JVCE 10 (1) (2025) : 9-15

Journal of Vocational Career Education

https://journal.unnes.ac.id/nju/index.php/jvce

Application of Android-Based E-Module in Occupational Health, Safety, and Environmental Protection and Industrial Work Culture Material

Tedi Nurrokhman[1]✉, Muhammad Khumaedi[2], Yeri Sutopo[2]

[1]SMK Negeri 5 Semarang, Jawa Tengah, Indonesia
[2]Universitas Negeri Semarang, Indonesia

Article Info

Article History :
Received
October 2024
Accepted
January 2025
Published
July 2025

Keywords:
E-Module, Android, Occupational Health, Safety, and Environmental Protection, Industrial Work Culture

Abstract

The problem with learning Occupational Health, Safety, and Environmental Protection (OHS-EP) and Industrial Work Culture is that most students show a lack of enthusiasm in participating in lessons and struggle to understand the teaching material, particularly in important aspects such as the application of OHS-EP procedures, the use of personal protective equipment (PPE), and understanding the principles of industrial work culture. This study aims to apply and analyze the feasibility and effectiveness of an Android-based E-Module to improve the cognitive abilities of vocational school students on the subjects of OHS-EP and Industrial Work Culture. The research follows the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation). A pre-experimental method with a two-group pretest-posttest design was employed, comparing an experimental class and a control class consisting of 70 students. The results indicate that the assessment of the material, media, and test instruments for the E-Module is deemed suitable for use. Statistical analysis reveals a significant improvement in the experimental class compared to the control class after the intervention. The results of the N-Gain test show that the experimental class experienced a 53.4% improvement (moderate category), while the control class showed only a 21.5% improvement, indicating enhanced cognitive abilities among the students. This study emphasizes the positive impact of technology on education and reinforces the importance of innovative teaching methods to improve cognitive abilities in students.

✉ Correspondence:
Jalan Dokter Cipto No.121, Karangturi, Kec. Semarang Tim., Kota Semarang, Jawa Tengah 50124, Indonesia
E-mail: tedi_nurrokhman@students.unnes.ac.id

p-ISSN 2339-0344
e-ISSN 2503-2305

INTRODUCTION

Vocational education must have high quality and continue to develop to meet the needs and create technology in line with industry developments. According to Vachruddin et al. (2023), vocational high schools aim to produce professional workers in specific fields through industry-based assessments and prepare them to compete in the era of technological advancement. The principles of vocational education, as stated by Dr. Charles Allen Prosser in his 16 theorems, emphasize several key concepts of vocational education, as explained by Yunus et al. (2023). Mastery of the material on Occupational Health, Safety, and Environmental Protection (OHS-EP) and Industrial Work Culture using E-Modules is part of the third category, training students to think and work as applied in the industry. The effectiveness of E-Modules, highlighted in the tenth theorem, shows that delivering learning material through Android-based E-Modules promotes a more effective understanding compared to conventional methods.

The basic competencies of mechanical engineering in the subjects of OHS-EP and Industrial Work Culture at SMK Negeri 5 Semarang are still not optimal. This can be seen from the average cognitive scores of the 10th-grade mechanical engineering class, which reached 77.08%, below the Learning Objective Achievement Criteria (LOAC). Classroom observations revealed that students were unresponsive to the teacher's explanations, lacked access to teaching modules, and faced challenges with the use of traditional teaching methods, all of which hindered their understanding of the material. In line with the findings of Patmasari et al. (2023), which state that the role of teachers as facilitators demands the ability to design digital tools to encourage active participation, creativity, and create a dynamic learning environment.

Subroto et al. (2023) stated that advances in information and communication technology have driven the creation of digital teaching modules, opening up opportunities and challenges for teachers in creating engaging and innovative learning media. Electronic teaching modules are books in software form and offer greater practicality in use compared to printed modules. E-Modules are interactive with navigation features and integrate images, animations, audio, videos, and quizzes. Surtikanti et al. (2024) emphasize that the advantage of digital modules lies in their flexibility, which allows teachers to innovate by transforming print format into electronic format. E-Modules support independent online learning, aligning with current educational trends.

The application of E-Modules often involves software and hardware, such as Android-based smartphones. According to Phillips et al. (2022), Android is a Linux-based operating system developed specifically for touch-screen devices like smartphones. This platform provides a complete framework, allowing developers to design interactive and adaptive applications. Android, as an operating system, enables the creation of electronic modules with interactive features such as animations, audio, videos, and quizzes. Android-based E-Modules actively engage students in the learning process. Alyusfitri et al. (2024) highlighted this advantage. Irawan et al. (2023) also emphasized that the use of E-Modules can boost motivation and improve learning outcomes. In line with Khoiron et al. (2023), E-Modules facilitate the learning process and enhance learning competencies.

