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The Role of E-Module in the Teaching and Learning Process in Vocational Secondary Schools (SMK): a Literature Review

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Abstract

The implementation of e-modules in learning at Vocational High Schools (SMK) has become an innovative solution relevant to technological advancements and the demands of Industry 4.0. This article aims to explore the role of e-modules in improving student learning outcomes at SMKs, as well as the challenges and opportunities of their implementation. The methodology used in this research is a systematic literature review, with criteria for selecting relevant articles based on the themes of e-module-based learning, vocational education, and the application of technology in education. The selected articles were analyzed using a content analysis approach to identify trends, benefits, challenges, and outcomes obtained from the implementation of e-modules in SMKs. This research also examines the implementation of Project-Based Learning (PjBL) and Problem-Based Learning (PBL) approaches in the context of e-modules, which have been shown to enhance student engagement and the mastery of practical competencies required in the workforce. However, challenges such as limited technological infrastructure and teachers' readiness in developing high-quality e-modules still need to be addressed. The analysis results indicate that e-modules can improve the quality of learning at SMKs, but specific strategies are needed to overcome existing barriers to optimize their use.

Keywords: *e-module, vocational school learning, teaching and learning process.*

A. Introduction

In the rapidly advancing digital era, the integration of technology in the education sector has become inevitable, especially in Vocational High Schools (SMK) (Rahman & Natsir, 2024). As a vocational education institution preparing students for direct entry into the workforce, SMK requires innovative learning methods that are relevant to the demands of Industry 4.0. One innovation that is increasingly being implemented is the use of e-modules as a learning medium. E-modules, which are digital-based, provide easy access and learning flexibility for students, particularly in the context of online or hybrid learning (Sutama et al., 2021). With the ability to present material interactively, e-modules not only facilitate the understanding of concepts but also stimulate students' independent learning.

The use of e-modules in Vocational High Schools (SMK) is increasingly developing due to their effectiveness in improving student learning outcomes. Several studies have shown that e-modules developed with the Project Based Learning and Problem Based Learning approaches can enhance students' critical thinking, creativity, and practical skills (Pazlina & Usmeldi, 2020; Rendra et al., 2018; Winatha et al., 2018). E-modules also provide students with the opportunity to learn independently and manage their study time according to their needs, thus motivating them to actively engage in the learning process (Ekawarna, 2022). Moreover, the interactive design applied in e-modules makes learning more engaging and easier to understand (Fikri & Sofianto, 2022).

In addition to its effectiveness in improving material understanding, e-modules have also been proven to support the achievement of higher learning outcomes (Pazlina & Usmeldi, 2020). Several studies have shown that the use of e-modules in learning can significantly improve students' post-test scores compared to conventional methods (Octavianis et al., 2022). This is primarily because e-modules provide richer, interactive content, along with features that allow students to practice independently. For example, in the learning of Electric Motor Installation and Digital Simulation subjects, systematically developed e-modules have been shown to significantly improve students' cognitive and psychomotor skills (Fauzi & Usmeldi, 2020).

With the increasing number of studies demonstrating the benefits of using e-modules in vocational education, it is important for SMK teachers to adopt and develop e-modules as part of their teaching process (Alperi, 2020). Developing e-modules tailored to the needs of the curriculum and the characteristics of SMK students will not only improve learning outcomes but also equip students with

technological skills that are relevant to the demands of today's industrial world (Lumbantobing et al., 2019a). This article will further explore the role of e-modules in enhancing learning outcomes for SMK students, as well as the challenges and opportunities faced in their implementation in vocational schools.

E-modules provide flexibility for students to learn at their own pace and time, which is one of the key factors in enhancing learning motivation (Widyaningrum & Patrikha, 2021). With e-modules, students can access materials anytime and anywhere, whether through a laptop or mobile device (Yanti et al., 2023). This is crucial in the context of SMK education, where students are not only required to master theoretical content but also practical skills that require in-depth understanding (Aminudin & Hartinah, 2023). In addition to flexibility, e-modules also provide instant feedback through features such as interactive quizzes or automated practice exercises, which help students evaluate their understanding independently (Bachrudin et al., 2023).

