) approach which examines previous relevant literature studies, the number of databases of 35 articles, 10 articles that were extracted data, 6 articles that were relevant in 2020–2025 based on inclusion criteria using the google schoolar search engine, and publish or perish. The results of the study showed that GBL had a positive impact on increasing learning motivation, student involvement, and learning outcomes in turning practices. The conclusion shows that the GBL approach can effectively be a solution for practice-based learning in SMK. These findings recommend wider adoption of GBL in technical vocational education.

Keywords: Game-Based Learning, Lathe Machining, SMK, Vocational Education, SLR

INTRODUCTION

Vocational education is a form of education that encompasses various fields of work where individuals can develop careers and contribute productively to society as well as to industries and businesses that require specific skills. Vocational education is designed to develop attitudes, skills, competencies, work habits, and appreciation that are needed in entering the world of work and in achieving meaningful and productive job progress (Ritonga, 2022). Among the core institutions in vocational education are Vocational High Schools (SMK), which are expected to become centers for the development of knowledge and skills, responding directly to labor market demands (R. Hidayat & Abdillah, 2019). One of the key vocational disciplines needed in industries is mechanical engineering, particularly machining. Machining refers to the process of removing material from a workpiece to achieve a specific geometry using machine tools, typically with a cutting tool acting upon the workpiece (Yudianto & Almuddin, 2023). Among machine tools, the lathe is one of the most commonly used. Lathe machining is a manufacturing process used to produce cylindrical parts by rotating the workpiece and applying a single-point cutting tool parallel to its axis (Sutrisna, Nugraha, & Dantes, 2019). However, the lathe machining learning model in vocational schools faces several significant challenges. These obstacles include limited access to expensive machines with dependence and stability of existing production machines, so that it does not achieve the expected vocational education (Sumbodo, Setiadi, & Sudiyono, 2024). The risk of injury during practical learning of turning of student work objects, some were hit on the face and hands until they were blistered because of holding the turned object, students' feet were hit by the work object, tools were placed carelessly, tools were used not according to their function and so on (Nurmahmudi, Rifelino, Nabawi, & Irzal, 2024). Limited time during lathe machining practice activities is less effective in achieving the lathe competencies that students obtain (A. Hidayat & Kartowagiran, 2021). The causes of these shortcomings include low student motivation, lack of learning resources in the classroom, students' difficulty in finding independent study materials, and ineffective teaching methods. An effective learning model must match student needs and characteristics to foster critical thinking, collaboration, and increased learning interest (Almaghfiroh & Darmawan, 2025).

One instructional approach that aligns with these needs is the Game-Based Learning (GBL) model (Mavromihales, Holmes, & Racasan, 2019). Game Based Learning (GBL) integrates play-based strategies with educational objectives to create engaging and meaningful learning experiences, based on constructivist learning principles (Pinedo, García-Martín, Rascón, Caballero-San José, & Cañas, 2022). This solution can examine the gap in the challenges of learning lathe machining techniques with a systematic literature review in collecting, analyzing, and summarizing previous literature findings using the Systematic Literature Review (SLR) approach which can enable identification of patterns, trends, and recommendations for

evidence of effective and relevant learning models. (Cabrera, Cabrera, & Cabrera, 2023). Therefore, this study aims to systematically review the literature on the implementation of GBL in vocational lathe machining education, including strategies, learning outcomes, challenges, and future opportunities. The findings are expected to provide both theoretical and practical foundations for improving vocational teaching practices.

METODS

This study employed a Systematic Literature Review (SLR) methodology. A systematic literature review is defined as the process of identifying, evaluating, and interpreting all available research relevant to a specific research question or topic (Kitchenham, 2014). In addition, SLR allows researchers to construct relevant hypotheses and understand patterns or trends in existing studies. According to (Wulangsih, Salma, Sa'diyah, & Wulandari, 2024) the SLR process in this study follows the PRISMA flow diagram and consists of several defined steps, as illustrated in Figure 1.

