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IMPLEMENTATION OF GREEN CURRICULUM IN VOCATIONAL EDUCATION: A PRELIMINARY STUDY IN VOCATIONAL HIGH SCHOOLS (SMK) IN MALANG CITY

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ABSTRACT

The increasing demand for sustainability-oriented competencies has encouraged vocational education institutions to integrate green curriculum principles into teaching and learning practices. This study aims to examine the implementation of the green curriculum in vocational education and identify institutional challenges in supporting sustainability integration. A descriptive quantitative approach with an exploratory design was employed. Data were collected using a 15-item Likert-scale questionnaire administered to four Heads of Fashion Design Study Programs from four vocational high schools (SMKs) in Malang City, Indonesia. The findings indicate that green curriculum implementation is generally at a high level, particularly in curriculum integration, instructional practices, and facilities supporting sustainability. However, teacher capacity development, alignment with green industry requirements, and evaluation systems remain only moderately implemented, indicating an implementation gap between pedagogical practices and institutional readiness. The study contributes to the literature by conceptualizing green curriculum implementation as a multidimensional institutional process rather than merely a pedagogical innovation. Nevertheless, the findings should be interpreted with caution because the study involved only four participants and was designed as an exploratory investigation, limiting the generalizability of the results. Future studies are recommended to involve larger samples and diverse vocational education sectors to strengthen empirical evidence.

Key words: *Green Curriculum, Vocational Education, Sustainability, Green Skills, Institutional Readiness.*

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INTRODUCTION

The accelerating transition toward a low-carbon and sustainable global economy has fundamentally reshaped the demand for workforce competencies, particularly in relation to green skills. Vocational education and training (VET) is increasingly positioned as a critical mechanism for preparing a workforce capable of supporting environmentally sustainable industries. International organizations such as OECD and UNESCO emphasize that the green transition requires not only technical reskilling but also systemic transformation within education and training systems (OECD, 2023; UNESCO, 2023).

In response to these demands, the concept of a *green curriculum* has emerged as a strategic approach to embedding sustainability principles into vocational education. A green curriculum extends beyond the inclusion of environmental content; it encompasses pedagogical practices, institutional policies, and alignment with industry needs to foster sustainability-oriented competencies (Pavlova, 2022; McGrath, 2023). Recent studies highlight that integrating green skills into VET is essential for enhancing employability while simultaneously addressing environmental challenges (Jackson, 2023; Succi & Canovi, 2022).

Despite growing policy attention, the implementation of green curriculum in vocational education remains uneven and often fragmented. Empirical evidence suggests that many institutions adopt sustainability practices at the instructional level without corresponding institutional support, resulting in partial or superficial integration (Billett, 2022; World Bank, 2022). Furthermore, gaps persist in teacher capacity, industry collaboration, and evaluation systems, which are critical for ensuring the effectiveness and sustainability of curriculum transformation (Cedefop, 2022; OECD, 2025).

In the context of developing countries, including Indonesia, these challenges are further compounded by structural limitations such as resource constraints, limited industry engagement, and the absence of standardized frameworks for green skills integration. While several initiatives have been introduced to promote sustainability in vocational education, empirical studies examining the actual implementation at the school level remain limited and underexplored.

Despite the increasing attention given to Education for Sustainable Development (ESD) and the integration of green skills into Technical and Vocational Education and Training (TVET), existing studies have predominantly focused on conceptual discussions, curriculum development, or instructional innovations. Previous research has highlighted the importance of sustainability-oriented competencies and the role of vocational education in preparing a green workforce. However, empirical evidence examining how green curriculum is implemented holistically at the institutional level remains limited, particularly within Indonesian vocational high schools. Moreover, most studies evaluate green curriculum implementation from a pedagogical perspective while paying limited attention to institutional dimensions such as teacher professional development, industry collaboration, governance, and evaluation mechanisms. Consequently, the relationship between

pedagogical implementation and institutional readiness has not been sufficiently explored.

This study addresses these research gaps by examining green curriculum implementation through a multidimensional framework that integrates curriculum integration, teaching practices, facilities and resources, teacher capacity, industry alignment, and evaluation systems. Unlike previous studies that primarily emphasize instructional practices, this research conceptualizes green curriculum implementation as a systemic institutional process. Furthermore, it introduces the concept of an "implementation gap" to explain the discrepancy between operational sustainability practices and institutional readiness. This multidimensional perspective constitutes the principal novelty of the study and contributes to a more comprehensive understanding of sustainable curriculum transformation in vocational education.

By doing so, the study contributes to the existing literature in two ways. First, it offers empirical evidence on the implementation gap between instructional practices and institutional readiness in green curriculum adoption. Second, it provides a conceptual basis for understanding green curriculum not merely as a pedagogical innovation but as a systemic reform agenda within vocational education.