The objectives of this research are to (1) apply Android-based E-Modules in the subjects of OHS-EP and Industrial Work Culture; (2) analyze the feasibility of Android-based E-Modules in the subjects of OHS-EP and Industrial Work Culture; (3) analyze the effectiveness of Android-based E-Modules in the subjects of OHS-EP and Industrial Work Culture; (4) analyze the improvement in cognitive abilities after using Android-based E-Modules in the subjects of OHS-EP and Industrial Work Culture.

METHODOLOGY

This research is a development study (Research and Development) that adopts the ADDIE model. This model is systematically and structurally designed to address issues in providing learning resources (Rasmi et al., 2023). The research design uses the two-group pretest-posttest with control group design.

Tabel 1. Pretest posttest with control group design.

Group	Pre test	Treatment	Post test
Experimental	O1	X	O2
Control	O3	-	O4

Information: X= Treatment, - = Without Treatment, O1= Pretest of Experiment Group, O2= Posttest of Experiment Group, O3 = Pretest of Control Group, O4 = Posttest of Control Group.

The subjects of this research are 10th-grade mechanical engineering students at SMK Negeri 5 Semarang, consisting of two classes, TM 1 and TM 2, with a total of 70 students. Class TM 1, consisting of 35 students, was designated as the experimental group, while class TM 2, also consisting of 35 students, served as the control group. The sampling technique used is simple random sampling, a method of selecting samples randomly where every member of the population has an equal chance of being selected as a sample.

Data collection was carried out through assessments by subject matter experts, media experts, and instrument experts using rubrics to evaluate the feasibility of the developed product. Meanwhile, the effectiveness of the product was tested through pretest and posttest results using t-test analysis and N-Gain test. Yulyantari (2018) stated that the assessment rubric plays an important role in ensuring the quality of the product or instrument, so the test items created must align with the indicators in the research variables.

RESULTS AND DISCUSSION

Results

Based on the data analysis, this study is a development and evaluation of an Android-based E-Module designed to enhance the cognitive abilities of students in the subjects of OHS-EP and Industrial Work Culture. The content validity of the material expert evaluation, with a Content Validity Index (CVI) of 0.92 and reliability measured by the Percentage of Agreement (PA) at 92%, was considered "highly feasible." The media expert validation, with a Content Validity Ratio (CVR) of 0.97 from eight experts and a PA reliability of 97%, was also categorized as "highly feasible." These results indicate that both material and media experts agree that the Android-based E-Module is well-suited for use in terms of content and media design.

Additionally, the feasibility of the test instrument was evaluated by eight experts, who reviewed 25 test items. Using Aiken's validity test, it was confirmed that all items were valid. The reliability of the cognitive test was evaluated using IBM SPSS Statistics 24 with the ICC method, yielding a result of 0.707, which is above the threshold of 0.70, confirming the reliability of the test. In conclusion, the Android-based E-Module is both feasible and effective for use.

The pretest and posttest were administered to 70 students from the 10th-grade Mechanical Engineering class at SMK Negeri 5 Semarang, with 35 students in the experimental group and 35 students in the control group. The pretest results for both groups were analyzed using a two-tailed t-test to compare the two independent groups and assess whether the differences were statistically significant. The results of the two-tailed pretest t-test showed a t-value of 0.562 and a significance level (Sig. 2-tailed) of $0.576 > 0.05$, indicating that there was no significant difference in the initial abilities between the two groups.

Posttest results were analyzed using descriptive analysis, normality tests, homogeneity tests, one-tailed t-tests, and N-Gain tests. The descriptive analysis revealed that the average posttest score for the experimental group was 81.60, while the control group had an average posttest score of 66.11. The normality tests, based on the Shapiro-Wilk statistic, showed that the control group had a value of 0.949 with a Sig. of $0.102 > 0.05$, and the experimental group had a value of 0.959 with a Sig. of $0.210 > 0.05$, confirming that both groups had normally distributed data. The homogeneity test yielded a significance value of $0.077 > 0.05$, confirming the data's homogeneity. The one-tailed t-test (independent sample t-test) showed that the t-value (6.318) was greater than the t-table value (1.668), with a significance level (Sig. 2-tailed) of $0.000 < 0.05$, indicating a significant difference in posttest performance between the experimental and control groups.