The main characteristic of this research method is that the data is derived from previously validated and published scientific studies related to the research question. The focus of this study is on analyzing the application of Game-Based Learning (GBL) to improve instructional outcomes in lathe machining.

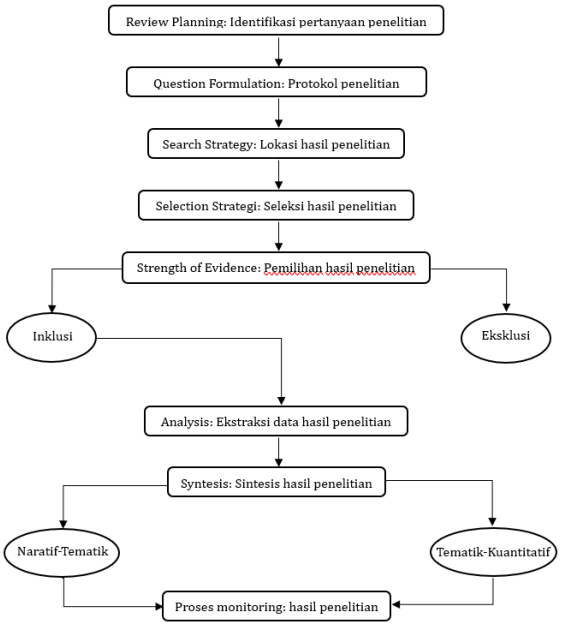

Figure 1. PRISMA Flowchart for Systematic Literature Review Method

The SLR process began with the formulation of a systematic protocol, followed by a structured literature search. The stages of the SLR were adapted from
(Perry & Hammond, 2002):

Table 1. Stages

No	Process Stage	Purpose
1	Identify the research question	Determine specific and relevant questions based on the observed issue.
2	Develop the systematic review protocol	Provide guidance on inclusion/exclusion criteria, search strategy, data extraction, and synthesis.
3	Determine the database search area	Define scope of search (e.g., Google Scholar, Publish or Perish).
4	Select relevant studies	Gather research articles aligned with the research question.
5	Choose high-quality studies	Apply inclusion and exclusion criteria to ensure methodological rigor.
6	Extract data from individual studies	Gather variables, sample size, methods, and statistical outcomes.
7	Synthesize results using narrative and thematic approaches	Interpret findings using narrative and thematic synthesis.
8	Present results	Report findings in a structured and academic format.

Based on the framework above, the following SLR protocol was developed and applied:

1. Research Questions:
   - How is Game-Based Learning implemented in lathe machining instruction?
   - Is the GBL model effective for vocational high school students?
2. Protocol Specifications:
   - Study Type: Journal articles
   - Location: Indonesia
   - Publication Year: 2020–2025, The year of publication of the journal article is no more than 5 years to approach relevant research results.
   - Subject: Vocational High School (SMK), Mechanical Engineering major
   - Indexing: SINTA 1 to SINTA 6

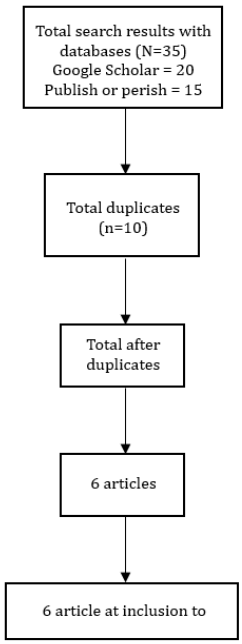

Figure 2. PRISMA Flow of Inclusion Article Selection

3. Search Strategy:
   - Databases: Google Scholar, and Publish or Perish.
   - Keywords: "Game-Based Learning", "lathe machining", and "vocational education".