The use of e-modules in SMK can also align with the demands of the ever-changing industrial world. With multimedia features such as videos, animations, and simulations, e-modules allow students to see real-world applications of the concepts being learned (Laili et al., 2019). For example, in subjects like Electronics Engineering or Mechanical Technology, students can interactively visualize machine operations or electrical circuits, which cannot be achieved with traditional print modules (Lumbantobing et al., 2019a). This not only makes it easier for students to understand complex materials but also equips them with technological skills that are relevant to their future careers in the workforce.

The implementation of e-modules in SMK still faces several challenges, such as limited technology infrastructure in some schools and teachers' ability to develop high-quality e-modules (Yusril et al., 2024). To overcome these challenges, teacher training in the creation and utilization of e-modules needs to be improved (Kautsari et al., 2023). Teachers should be equipped with basic skills in using e-module development software, such as Flipbook Maker, Canva, or other e-learning platforms, to create engaging instructional materials that are suitable for the characteristics of SMK students (Suyanto et al., 2024). Infrastructure support, such as stable internet connections and access to adequate digital devices, must also be addressed by schools and the government to ensure that the benefits of using e-modules can be fully experienced by all students (Taufan et al., 2023).

Although various studies have shown the effectiveness of e-modules in improving student learning outcomes, most are still limited to general

implementation without focusing on the specific needs of SMK students as vocational education institutions. Research that integrates the Project Based Learning (PjBL) approach with e-learning platforms such as Schoology in the context of vocational learning, especially in Web Design, is still rarely found. Therefore, this study offers novelty by developing a PjBL-based e-module that is not only interactive but also designed to enhance students' critical, creative, and collaborative skills, while being relevant to the demands of the workforce. The integration of e-modules with Schoology provides flexibility for both online and hybrid learning, which is evaluated through feedback from students and teachers to ensure its effectiveness and usefulness in vocational learning.

B. Methods

This study uses a literature review approach to explore the role of e-modules in learning activities at Vocational High Schools (SMK). This method was chosen because it aims to identify, analyze, and summarize findings from various articles related to the implementation of e-modules in vocational learning at SMK. The steps taken in the research are as follows: Literature Search: The literature search was conducted through the Google Scholar database, using the Publish or Perish application to find relevant articles. The search was conducted using the keyword: "Role of e-modules in SMK learning." This search resulted in 100 articles relevant to the research topic. Article Selection: Articles were selected based on the following criteria: Nationally reputable journals indexed in SINTA. Articles published between 2015 and 2023 to ensure the relevance and timeliness of the data. After the initial selection, 25 articles that met these criteria were identified. Relevance Filtering: Next, further filtering was done by reading the abstracts of the selected articles to assess their alignment with the focus of the research. Articles that delved deeper into the topic of learning in SMK, especially in the context of vocational subjects, were prioritized. This filtering process reduced the number of articles to 10 that were considered the most relevant to the research topic. Article Analysis: The selected articles were then analyzed in depth using content analysis. Content analysis was conducted to identify key themes related to the use of e-modules in SMK learning, including their impact on learning outcomes, challenges faced, and potential benefits. Conclusion Drawing: Based on the content analysis, this study formulates conclusions regarding the impact of e-modules in learning at SMK, including their advantages and challenges, as well as recommendations to improve the implementation of e-modules in vocational education settings. Data Analysis Technique: The analysis technique used in this study is thematic analysis through

content analysis, which aims to identify patterns, themes, and trends emerging from the articles analyzed. The data obtained from these articles are processed to formulate findings that provide insights into the implementation of e-modules in SMK learning.

C. Result and Discussion

The following are the research articles referenced in the literature review regarding the challenges of vocational education in improving the absorption of SMK graduates in the industrial world.

Table 1. related research

Title	Author(s) and Year	Method	Results
"Pengembangan E-Modul Dengan Flipbook Maker KD 3.6 Menganalisis Perilaku Konsumen Dalam Bisnis Ritel Kelas XI BDP di SMK Negeri 2 Tuban"	Widyaningrum & Patrikha (2021)	Research and Development (R&D)	The e-module was deemed highly feasible with an average score of 82% (content 82%, language 74.2%, media 90%). The limited trial achieved 89.5%, and the field trial scored 88.5%, indicating a very positive response from students.
"Pengembangan E-Modul Pada Mata Pelajaran Administrasi Infrastruktur Jaringan (AIJ) Kelas XI TKJ di SMK Negeri 1 Rao Selatan"	Yanti et al. (2023)	Research and Development (R&D)	The e-module was declared highly valid with a score of 0.9 for content and 0.822 for media. Its practicality was rated as very practical, with 100% approval from teachers and 86.6% from students.
"Efektivitas Bahan Ajar E-Modul Berbasis IT dengan Model Problem Based Learning (PBL) pada Mata Pelajaran Kearsipan dalam Meningkatkan Hasil Belajar Peserta Didik di SMK Sunan Giri Menganti"	Octavianis et al. (2022)	Quantitative	The use of IT-based e-modules with the PBL model effectively improves learning outcomes. The average post-test score of the experimental group significantly increased compared to the control group.