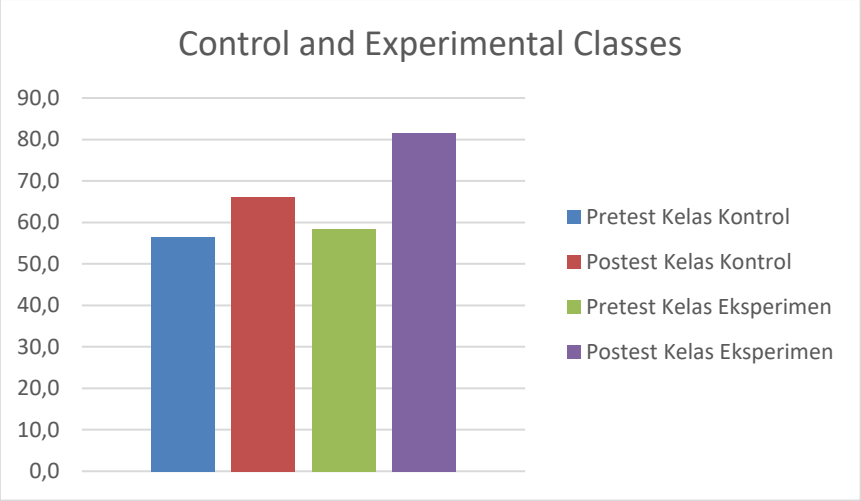

Figure 1. Cognitive Learning Results for Control and Experimental Classes

The results presented in the diagram show a clear difference in improvement between the control and experimental groups. In the control group, the pretest score was 56.5, while the experimental group had a pretest score of 58.4, showing no significant initial difference between the two groups. After the posttest, the control group scored 66.1, while the experimental group scored 81.6. The cognitive ability improvement for the control group was 21.5%, reflecting progress in mastering the OHS-EP and Industrial Work Culture material through conventional methods. In contrast, the experimental group achieved an improvement of 53.4%, indicating a significant enhancement in cognitive abilities related to the OHS-EP and Industrial Work Culture material when using the Android-based E-Module.

The N-Gain test results showed that the average posttest score for the experimental group was 0.534, or 53.4%, categorized as "moderate," compared to the control group at 21.5% (low category). This demonstrates that using the Android-based E-Module significantly improved the cognitive abilities of students in OHS-EP and Industrial Work Culture, leading to positive impacts on students learning outcomes.

Discussion

The Android-based E-Module implemented in this study aims to enhance the cognitive abilities of students in the subjects of OHS-EP and Industrial Work Culture for the 10th-grade Mechanical Engineering class. The implementation process follows the ADDIE model, which includes five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Alodwan & Almosa, 2020). The analysis phase involved identifying the needs and characteristics of the E-Module, as well as reviewing the curriculum and technology (Priyantama et al., 2024). Observations highlighted several challenges in teaching the OHS-EP and Industrial Work Culture material, such as low student interest in learning materials, limited use of technology by teachers, and a need for self-learning media. In the design phase, a framework for the E-Module was developed, selecting relevant references and a visually appealing layout optimized for Android devices. This engaging design was expected to increase student participation and help with a more effective understanding of the material.

Previous research has shown that teaching OHS-EP and Industrial Work Culture often encounters difficulties in helping students understand the concepts. Research by Wahrini & Makmur (2023) found that students struggle to connect OHS concepts to real-world practices in the workplace. Meanwhile, a study by Aprilianto et al. (2025) revealed that the lack of interactive learning media results in low student participation in class. Unlike the previous studies, this research focuses on developing an Android-based E-Module that not only presents OHS-EP material interactively but also aims to enhance the cognitive abilities of students by incorporating evaluative and simulation features.

Cognitive abilities are a critical aspect of the learning process, involving mental activities to acquire knowledge and understanding. According to Bloom's taxonomy, cognitive abilities consist of six levels: remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). In the context of learning OHS-EP and Industrial Work Culture, these abilities are essential for students to not only memorize concepts but also apply OHS-EP principles in real situations, analyze work risks, and design safe work procedures.

The E-Module developed in this study offers several advantages over existing learning media. First, being Android-based, it can be accessed anytime and anywhere without the need for an internet connection, aligning with the digital habits of students today. Second, the module is equipped with multimedia elements such as images, videos, interactive quizzes, and simulations designed to boost student understanding and engagement. Third, the E-Module includes evaluation features at each cognitive level, allowing teachers to measure student progress more effectively. These advantages make the E-Module a promising solution to overcome previous learning challenges and improve the quality of OHS-EP and Industrial Work Culture education. This aligns with the characteristics of 21st-century learning, which emphasizes the use of technology. The E-Module provides an interactive and engaging learning experience, which helps enhance learning outcomes and foster the development competencies of students (Mulia et al., 2024).