4. Selection of research results for the search area

Literature selection using the PRISMA method can be seen in the following figure2. Researchers conducted an article search through Google Scholar and publish or perish with the keywords game-based learning model, machining techniques, lathes found 35 articles. Furthermore, researchers analyzed all of them found a total of 10 duplicate articles. 6 articles included in the quality literature study. The quality of the article was also assessed through the PRISMA flow checklist scheme.

5. Selecting quality research results with inclusion and exclusion criteria

Systematic Literature Review (SLR) selection through Inclusion and Exclusion criteria in selecting articles that will later be included in the analysis. These criteria are as follows:

Table 2. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Published between 2020–2025	Review articles not based on primary research
Full Paper	Articles not related to game based learning
Focus on GBL, lathe machining, and vocational education	General discussion without relevance to topic

After knowing the inclusion and exclusion criteria in the research articles being searched for, they can be selected according to the criteria. The following are research articles that are already appropriate and will be included in the inclusion criteria article:

Table 3. Article Inclusion Criteria

No	Article Title	Writer
1	Application Of Kahoot Learning Media Based On Game Based Learning To Improve Motivation, Activeness, And Learning Outcomes Of Class X Students Of Machinery Engineering Smkn 2 Surabaya	(Saputra & Ramdani, 2024)
2	Learning Media Model With The Use Of Lathe Machine Simulation Applications As A Learning Support For Students In Vocational Schools	(Iqbal et al., 2022)
3	Evaluation Of The Use Of Lathe Simulator Software Using The User Experience Questionnaire	(Prasetyo, Suprapto, Sari, & Sari, 2022)
4	Effectiveness of Swansoft CNC Simulation Software Implementation on Students' Psychomotor Learning Outcomes in Non-Conventional Machining Engineering Elements in Vocational High Schools	(Andariansyah et al., 2025)
5	EFFECTIVENESS OF TEAMS GAMES TOURNAMENTS (TGT) LEARNING METHOD ON STUDENTS' COMMUNICATION ABILITIES	(Toifur & Kurniawan, 2022)
6	Development of Interactive Learning Media Using Articulate Storyline for Conventional Mechanical Engineering Subjects	(Putra, Samidjo, & Johan, 2023)

RESULT AND DISCUSSION

The review process resulted in the selection of six articles based on relevance, research methods, and key findings. These articles were analyzed thematically and narratively as follows:

1. APPLICATION OF KAHOOT LEARNING MEDIA BASED ON GAME BASED LEARNING TO IMPROVE MOTIVATION, ACTIVENESS, AND LEARNING OUTCOMES OF CLASS X STUDENTS OF MACHINERY ENGINEERING SMKN 2 SURABAYA

This study employed a classroom action research method using a quantitative approach, involving 35 tenth-grade students majoring in Mechanical Engineering at SMKN 2 Surabaya. The average pre-test score was 67 with only 25% classical completeness. Only 3% of students demonstrated high motivation and 9% showed active participation. In Cycle I, the average score rose to 89 with 88% completeness; 78% showed very high motivation, and 75% high engagement. In Cycle II, the average score improved to 93, with 94% completeness, 94% motivation, and 97% engagement.

Conclusion: Kahoot-based GBL significantly improved students' motivation, engagement, and learning outcomes, and is effective for use in vocational technical education.

Limitations: Kahoot learning media based on game-based learning cannot yet be applied to other subject materials.

2. Learning media model with the use of lathe machine simulation applications as a learning support for students in vocational schools

This literature-based study explored the use of lathe simulation apps as substitutes for hands-on practice in vocational machining programs. The findings suggested that such applications can overcome the limitations of physical workshops, especially during online learning, while also enhancing engagement and learning efficiency.

Conclusion: Simulation-based GBL media are feasible for use in vocational education, increasing motivation and supporting practice-based learning in both online and offline contexts.

Limited: there has been no further application of lathe machine simulation.