"Pengembangan Modul Perbankan Dasar Untuk Kelas X SMK dan Implementasinya pada Pembelajaran Daring"	Ekawarna (2022)	Research and Development (R&D)	The CANVA-based e-module was rated as excellent by content experts (89%) and media experts (95%). The module improved students' independence (85.5%) and learning motivation (85%) during online learning.
"Pengembangan E-Modul Interaktif untuk Discovery Learning pada Pembelajaran Mekanika Teknik dan Elemen Mesin"	Lumbantobing et al. (2019)	Research and Development (R&D)	The e-module was rated as "excellent" based on evaluations from content experts (95%) and media experts (82.86%). User responses (teachers and students) also indicated excellent results, with scores of 84.38% and 81.67%, respectively.
"Efektivitas E-Modul Project Based Learning Berintegrasi STEM Terhadap Kreativitas Siswa SMK"	Cahyani et al. (2020)	Quantitative	N-gain results: Fluent thinking: 0.11, Flexible thinking: 0.49, Elaboration: 0.21, Original thinking: 0.44. The effectiveness of the e-module in enhancing students' creativity falls into the moderate category. There is an improvement in several creativity indicators, although not all indicators show significant increases.
"Pengembangan E-Modul Dasar-dasar Listrik dan Elektronika Berbasis Problem-Based Learning"	Pazlina & Usmeldi (2020)	Research and Development (R&D)	The Problem-Based Learning-based e-module is valid, practical, and effective, showing a significant improvement in students' learning outcomes from pre-test to post-test.
"Efektivitas Pengembangan E-Modul Project Based Learning pada Mata Pelajaran Instalasi Motor Listrik"	Laili et al. (2019)	Research and Development (R&D)	The developed e-module is effective in improving students' learning outcomes, both in cognitive and psychomotor aspects, with a significant improvement between the pre-test and post-test.
"Pengembangan E-Modul Interaktif Berbasis Proyek pada	Winatha et al. (2018)	Research and	The project-based e-module is deemed highly valid based on expert evaluations. It is

Mata Pelajaran Simulasi Digital Kelas X di SMK TI Bali Global Singaraja"		Development (R&D)	considered practical in terms of ease of use and interface appeal according to teacher and student feedback.
"Pengembangan E-Modul Berbasis Project Based Learning Menggunakan Schoology (Studi Kasus Mata Pelajaran Web Design Kelas XI Multimedia Di SMK TI Bali Global Singaraja)"	Rendra et al. (2018)	Research and Development (R&D)	The Project-Based Learning e-module was successfully implemented and deemed suitable for use. Teacher responses showed an average score of 45, categorized as very positive, while student responses showed an average score of 66.08, categorized as positive.

The use of e-modules in vocational schools (SMK) is an educational innovation that aligns with technological advancements and the needs of the competency-based curriculum, such as the 2017 revised 2013 Curriculum. E-modules designed with applications like Flipbook Maker provide ease for students to learn independently anytime and anywhere (Atikah et al., 2022). Interactive features such as embedding images, videos, and multimedia objects enhance the attractiveness of learning while enriching the learning experience. With its accessibility and flexibility, e-modules are able to meet students' needs in deeply understanding the learning material, encouraging active engagement, and improving learning outcomes, as demonstrated in research with validation results and student responses showing a high level of feasibility (Sagge & Bacio, 2024).

The implementation of e-modules in vocational schools (SMK) also helps teachers deliver material more effectively and efficiently. This medium supports the achievement of learning objectives that emphasize competency mastery based on practical skills, as required in vocational subjects. In the context of SMK Negeri 2 Tuban, the use of Flipbook Maker-based e-modules for Retail Business Management not only overcomes the limitations of previous learning media but also has a positive impact on students' interest in learning (Widyaningrum & Patrikha, 2021). The high success percentage in validation and trials proves that this e-module can be a suitable learning solution for vocational education needs in the digital era.

