JVCE 10 (1) (2025) : 16-23

Journal of Vocational Career Education

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

Effectiveness of the Sustainable Fashion E-Module in Improving Students Analysis of the Fashion Industrys Environmental Impact at Vocational High School

Dewi Zulaekah[1]✉, Adhi Kusumastuti[2], Dwi Widjanarko[2], Sri Endah Wahyuningsih[2]

[1]SMK Negeri 6 Semarang, Indonesia
[2]Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

Article History :
Received
December 2024
Accepted
February 2025
Published
July 2025

Keywords:
E-Module; Sustainable Fashion; Cognitive Ability; Vocational High School

Abstract

Most students in the fashion program, particularly at SMK Negeri 6 Semarang, still show low levels of understanding regarding the principles of sustainability in the fashion industry. This is evident from the failure to meet the Learning Objective Achievement Criteria (KKTP) of 75. This condition indicates the need for more engaging, contextual, and relevant learning solutions aligned with global issues. So far, the material has been delivered conventionally through textbooks and presentations, which have proven ineffective. There is a need for the development of more engaging learning media. This study aims to assess the effectiveness of the Sustainable Fashion E-Module in enhancing student ability to analyze the fashion industries impact on the environment. The research uses a quantitative method with a pretest-posttest control group design. The sample consists of 69 students from the fashion program at SMK Negeri 6 Semarang, divided into experimental and control groups. The instruments used were pretest and posttest questions. The research data were tested for normality and homogeneity as prerequisites for analysis. Data analysis was then performed using the Normalized Gain (N-Gain) test to measure learning improvement and the Independent Sample T-Test to examine significant differences between groups. The results showed that the average N-Gain for the experimental group was 76%, categorized as effective, while the control group had only a 37% N-Gain, categorized as less effective. The T-Test showed a significance value of 0.000 < 0.05, indicating a significant difference between the two groups. Based on these findings, it can be concluded that the use of the E-Module is effective in enhancing student cognitive abilities regarding the concept of sustainable fashion.

✉ Correspondence:
Jl. Sidodadi Barat No.8, Karangturi, Kec. Semarang Tim., Kota Semarang, Jawa Tengah 50124, Indonesia
E-mail: dewiaira12@students.unnes.ac.id

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

INTRODUCTION

The fashion industry plays an important role in both the global and national economies, as it not only generates significant income but also provides employment for millions of people. However, the rapid growth of this industry, especially with the emergence of fast fashion trends, has led to serious environmental issues. Fast fashion encourages the mass production of clothing in short time frames and at low costs, which results in a massive increase in textile waste (Albab et al., 2024). Azizah et al. (2025)mentioned that textile waste is now one of the fastest growing types of solid waste globally. In Indonesia itself, reports from the Kementerian Lingkungan Hidup dan Kehutanan (2020) indicate that textile waste increased from 2.4% in 2019 to 6.99% in 2021 of the total national waste. This situation demands a shift in the paradigm within the industry and education, particularly in Vocational High Schools (SMK) that train future workers for the fashion industry. One form of contribution from education to this issue is by integrating the concept of sustainable fashion into the learning process (Tahalele & Widyakirana, 2020).

Sustainable fashion is an approach to designing and producing fashion that considers environmental, social, and economic impacts throughout the product's life cycle (Arzaq & Hermawan, 2024). According to Handiyati et al. (2023), sustainability-based education is not only about conveying knowledge but also about forming awareness, values, and responsible attitudes towards the environment. In Vocational High Schools, especially in the fashion program, this concept should be internalized early so that students not only acquire sewing skills but also understand the ecological impact of the production processes they engage in (Marlina, 2016). However, based on observations and interviews with teachers and students from class X in the Fashion Program at SMK Negeri 6 Semarang, it was found that the concept of sustainable fashion is still difficult to comprehend. This material was only introduced through the Merdeka Curriculum in the Basics of Fashion Skills subject and had not been taught previously. One student mentioned in an interview that the sustainable fashion material was hard to understand because it had not been taught before, and there were no specific textbooks that explain this topic. This illustrates the low level of understanding students have regarding a topic that should serve as the foundation for fostering an eco-friendly mindset in the fashion field.

Data from daily assessments of students in class X Fashion show an average score of 68.35, which is still below the Learning Objective Achievement Criteria of 70. This shows a gap between the current condition and the ideal conditions expected in the curriculum achievement. According to Hakim & Abidin (2024), vocational education that focuses solely on technical aspects without reinforcing conceptual understanding will produce graduates who are less adaptable to the challenges of modern industries, including sustainability issues. In addition, Kornelis (2022) emphasized that the lack of literacy about sustainable fashion among students is a major barrier to pushing the fashion industry towards a more ethical direction.