3. Evaluation of the Use of Lathe Simulator Software Using the User Experience Questionnaire

Using a quantitative descriptive approach, this study evaluated the user experience of the Lathe Simulator software via the User Experience Questionnaire (UEQ). Thirty respondents with prior lathe experience participated. The highest ratings were found in Efficiency (1.875) and Stimulation (1.783), while Attractiveness (1.722) and Dependability (1.483) were also favorable. However, Perspicuity (1.417) and Novelty (0.9) were relatively lower.

Conclusion: The Lathe Simulator is effective and practical, with strong potential to support virtual machining instruction when access to physical equipment is limited.

Limitations: conducting a review in this study on the variables perspicuity and novelty.

4. Effectiveness of Swansoft CNC Simulation Software Implementation on Students' Psychomotor Learning Outcomes in Non-Conventional Machining Engineering Elements in Vocational High Schools

This quasi-experimental study involved 54 eleventh-grade students in a mechanical engineering program. No statistically significant difference was found in post-test scores between the control and experimental groups (85.17 vs. 85.32). However, the N-Gain in the experimental group was 0.613, compared to 0.594 in the control group.

Conclusion: Although the difference was not significant, Swansoft CNC was shown to be moderately effective in improving students' psychomotor skills in CNC operation.

Limitations: there has been no addition of computer media in using simulation software for learning non-conventional machining techniques.

5. EFFECTIVENESS OF TEAMS GAMES TOURNAMENTS (TGT) LEARNING METHOD ON STUDENTS' COMMUNICATION ABILITIES

This systematic literature review analyzed studies involving the TGT cooperative learning model. The model includes phases such as goal setting, class presentations, group formation, gameplay, tournaments, and recognition. These stages foster communication, collaboration, and self-confidence.

Conclusion: TGT is highly effective in enhancing communication skills, aligning well with the vocational focus on soft skill development.

Limitations: there has been no development of research contributions in the development of research on the effectiveness of the TGT cooperative learning model on students' communication skills.

6. Development of Interactive Learning Media Using Articulate Storyline for Conventional Mechanical Engineering Subjects

This R&D study followed the ADDIE model and developed Android-based media using Articulate Storyline. It focused on teaching lathe spindle speed calculations. Expert validation yielded scores of 3.26 (content expert) and 3.74 (media expert), while practicality was rated at 3.54 (teachers) and 3.38 (students). The classical completeness score reached 71%.

Conclusion: The interactive media was found to be feasible, practical, and effective in improving learning outcomes, especially in theoretical aspects of lathe machining.

Limitations: it is expected that there will be an application of articulate storyline in conventional mechanical engineering lessons.

Table 4. Thematic and Quantitative Synthesis

No	Theme	Dominant Learning Outcome	Effectiveness	Key Results
1.	Kahoot	Cognitive + Motivation	Very Effective (94%)	Motivation and learning outcomes increased
2.	Lathe Simulator	Virtual Comprehension	Practical (UEQ Score: 1.875)	Appropriate to use, online practice, Efficient, and interesting
3.	Swansoft CNC	Psychomotor	N-Gain: 61.3%	Quite effective
4.	TGT	Communication (Soft Skills)	Descriptive - Effective	Student communication increased
5.	Articulate Storyline	Cognitive	Effective (71%)	Media appropriate, effective

Visualization of Content Analysis focuses most on aspects of learning outcomes and the use of quantitative approaches, while aspects such as communication skills and interactive media are still less explored in depth. The following figure shows the distribution of focus from the 6 articles reviewed in this SLR study.