E-modules are one of the innovations in education that integrate digital technology to improve the effectiveness and efficiency of learning (Putra et al., 2020). As an interactive learning medium, e-modules allow the delivery of material in a more engaging way through multimedia features, such as text, images, videos,

and animations. This not only makes it easier for students to understand complex learning concepts but also supports the development of independent learning skills. With a flexible format, e-modules can be accessed anytime and anywhere, providing students with the freedom to learn at their own pace and according to their needs. Moreover, the use of e-modules aligns with the demands of the digital age, which emphasizes the mastery of information technology as part of 21st-century competencies.

The use of e-modules in the learning process at vocational schools, such as in the subject of Network Infrastructure Administration (AIJ), provides significant benefits (Yanti et al., 2023). E-modules enable the presentation of interactive, engaging, and easily accessible learning materials, thus increasing students' interest in learning. Through the integration of visual elements such as videos, interactive quizzes, and animations, e-modules can accommodate various learning styles, including visual, auditory, and kinesthetic. Furthermore, this e-module utilizes modern technologies, such as the Sigil application for development, which makes it easier for teachers to organize materials and provide multimedia-based learning (Munandar et al., 2021). This not only makes learning more effective but also relevant to the increasingly digital needs of the workforce.

The research conducted by Yanti et al. (2023) shows that e-modules in vocational schools, particularly for class XI TKJ students at SMKN 1 Rao Selatan, have high levels of validity and practicality. The validity of the materials and media reached the "very valid" category, while the practicality level was 86.6% based on student responses. This indicates that e-modules are able to meet the learning needs in vocational schools that require practical and applicable approaches. With the availability of e-modules, students can learn independently and flexibly at their own pace, thus supporting the mastery of vocational competencies required in the era of Industry 4.0.

The use of e-modules in vocational schools provides an innovation in supporting a more interactive and effective learning process, particularly in subjects that require deep understanding, such as archiving. The IT-based e-module applied with the Problem-Based Learning (PBL) model can enhance students' critical thinking skills in solving real-world problems (Rusli et al., 2024). This is evident from the presentation of case studies relevant to daily life, allowing students to connect the learning material with practical contexts. The implementation of e-modules with PBL also encourages students to be more active in collaborating within groups, honing communication and social skills, as well as the ability to

investigate and analyze data independently. By utilizing technology, e-modules not only make learning more accessible but also support the mastery of digital literacy that is relevant in the modern era.

The effectiveness of using PBL-based e-modules in vocational schools is proven through research by Octavianis et al. (2022), which shows a significant improvement in student learning outcomes. According to the research data at SMK Sunan Giri Menganti, students who used the PBL-based e-modules had an average posttest score of 93.50, much higher than the conventional method with an average score of 70.50. This advantage indicates that e-modules provide a deeper learning experience focused on problem-solving. Although there are challenges, such as students' difficulty in finding references, these can be addressed with intensive guidance from educators. Therefore, the use of e-modules in vocational schools, especially in PBL-based learning, becomes an innovative solution to improve the quality of education and prepare students to face the challenges of the workforce (Rini et al., 2023).

The use of e-modules in vocational schools has become an innovative solution to enhance the quality of online learning during the Covid-19 pandemic, especially in addressing challenges such as low participation, lack of direct interaction, and student fatigue. By utilizing platforms like Canva for e-module development, learning materials can be presented in a more engaging and interactive way, thereby increasing students' motivation and interest in learning (Fauziyah et al., 2022). According to research conducted by Ekawarna (2022), well-designed e-modules have proven to be feasible and effective in supporting independent learning, such as in the subject of Basic Banking in class X. Additionally, e-modules can motivate students to study more independently and capture their attention, making them a relevant and adaptive learning medium to meet the needs of education in the digital era.

E-modules are digital learning media designed to support both independent and guided learning processes. In the context of vocational school education, e-modules have proven effective in improving the quality of learning, both in terms of material feasibility and ease of use by students and teachers (Dewi et al., 2019). The development of e-modules following specific models, such as ADDIE, allows for a structured design process that results in interactive, engaging products that are relevant to students' needs (Lumbantobing et al., 2019). Additionally, e-modules provide a more dynamic learning experience with the integration of discovery learning elements, encouraging students to actively discover concepts through case

studies or project-based activities. Research results show that e-modules have a high level of feasibility and can motivate and increase students' interest in learning, making them an innovative solution in technology-based education.