Hasibuan et al. (2023) found that the E-Module is practical and effective, especially in increasing students' interest in the learning material. Similarly, Depi & Zahmi (2024) stated that using an Android-based module as a teaching method makes learning quicker, easier, and safer for students. Rohmatika & Ibrohim (2024) also reported that the use of the E-Module improves the practicality of learning and enhances the cognitive abilities of students. Therefore, implementing the Android-based E-Module is an ideal solution to address the challenges faced in teaching OHS-EP and Industrial Work Culture at SMK Negeri 5 Semarang. Feedback from the implementation process is expected to provide a foundation for future improvements to enhance the quality of education.

The Android-based E-Module for OHS-EP and Industrial Work Culture received positive feedback from experts, who deemed it suitable for use in teaching, which is in line with research by Indraswari, D., & Susilowibowo (2022), who found that this learning media meets the required feasibility standards. This feasibility suggests that the Android-based E-Module for OHS-EP and Industrial Work Culture has the potential to be implemented in various technical subjects, not just limited to OHS-EP and Industrial Work Culture.

Rosita et al. (2021) explained that validity testing ensures that the instruments used to measure a product meet the established standards. Research by Bisri et al. (2023) showed that the developed E-Module had an average material validity of 97.33% and media validity of 91.16%, both categorized as highly feasible. Similarly, Yuliani & Setiawan (2024) reported that the feasibility of the electronic modules received a high rating, with 92.5%, categorized as highly feasible.

Overall, the implementation of the Android-based E-Module has proven to be effective in meeting the need for students to improve their cognitive abilities in OHS-EP and Industrial Work Culture. Cognitive improvement in the experimental class was higher compared to the control class, as shown by the lower average posttest score in the control class compared to the experimental class. This improvement aligns with Charles Prosser's theory, which states that every job requires a minimum level of competence that individuals must possess in order to carry out tasks effectively.

CONCLUSION

Based on the research results and discussion in this study, it can be concluded that: (1) The implementation of the Android-based E-Module in the subjects of OHS-EP and Industrial Work Culture using the ADDIE model has been completed and successfully tested. (2) The developed Android-based E-Module is highly suitable for use in the learning process. (3) The

Android-based E-Module enhances the effectiveness of learning in OHS-EP and Industrial Work Culture subjects. (4) A significant improvement in cognitive abilities was observed, with an N-Gain value of 0.534 or 53.4%, which is higher compared to the conventional teaching method applied by the teacher.

REFERENCES

Alodwan, T., & Almosa, M. (2018). The Effect of a Computer Program Based on Analysis, Design, Development, Implementation and Evaluation (ADDIE) in Improving Ninth Graders' Listening and Reading Comprehension Skills in English in Jordan. *English Language Teaching*, *11*(4), 43. https://doi.org/10.5539/elt.v11n4p43

Aprilianto, L., Sulistiyo, E., & Fransisca, Y. (2025). *Pengembangan Media Pembelajaran Berbasis Web Menggunakan Google Sites Pada Materi K3lh Dan Budaya Kerja Industri Mata Pelajaran Dasar Listrik Dan Elektronika Kelas X Toi Di Smkn 1 Cerme Gresik Lingga Aprilianto*. 79–85.

Bisri, M. A., Wintarti, A., & Fiangga, S. (2023). The Development of a Flibook-Based Interactive E-Module to Facilitate Sequences and Series Learning Process for 10th-Grade. *MATHEdunesa*, *12*(1), 194–206. https://doi.org/10.26740/mathedunesa.v12n1.p194-206

Depi, S., & Zahmi, A. (2024). Android Aplikasi Modul Pembelajaran Berbasis Android Untuk Siswa Kelas X Smk Dhuafa Padang Tahun Ajaran 2023/2024. *Journal of Scientech Research and Development*. https://api.semanticscholar.org/CorpusID:266810196

Hasibuan, S. H., Zulfarina, & Putra, R. A. (2023). Development of Interactive Systems Based on Patterns. *Journal of Educational Science*, *7*(3), 5–8.