One factor contributing to the low understanding of students is the limited availability of contextual, engaging learning media that suits the characteristics of vocational students, who tend to be more visual and applied in nature (Kosasih et al., 2023). This aligns with the opinion of Herdiningrum et al. (2021) that conventional learning models, such as lectures, have been unable to facilitate meaningful learning for abstract topics like sustainability. Therefore, innovative learning media that can present the material interactively and make it easier to understand are needed. According to Asih et al. (2021), learning media designed with the students' characteristics in mind can enhance attention, retention, and understanding. Developing learning media such as the sustainable fashion E-Module becomes a relevant solution. The E-Module allows the presentation of materials integrated with multimedia elements such as videos, images, and interactive simulations that not only clarify concepts but also enhance student motivation (Prihatiningtyas & Sholihah, 2021).

From the issues outlined above, this study aims to determine the effectiveness of using the sustainable fashion E-Module to improve the

cognitive abilities of students in class X Fashion Program at SMK Negeri 6 Semarang. This research is based on the need to bridge the gap between the sustainability material, which is beginning to be adopted in the Merdeka Curriculum, and the low level of student understanding. It is hoped that through the use of the E-Module, students will have a more comprehensive understanding of the concept of sustainable fashion and will be able to apply it in their learning practices, aligning with the direction of vocational education transformation that focuses on environmentally friendly industries.

METODHOLOGY

This study uses a quantitative approach aimed at measuring the effectiveness of using the e-module to improve students understanding of sustainable fashion material. The analysis method applied is Normalized Gain, a technique used to measure the extent of students learning improvement after participating in the learning process. Data collection was done through pretest and posttest, applying a control group design for comparison, involving an experimental group using the E-Module and a control group using conventional learning methods. In addition to the test instruments, direct observation was also conducted to monitor student involvement and active participation during the learning process. Furthermore, in-depth interviews were used as supplementary data to gain a comprehensive understanding of students learning experiences when using the E-Module and their perceptions of using electronic-based learning media.

The test instruments were developed based on indicators that represent two main variables: the use of the E-Module as a learning medium and student cognitive ability in understanding sustainable fashion concepts. The observation instrument was developed in the form of an observation sheet containing aspects of student activities, such as attention, asking questions actively, involvement in discussions, and the use of features in the E-Module. To ensure the validity and feasibility of the instruments, all measurement tools used underwent a review and validation process by experts in the fields of education and fashion expertise. After being declared valid and reliable, the instruments were used in the data collection process in the field. The relationship between the variables studied in this research is illustrated in the conceptual framework presented in Figure 1.

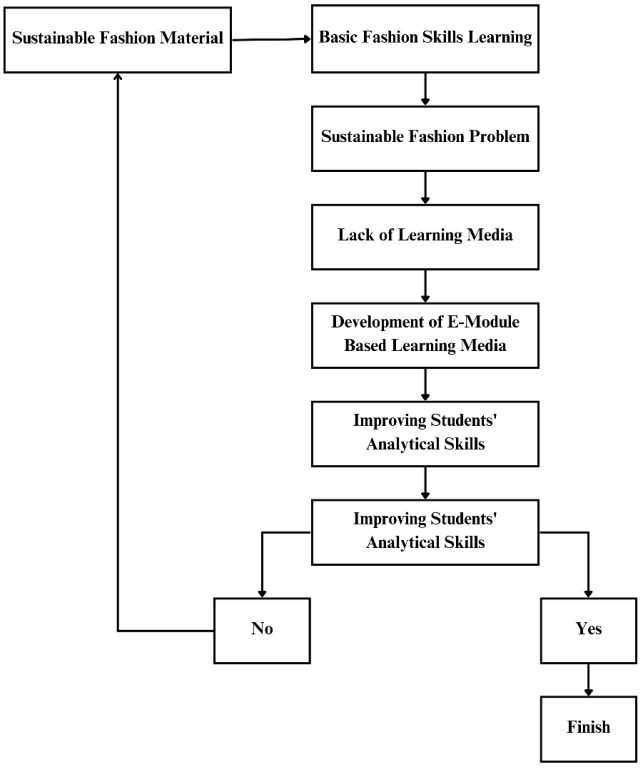

Figure 1. Research Conceptual Framework

According to various learning theories reviewed by the researcher, the learning process will be more effective and meaningful when supported by the use of appropriate media. Learning media plays an important role in facilitating the delivery of material, clarifying information, overcoming limitations of the senses and time, and increasing student motivation, making the material easier to understand. When selecting learning media, several aspects need to be considered, including the learning objectives, the characteristics of students, time and cost availability, the teaching strategies used, and the effectiveness of the media in supporting the learning process. Based on the theory of characteristics and media selection, the E-Module was chosen as the development product deemed suitable. The E-Module serves as a learning resource that supports students in understanding the material independently and contextually (Sape et al., 2024). This E-Module was designed as a learning guide for the Basics of Fashion Skills subject, specifically in the learning achievements related to sustainable fashion.