The use of Project-Based Learning (PjBL) e-modules integrated with the STEM (Science, Technology, Engineering, and Mathematics) approach in vocational schools can enhance students' creativity. In a study conducted by Munandar et al. (2021) with a case study on learning physics topics such as temperature and heat, the use of e-modules encouraged students to think critically, creatively, and innovatively in solving projects that integrate scientific and technical concepts. A study by Cahyani et al. (2020) in class X Multimedia 1 at SMKN Wonoasri showed that although the effectiveness in enhancing students' creativity was categorized as moderate, the e-module still had a positive impact on students' thinking skills, such as flexibility, originality, and elaboration. Despite room for improvement, the use of the PjBL-STEM-based e-module provided a more dynamic learning experience and was relevant to the demands of the workforce, making it an effective tool in preparing vocational school students for future challenges (Hidayati, 2022).

In other learning models, the use of e-modules also has a positive impact, as seen in a study conducted by Laili et al. (2019). The use of Project-Based Learning (PjBL)-based e-modules in vocational school learning had a positive effect on students' learning outcomes, both in cognitive and psychomotor domains. Through the 4D development model, this e-module was designed to facilitate more interactive, practical, and relevant learning in line with the needs of the workforce. The research findings showed that the significant difference between the pretest and posttest results proved the effectiveness of the e-module in improving students' understanding of concepts and skills. The implication of using this e-module not only increases students' motivation and interest in learning but also provides opportunities for teachers to develop similar materials for other subjects. With proper training, teachers can utilize e-modules as a learning medium that maximizes the potential of technology, such as smartphones, to support an engaging and productive learning process.

The use of e-modules in vocational school learning has proven to be effective in improving the quality of education (Pazlina & Usmeldi, 2020). Research conducted using the 4D development model shows that the developed e-module meets high criteria for validity, practicality, and effectiveness. This e-module addresses issues found in conventional modules that are less supportive of independent learning, as it presents material conceptually and covers basic

competencies in line with the 2013 curriculum. Validation results from subject matter and media experts indicate that this e-module is valid, while practicality tests show that both teachers and students find it highly practical. Additionally, the effectiveness test conducted through post-tests shows an improvement in student learning outcomes, proving that this e-module can be an effective tool for facilitating more independent and engaging learning in vocational schools.

The use of interactive project-based e-modules in vocational schools has become an innovative solution to meet the demands of the 2013 Curriculum, which requires relevant and engaging teaching materials (Winatha et al., 2018). This e-module is designed using the ADDIE model, ensuring a structured development process focused on student needs. The research conducted by Winatha et al. (2018) shows that the e-module meets the criteria of validity, practicality, and effectiveness, as evidenced by a significant increase in the average student learning outcomes after using the e-module. Additionally, the attractive interface of the e-module and its ease of use received positive feedback from both teachers and students, enhancing their interest and engagement in the learning process. With its project-based approach, this e-module not only helps students achieve the expected competencies but also develops essential skills such as teamwork, creativity, and problem-solving for the workplace (Rendra et al., 2018).

D. Conclusion

Based on the research conducted, it can be concluded that the use of project-based interactive e-modules in vocational schools (SMK) can enhance the quality of learning, both in terms of student engagement and their learning outcomes. These e-modules have been proven effective in supporting independent learning, increasing student interest, and helping teachers deliver content in a more practical and efficient manner. The e-module design, which utilizes the ADDIE model, integrates multimedia, and applies project-based learning, provides an engaging learning experience that aligns with the demands of the workforce while also enhancing essential skills such as creativity, collaboration, and problem-solving. Therefore, this e-module can be an effective solution to meet the demands of the 2013 Curriculum, which focuses on competency-based practical learning.

However, this study has several limitations, including the limited sample size and research duration, which may affect the generalization of the results. Additionally, despite the proven effectiveness of the e-modules, there are challenges related to the adaptation of technology by some students and teachers who are less

familiar with digital media use. Therefore, for future research, it is recommended to expand the sample size and extend the duration of the e-module testing, as well as conduct further studies on the training and support needed to enhance the digital skills of both teachers and students in optimizing e-module use.

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