Indraswari, D., & Susilowibowo, J. (2022). Pengembangan Bahan Ajar Practice Set Akuntansi Perusahaan Dagang Berbasis Flipbook untuk Kelas XI Akuntansi. Jurnal Pendidikan Akuntansi (JPAK), 10(3), 242-256

Irawan, D., Khumaedi, M., & Kusumawardani, R. (2023). The Development of an Android-Based Interactive Learning Media to Enhance Understanding of OP-AMP Application as a Temperature Sensor Controller. *Journal of Vocational and Career Education*, *8*(2), 77–84. https://doi.org/10.15294/jvce.v8i2.10856

Khoiron, A. M., Pardjono, N. A., & Djatmiko, I. W. (2023). The innovation of electronic module integrated job sheet chassis dynamometer teaching materials to improve machine performance practicum competence. International Journal of Innovation and Learning. https://api.semanticscholar.org/CorpusID:265146419

Mulia, N., Advinda, L., Syamsurizal, & Ahda, Y. (2024). Development of an Android-Based E-Module in the Form of a Flipbook on Excretory System and Coordination System Material for Class XI SMA Students. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2388–2397. https://doi.org/10.29303/jppipa.v10i5.7237

Patmasari, L., Hidayati, D., Ndari, W., & Sardi, C. (2023). Digitalisasi Pembelajaran Yang Berpusat Pada Siswa Di Smk Pusat Keunggulan. *Jurnal Ilmiah Mandala Education*, *9*(1), 1–7. https://doi.org/10.58258/jime.v9i1.3729

Phillips, B., & Stewart, C. (2022). Android Programming: The Big Nerd Ranch Guide. Pearson Education. https://books.google.co.id/books?id=GjZKCgAAQBAJ

Priyantama, R. D., Khumaedi, M., & Anis, S. (2024). Journal of Vocational Career Education Development and Implementation of Interactive Multimedia for Achieving Learning Outcomes in Manufacturing Engineering Drawing Elements. *Journal of Vocational Career Education*, *9*(2), 50233.

Rasmi, D. P., Hendri, M., & Azriyanti, R. (2023). Analysis of the Need for Development of

Teaching Materials in the Form of STEM-Based Electronic Modules. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4135–4141. https://doi.org/10.29303/jppipa.v9i6.2683

Rohmatika, V., & Ibrohim, I. (2024). Development of inquiry learning-based electronic module on human respiration system materials to improve scientific literacy and cognitive learning. *AIP Conference Proceedings*, *3106*(1), 30012. https://doi.org/10.1063/5.0215077

Rosita, E., Hidayat, W., & Yuliani, W. (2021). Uji Validitas Dan Reliabilitas Kuesioner Perilaku Prososial. *FOKUS (Kajian Bimbingan & Konseling Dalam Pendidikan)*, *4*(4), 279–284. https://doi.org/10.22460/fokus.v4i4.7413

Subroto, D. E., Supriandi, Wirawan, R., & Rukmana, A. Y. (2023). Implementasi Teknologi dalam Pembelajaran di Era Digital: Tantangan dan Peluang bagi Dunia Pendidikan di Indonesia. *Jurnal Pendidikan West Science*, *1*(07), 473–480. https://doi.org/10.58812/jpdws.v1i07.542

Surtikanti, H. K., Suwandi, T., Utami, K., & Faritzah, C. P. (2024). Development of Digital Modules in the Environmental Toxicology Course at the Undergraduate Level in the Biology Program Study. *KnE Social Sciences*, *2024*, 1439–1448. https://doi.org/10.18502/kss.v9i13.16084

Vachruddin, V. P., Susanto, B. A., Karim, A. R., Kusaeri, K., & Aditomo, A. (2023). Industrial-based competency and expertise assessment: study of management assessments at SMK center of excellence and vocational education and training (vet). *Jurnal Pendidikan Teknologi Dan Kejuruan*, *29*(2), 208–229. https://doi.org/10.21831/jptk.v29i2.63801

Wahrini, R., & Makmur, E. (2023). Pengembangan E-Modul Pembelajaran Keselamatan Kerja Dan Kesehatan Lingkungan (K3L) Kompetensi Keahlian Teknik Instalasi Tenaga Listrik Smk Negeri 1 Sedayu Yogyakarta. *Jurnal Media Elektrik*, *20*(3), 87. https://doi.org/10.59562/metrik.v20i3.50831

Yuliani, E., & Setiawan, D. (2024). Development of flipbook-based digital comics to improve learning outcomes on simple comic material. *Research and Development in Education (RaDEn)*, *4*(1), 219–236. https://doi.org/10.22219/raden.v4i1.32280

Yunus, Y., Yulianti, R., Oriza, W., Jalinus, N., & Abdullah, R. (2023). Teori Prosser : Philosophy Pendidikan Kejuruan pada Era Revolusi Industri 4.0. AT-TAJDID: Jurnal Pendidikan Dan Pemikiran Islam, 07. https://doi.org/10.24127/att.v6521a2366