The data collected through the research instruments were analyzed using the SPSS application, after undergoing a series of prerequisite tests, including normality and homogeneity tests (Sugiyono, 2019). Once all requirements were met, the main analysis was conducted using the Normalized Gain (N-Gain) method to measure the effectiveness of the E-Module in improving students understanding of the material. To strengthen the analysis results, advanced statistical tests were also conducted using the Independent Sample T-Test. This research involved all students in the class X Fashion Program at SMK Negeri 6 Semarang, with a total of 69 students as the research sample. The sampling technique used was total sampling, so the sample size is equal to the population. The instrument grid used in the study can be seen in Table 1.

Table 1. Grid of Instruments for Using the Sustainable Fashion E-Module

No.	Material	Indicator
1.	Understanding the concept of sustainable fashion	1. Explaining the main goals of sustainable fashion 2. Identifying the meaning of slow fashion in the context of sustainability 3. Naming the benefits of using organic materials in fashion
2.	Analyzing efforts to promote sustainable fashion	1. Identifying ways to promote environmentally friendly products 2. Explaining the importance of using textile waste
3.	Analyzing the application of sustainability principles	1. Identifying the application of sustainable fashion principles in design 2. Integrating local wisdom values into fashion design 3. Determining projects that can reduce the impact of fast fashion 4. Explaining how to utilize local potential for fashion products 5. Determining strategies to reduce textile waste at school
4.	Choosing environmentally friendly materials	1. Determining the right materials to support sustainability 2. Determining how to make fabric waste products attractive 3. Determining collaboration strategies with local artisans 4. Determining educational ways to set up an exhibition booth for sustainable products
5	Designing functional products	1. Determining how to make textile waste products functional and aesthetic 2. Determining steps to reduce energy use in production 3. Determining strategies to promote environmentally friendly fashion products globally

RESULTS AND DISCUSSION

Research Results

The data processing in this study was carried out using the SPSS software, applying the Normalized Gain (N-Gain) analysis method. Before performing the main analysis, the data were first tested for prerequisite analysis. The normality test was conducted using the Kolmogorov-Smirnov method, and the results showed that all significance values were above 0.05. This indicates that the data are normally distributed. Next, to test the homogeneity of variances, Levene's Test was used. Based on the

average values (mean), the significance result was 0.942. This value is much higher than the significance threshold of 0.05, so it can be concluded that the variances between the groups are homogeneous. After all the prerequisite tests were fulfilled, the analysis continued using the N-Gain method and the Independent Sample T-Test to determine the effectiveness of using the E-Module by comparing the pretest and posttest results of the students. The detailed results of this analysis are presented in Tables 2, 3, and 4 below.

Table 2. Average Results of Normalized Gain Analysis

SPSS Analysis N-Gain Percent		
Group	**Control**	**Experimental**
Mean	36.74	75.84
Minimum	8.33	41.38
Maximum	65.63	100.00
Percentage	37%	76%
Category	Not Effective	Effective

The N-Gain test results show a significant difference between the control and experimental groups. The average percentage of the control group is categorized as "Not Effective" due to the relatively low average increase, which only reached 37%. In contrast, the experimental group showed a much more significant improvement, with an average N-Gain percentage of 76%, which can be categorized as "Effective". These results align with Arikunto (2014) statement that a learning medium can be considered effective if it achieves a minimum effectiveness level of 76%.

Table 3. Output 1 Independent Sample T-Test

Group Statistics					
	Class	N	Mean	Std. Deviation	Std. Error Mean
N-Gain Scores	Control Class	35	36.74	16.163	0.2732
	Experimental Class	34	75.84	18.012	0.3089

In Output 1 of the t-test, the mean values show a significant difference between the two groups. The control class had a mean of 36.74, which corresponds to the average N-Gain score of this group. Meanwhile, the experimental class recorded a mean of 75.84, which is also consistent with the earlier N-Gain results. This difference indicates that the students who used the E-Module showed a higher improvement in their learning outcomes compared to those who used the conventional learning method.