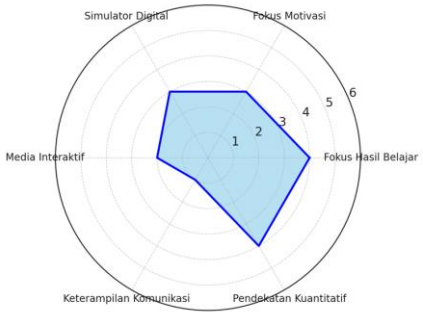

Figure 3. Content Analysis of SLR GBL Articles Lathe Machining Techniques

The radar section visualizes the frequency of occurrence of each thematic focus in the six articles reviewed. Each axis represents a specific theme identified through content analysis:

- Learning Outcomes (Fokus Hasil Belajar)
- Student Motivation (Fokus Motivasi)
- Digital Simulator Use (Simulator Digital)
- Interactive Media (Media Interaktif)
- Communication Skills (Keterampilan Komunikasi)
- Quantitative Approach (Pendekatan Kuantitatif)

From the visualization, we can conclude that the majority of the reviewed studies concentrated on cognitive learning outcomes and quantitative assessments (each mentioned in four articles), followed by digital simulator use and motivation (three articles each). Interactive media received moderate attention (two articles), while communication skills were the least discussed theme (only one article).

This thematic imbalance highlights the current research emphasis on measurable academic performance and the lack of representation of affective and interpersonal domains. This suggests the need for future studies to explore how GBL can also be leveraged to strengthen communication, collaboration and engagement, particularly in vocational education contexts where these competencies are equally important.

This visualization also supports the argument that Game-Based Learning (GBL) in lathe engineering learning in vocational schools has been widely used to improve motivation and learning outcomes, but needs strengthening in the integration of interactive media and the development of soft skills such as communication.

The discussion of the article based on the thematic-quantitative approach of content analysis visualization is divided into 4 as follows:

1. Learning Outcome Theme

Three of the six articles present quantitative data related to improving student learning outcomes. The use of Kahoot media in the Game-Based Learning (GBL) model by Saputra & Ramdani (2024) showed a classical completion of 94%, the highest among all studies. The Articulate Storyline model showed a completion of 71% (Putra et al., 2023), while Swansoft CNC had an N-Gain of 61.3% (Andariansyah et al., 2025), categorized as "quite effective". This shows that GBL has great potential in improving theoretical understanding and psychomotor skills of vocational high school students.

2. Keaktifan Motivation and Activeness Theme

Saputra & Ramdani (2024) reported an increase in learning motivation from only 3% to

94%, and activeness from 9% to 97% after the implementation of GBL. The data shows that students' effective aspects increased sharply using learning methods combined with game elements. This is important in vocational education that requires active involvement.

3. Digital Media and User Experience Theme

The evaluation of the Lathe Simulator using the User Experience Questionnaire (UEQ) instrument showed high scores on efficiency (1,875) and stimulation (1,783), which means that this simulator is efficient and motivates users. However, the novelty value is only 0.9, this indicates a lack of innovation from the student's perspective.

4. Soft Skills and Communication

The article (Toifur & Kurniawan, 2022) discusses the effect of GBL on soft skills. Through the Teams Games Tournament (TGT) model, students are trained to communicate, collaborate, and compete healthily. Although it does not present quantitative data, this study confirms the relevance of GBL to 21st century competencies.

The findings in this study are in line with international research results that show the effectiveness of Game-Based Learning in engineering education. Research in the United States found that GBL is able to increase students' intrinsic motivation and problem-solving abilities in the context of STEM education (Qian & Clark, 2016). Research in Belgium also shows that the application of GBL in mechanical engineering learning is able to increase concept retention and active student engagement during the learning process. This shows that the GBL approach is not only relevant in the Indonesian context, but has also been proven effective globally, especially in vocational education that emphasizes the mastery of practical skills (All, Nuñez Castellar, & Van Looy, 2016).

CONCLUSIONS

Based on the results of the research and discussion that have been described, it can be concluded that the application of game-based learning models to lathe machining techniques shows significant results in improving learning of lathe machining techniques by adding variations of game applications to the game-based learning model, then this learning model is often used by machining engineering teachers in educating vocational high school students. This learning model is quite effective and efficient to use because every vocational high school student really likes games during learning. The game-based learning model is also effective and practical in vocational high school learning in the field of mechanical engineering in general, so that the GBL model is very supportive of learning theory and workshop practice. The game-based learning model is highly recommended to be further developed through its game application in learning machining techniques in general, especially lathe machining techniques, so that teachers can practically use the GBL model which can provide good feedback to students.