Table 4. Output 2 Independent Sample T-Test

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**	**95% Confidence Interval of the Difference**	
									Lower	**Upper**
N-Gain Scores	Equal variances assumed	,001	,975	-9,495	67	,000	-39,094	0,4117	-47,312	-30,876
	Equal variances not assumed			-9,480	65,764	,000	-39,094	0,4124	-47,328	-30,860

In Output 2, the t-test results for the N-Gain scores show that the averages between the experimental and control groups have a significant difference. This is indicated by the Sig. (2-tailed) value of 0.000 in the equal variances assumed row, which is much smaller than the significance threshold of 0.05. Therefore, it can be concluded that there is a statistically significant difference between the two groups. The assumption of equal variances assumed in this analysis is based on the previous homogeneity test result, which showed a value of 0.975, indicating that the variances of both groups are homogeneous. This analysis reinforces that the

use of the E-Module on sustainable fashion material in the experimental class has a significant effect on improving students understanding, compared to the control class that did not receive the treatment of using the E-Module.

Discussion

The use of the E-Module in sustainable fashion learning has proven to contribute significantly to improving student cognitive abilities. Based on the results of the pretest and posttest, it is evident that the experimental class using the E-Module experienced a much higher average score increase compared to the control class. The average pretest score for the experimental class was 61.62, which increased to 91.06 in the posttest, while the control class only increased from 62.11 to 75.91. These results are supported by the Independent Sample T-Test, which showed a significance value of 0.000 < 0.05, indicating a significant difference between the two groups after the treatment was applied.

The Normalized Gain analysis showed that the experimental group had an average gain of 76%, while the control group only reached 37%. According to the gain effectiveness classification by Hake (1998), a gain value above 70% is categorized as "effective". This result shows that the use of the E-Module in learning significantly improves students understanding of sustainable fashion material. This also aligns with Arikunto (2014) statement that a learning medium is considered effective if it achieves a learning outcome percentage of at least 76%.

The effectiveness of the E-Module is also supported by field observations during the learning process. During the learning activities, students appeared more active and focused. They showed greater interest when using the E-Module compared to when they only used textbooks or PowerPoint presentations. Students utilized break times and after-school hours to reopen the E-Module on their mobile devices. The researcher also observed that the E-Module allowed students to access the material independently, without being limited by space and time. This flexible access allowed students to learn anytime and anywhere, without having to carry bulky and less engaging printed books.

In-depth interviews with several students also reinforced these observational findings. The majority of students stated that they preferred learning with the E-Module because its design was more interesting, easy to use, and helped them understand material that seemed abstract when explained verbally. One student mentioned that they liked the E-Module because the material provided was clear and included images, making it less boring and available for access anytime. Another student mentioned that using the E-Module helped them learn more independently, especially when there was no teacher or peer to discuss with.

Interactive features such as intuitive navigation, infographics, and the use of communicative language made this E-Module not only visually appealing but also user-friendly. This aligns with Nurdyansyah (2019) statement that learning using interactive media can enhance student memory and understanding transfer because information is presented in an engaging visual format that supports the students thinking process.

The effectiveness of the E-Module not only includes cognitive aspects but also builds independent learning skills and strengthens awareness of sustainability issues (Anwar & Murtopo, 2024). In line with Sholikhah et al. (2025), the sustainable fashion material presented in the E-Module makes it easier for students to understand how the fashion industry contributes to environmental issues and their role as future professionals in the fashion field to make contributions. This approach fosters a sense of social and environmental responsibility in the learning process.

From the research results and discussions, it can be concluded that the use of the E-Module in sustainable fashion learning can be considered effective. The E-Module does not only function as an alternative learning medium but also as a learning strategy that is adaptive to students needs in the digital era. Therefore, the integration of the E-Module into vocational learning in SMK, especially in the fashion program, is highly recommended to be applied continuously and expanded to other topics that require contextual and applied understanding.

CONCLUSION

The use of the E-Module has proven to be effective in improving the cognitive abilities of SMK students, especially in the sustainable fashion material. The test results show a significant improvement in the learning outcomes of the experimental group compared to the control group, with an average N-Gain reaching 76%. Additionally, observations during the learning process show that students are more enthusiastic and find the material easier to understand because the E-Module can be accessed anytime and anywhere. Students also mentioned that they found the E-Module more engaging, simple, and easier to understand compared to textbooks. Therefore, this E-Module is not only academically effective but also supports flexible and enjoyable learning in the digital era.