Suggestions in this study for teachers can improve their ability in using learning media in game-based learning, for academics learning media must be more innovative to be developed in the game-based learning model, and this study can provide contributions regarding the application of the game-based learning model to vocational education in lathe machining engineering, and for researchers in this study can be used as a reference for literature that will have a long-term impact.

REFERENCE

Agus Saputra, L., & Hasbi Ramdani, A. (2025). Penerapan Media Pembelajaran Kahoot Berbasis Game Based Learning Untuk Meningkatkan Motivasi, Keaktifan, dan Hasil Belajar Siswa Kelas X Teknik Pemesinan SMKN 2 Surabaya. *Jurnal Pendidikan Teknik Mesin Unesa*, *01*(01), 1–8. Retrieved from https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-teknik-mesin/article/view/65909

All, A., Nuñez Castellar, E. P., & Van Looy, J. (2016). Assessing the effectiveness of digital game-based learning: Best practices. *Computers and Education*, *92–93*, 90–103. https://doi.org/10.1016/j.compedu.2015.10.007

Almaghfiroh, Z. A., & Darmawan, D. (2025). Pengaruh Model Pembelajaran Terhadap Minat Belajar Siswa Tingkat Madrasah Tsanawiyah. *QOSIM : Jurnal Pendidikan, Sosial & Humaniora*, *3*(1), 104–119. https://doi.org/10.61104/jq.v3i1.724

Andariansyah, P., Prihantoro, C. R., & Nugraha, H. D. (2025). Efektivitas Penerapan Software Swansoft CNC Simulation Terhadap Hasil Belajar Psikomotorik Siswa pada Elemen Teknik Pemesinan Nonkonvensional di SMK. *Jurnal Pendidikan Teknik Mesin Undiksha*, *13*(1), 75–85. /https://doi.org/10.23887/jptm.v13i1.91248

Cabrera, D., Cabrera, L., & Cabrera, E. (2023). The Steps to Doing a Systems Literature Review (SLR). *Journal of Systems Thinking*, *6*(April), 1–28. https://doi.org/10.54120/jost.pr000019.v1

Hidayat, A., & Kartowagiran, B. (2021). Penilaian Hasil Belajar Praktik Pemesinan Bubut diSMK N 1 Gombong di Masa Covid-19. *Jurnal*

Dinamika Vokasional Teknik Mesin, *6*(2), 174–180. https://doi.org/10.21831/dinamika.v6i2.44137

Hidayat, R., & Abdillah. (2019). *Buku Ilmu Pendidikan Konsep, Teori dan Aplikasinya*. (C. Wijaya & Amiruddin, Eds.) (Pertama). Medan: Lembaga Peduli Pengembangan Pendidikan Indonesia (LPPPI).

Kitchenham, B. (2014). Procedures for Performing Systematic Reviews. *Keele University Technical Report*, *33*(2004), 1–26. Retrieved from https://www.researchgate.net/publication/228756057

Mavromihales, M., Holmes, V., & Racasan, R. (2019). Game-based learning in mechanical engineering education: Case study of games-based learning application in computer aided design assembly. *International Journal of Mechanical Engineering Education*, *47*(2), 156–179. https://doi.org/10.1177/0306419018762571

Nurmahmudi, Rifelino, Nabawi, R. A., & Irzal. (2024). Analisis Risiko Keselamatan Kerja di Mesin Bubut Menggunnakan Metode HIRARC. *Jurnal Inovasi Dan Pengabdian Kepada Masyarakat*, *3*(1), 112–122. https://doi.org/10.58578/aldyas.v3i1.2428

Perry, A., & Hammond, N. (2002). Systematic Reviews: The Experiences of a PhD Student. *Psychology Learning & Teaching*, *2*(1), 32–35. Retrieved from https://journals.sagepub.com/doi/epdf/10.2304/plat.2002.2.1.32

Pinedo, R., García-Martín, N., Rascón, D., Caballero-San José, C., & Cañas, M. (2022). Reasoning and learning with board game-based learning: A case study. *Current Psychology*, *41*(3), 1603–1617. https://doi.org/10.1007/s12144-021-01744-1

Prasetyo, R., Suprapto, Sari, M. P., & Sari, M. H. R. S. R. (2022). Evaluasi Penggunaan Software Lathe Simulator Dengan Menggunakan User Experience Questionaire. *Jurnal Al-Azhar Indonesia Seri Sains Dan Teknologi*, *7*(3), 200–206. http://dx.doi.org/10.36722/sst.v7i3.1239

Putra, Y., Samidjo, S., & Johan, A. B. (2023). Pengembangan Media Pembelajaran Interaktif Menggunakan Articulate Storyline Untuk Mata Pelajaran Teknik Permesinan Konvensional. *Jurnal Taman Vokasi*, *11*(1), 111–118. https://doi.org/10.30738/jtvok.v11i1.12873

Qian, M., & Clark, K. R. (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior*, *63*, 50–58. https://doi.org/10.1016/j.chb.2016.05.023

Ritonga, A. K. (2022). Pengembangan dan Pembinaan Karir Guru di bidang Pendidikan Kejuruan. *JISIP (Jurnal Ilmu Sosial Dan Pendidikan)*, *6*(2), 3973–3982. http://dx.doi.org/10.58258/jisip.v6i2.3042

Sumbodo, W., Setiadi, R., & Sudiyono, S. (2024). Vocational High School Learning Management: Opportunities and Challenges in the Industrial Revolution 4.0 Era, *Veic*, 79–83. https://doi.org/10.2991/978-2-38476-198-2_9

Sutrisna, K., Nugraha, I. N. P., & Dantes, K. R. (2019). Pengaruh Variasi Kedalaman Potong Dan Kecepatan Putar Mesin Bubut Terhadap Kekasaran Permukaan Benda Kerja Hasil Pembubutan Rata Pada Bahan Baja St 37. *Jurnal Pendidikan Teknik Mesin Undiksha*, *5*(3). https://doi.org/10.23887/jjtm.v5i3.20248

Toifur, A., & Kurniawan, W. D. (2022). Efektivitas Metode Pembelajaran Teams Games Tournaments (TGT) Terhadap Kemampuan Komunikasi Siswa. *Jurnal Pendidikan Teknik Mesin Unesa*, *11*(2), 147–153. Retrieved from https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-teknik-mesin/article/view/47205

Vikri Iqbal, M., Abdillah, H., Fawaid, M., Abizar, H., & Supriyatna, D. (2022). Model Media Pembelajaran dengan Pengunaan Aplikasi Simulasi Mesin Bubut Sebagai Penunjang Belajar Siswa di SMK. *Vocational Education National Seminar (VENS)*, *01*(01), 90–95. Retrieved from https://jurnal.untirta.ac.id/index.php/VENS/article/view/15742/9009

Wulangsih, D. F., Salma, S. M., Sa'diyah, L. A., & Wulandari, A. (2024). Systematic Literature Review (Slr): Pengukuran Kinerja Pada Sektor Pendidikan Menggunakan Balanced Scorecard. *Jatilima : Jurnal Multimedia Dan Teknologi Informasi*, *6*(2), 87–101. https://doi.org/10.54209/jatilima.v6i02.435

Yudianto, H., & Almuddin, A. (2023). *Dasar-Dasar Teknik Mesin*. (S. Maharani, Ed.) (Pertama). Jakarta Selatan: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. Retrieved from https://static.buku.kemdikbud.go.id/content/pdf/bukuteks/kurikulum21/Dasar-Teknik-Mesin-BS-KLS-X.pdf