REFERENCES

Albab, W. U., Mardiah, A. R., Ranjani, G., Karina, G. D., & Safitri, M. N. (2024). Pengaruh Industri Fast Fashion Terhadap Pencemaran Lingkungan dan Penurunan Keadilan Antar Generasi. *Indonesian Journal of Criminal Law and Criminology (IJCLC)*, *5*(3). https://doi.org/10.18196/ijclc.v5i3.22830

Anwar, K., & Murtopo, M. (2024). Pemanfaatan Teknologi Informasi dan Komunikasi (ICT) dalam Mengembangkan Media Pembelajaran. *EDU-RILIGIA: Jurnal Ilmu Pendidikan Islam Dan Keagamaan*, *8*(1). https://doi.org/10.47006/er.v8i1.20422

Arikunto, S. (2014). *Evaluasi Program Pendidikan*. Bumi Aksara.

Arzaq, K. N., & Hermawan, A. H. (2024). Analisis Penerapan Sustainable Fashion dan Trend Forecasting 2023-2024 pada Butik Wilsenwillim. *Islamic Economic and Business Journal*, *6*(1), 15–35. https://doi.org/10.30863/iebjournal.v6i1.6610

Asih, D. P., Syamwil, R., & Qudus, N. (2021). Online Learning Model To Improve Student's Practical Skills In Batik Course. *Journal of Vocational Career Education*, *6*(1), 28–36.

Azizah, A. N., Riza, A. A., S, D., & Permana, I. (2025). Dari Limbah Menjadi Manfaat: Kain Lap sebagai Produk Inovatif dalam Bisnis Islam. *Abdiya: Jurnal Abdi Cindekia Nusantara*, *1*(6), 134–141.

Hake, R. R. (1998). *Interactive-engagement methods in introductory mechanics courses*.

Hakim, M. N., & Abidin, A. A. (2024). Platform Merdeka Mengajar: Integrasi Teknologi dalam Pendidikan Vokasi dan Pengembangan Guru. *Kharisma: Jurnal Administrasi Dan Manajemen Pendidikan*, *3*(1), 68–82. https://doi.org/10.59373/kharisma.v3i1.47

Handiyati, T., Qomariyah, S., & Kurniawan, J. (2023). Peran Pembelajaran Berbasis Lingkungan Dalam Meningkatkan Pemahaman Peserta Didik Di MI Cimahi Peuntas Kabupaten Sukabumi. *PENDEKAR: Jurnal Pendidikan Karakter*, *1*(4), 86–105.

Herdiningrum, R. R., Wahyuningsih, S. E., & Supraptono, E. (2021). Development of Richpeace Software-Based e-Modules on Digital Clothing Pattern Making Competence. *Journal of Vocational Career Education*, *6*(2), 104–118.

Kementerian Lingkungan Hidup dan Kehutanan. (2020). *Laporan Kinerja Kementerian Lingkungan Hidup dan Kehutanan* .

Kornelis, Y. (2022). Fenomena Industri Fast Fashion: Kajian Hukum Perspektif Kekayaan Intelektual Indonesia. *Jurnal Komunitas Yustisia*, *5*(1), 262–277. https://doi.org/10.23887/jatayu.v5i1.46040

Kosasih, Y., Sutopo, Y., & Wahyuningsih, S. E. (2023). *The Development of CLO3D Software E-Module for Digital Creation of Party Attire Patterns And Designs*. *8*(1), 9–16.

Marlina. (2016). Kompetensi Pendidikan Teknologi dan Kejuruan Program Keahlian Tata Busana Mendukung Sumber Daya Manusia yang Profesional. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Nurdyansyah. (2019). *Media Pembelajaran Inovatif*. UMSIDA Press.

Prihatiningtyas, S., & Sholihah, F. N. (2021). *Physics Learning by E-Module*. Fakultas Pertanian Universitas KH. A. Wahab Hasbullah.

Sape, H., Lukman, & Sambara, P. M. (2024). Penggunaan E-Modul Interaktif dalam Meningkatkan Kemampuan Literasi Siswa. *Jurnal Pendidikan Dan Pembelajaran*, *4*(2), 101–106. https://doi.org/10.62388/jpdp.v4i2.522

Sholikhah, R., Widowati, W., & Atika, A. (2025). *Development of 3D Virtual Fashion Design E-module Using CLO3D Software to Improve 21st Century Skills in Fashion Design Education* (pp. 819–841). https://doi.org/10.2991/978-2-38476-360-3_72

Sugiyono. (2019). *Statistika Untuk Penelitian*. CV. ALFABETA.

Tahalele, Y. K. S., & Widyakirana, R. (2020). Analisa Produk Fesyen Berkelanjutan: Tantangan Dan Penentu Keberhasilan. *Seminar Nasional ENVISI 2020 : Industri Kreatif*, 1–17.