RESEARCH METHOD

Research Design

This study employed a descriptive quantitative approach with an exploratory research design to examine the implementation of a green curriculum in vocational education. The exploratory design was chosen to provide an initial empirical understanding of how sustainability principles are integrated within vocational school practices, particularly in contexts where empirical evidence remains limited. Rather than testing hypotheses, this study focuses on identifying patterns and tendencies in green curriculum implementation across key dimensions.

Research Setting and Participants

The study was conducted in vocational schools (*Sekolah Menengah Kejuruan/SMK*) offering Fashion Design programs (Tata Busana) in Malang. This setting was selected due to the relevance of the fashion sector to sustainability issues, particularly in relation to environmentally responsible production, material usage, and waste management. The fashion industry is widely recognized as one of the sectors with significant environmental impact, making it a strategic context for examining the integration of green curriculum principles in vocational education.

The participants of this study were heads of study programs responsible for the Fashion Design department. These individuals were selected because of their direct involvement in curriculum planning, instructional supervision, and program evaluation, enabling them to provide comprehensive insights into both pedagogical practices and institutional support related to green curriculum implementation.

Given the exploratory nature of this study and the limited number of participants, the findings are intended to reflect an initial understanding of green curriculum practices within the specific context of fashion-related vocational education, rather than to provide

generalizable conclusions across all vocational sectors.

The study involved participants from four vocational schools, with a total of four respondents, providing a broader perspective compared to single-site studies while still positioned as an exploratory investigation.

Justification of Sample Size

The study involved four respondents, each representing the Head of the Fashion Design Study Program from four vocational high schools (SMKs) in Malang City that offer Fashion Design programs. The number of respondents reflects the total accessible population that met the predefined inclusion criteria within the selected research setting. Rather than seeking statistical generalization, this exploratory quantitative study aimed to obtain preliminary empirical evidence regarding the implementation of the green curriculum from individuals holding strategic responsibilities for curriculum planning, implementation, and evaluation. Consequently, each respondent served as a key institutional informant representing the implementation practices within his or her respective school.

In exploratory quantitative research, particularly when investigating an emerging phenomenon with a limited target population, small purposively selected samples can provide meaningful initial insights and help identify patterns for future large-scale investigations. Therefore, although the sample size is limited, it is considered appropriate for the exploratory objectives of this study and for generating preliminary empirical evidence rather than testing causal relationships or producing statistically generalizable findings.

Sampling Technique

This study employed a purposive sampling technique, selecting participants based on their relevance to the research objectives. The focus was on individuals who hold strategic roles in curriculum implementation within vocational education, particularly in the Fashion Design program.

Table 1. Sampling Criteria and Participant Characteristics

No.	Criteria	Description
1.	Position	Head of Study Program (*Ketua Program Keahlian*)
2.	Field of Expertise	Fashion Design (Tata Busana)
3.	Institutional Setting	Vocational Schools (SMK)
4.	Location	Malang City, Indonesia
5.	Role Relevance	Responsible for curriculum planning, implementation, and evaluation
6.	Sampling Technique	Purposive Sampling
7.	Number of Participant	4 respondents

As presented in Table 1, participants were selected based on specific criteria to ensure their relevance to the research objectives. The use of purposive sampling allows the inclusion of information-rich participants who possess direct experience and responsibility in curriculum implementation.

Although the number of participants is limited (four participants), their strategic roles provide valuable insights into both

pedagogical and institutional aspects of green curriculum implementation. Therefore, the data obtained are considered adequate for an exploratory study aiming to generate initial empirical understanding.

Research Variables

Recognizing that green curriculum implementation extends beyond a single dimension, this study operationalizes the construct into multiple indicators across pedagogical and institutional domains, as presented in Table 2.

No.	Dimension	Indicator	Item Code
1.	Curriculum Integration	Integration of sustainability principles in curriculum	Q1
2.	Curriculum Integration	Availability of planning documents supporting sustainability	Q2
3.	Curriculum Integration	Alignment of vision and mission with sustainability	Q3
4.	Teaching Practices	Integration of sustainability in teaching activities	Q4
5.	Teaching Practices	Implementation of environmentally friendly practices	Q5
6.	Teaching Practices	Development of eco-friendly student products	Q6
7.	Facilities & Resources	Availability of environmentally supportive facilities	Q7
8.	Facilities & Resources	Use of eco-friendly materials in practice	Q8
9.	Facilities & Resources	Training on sustainability for teachers	Q9
10.	Industry Alignment	Collaboration with industry in sustainability practices	Q10
11.	Industry Alignment	Industry contribution to green skills development	Q11
12.	Industry Alignment	Alignment with green industry needs	Q12
13.	Evaluation System	Implementation of evaluation related to sustainability	Q13
14.	Evaluation System	Availability of sustainability performance indicators	Q14
15.	Evaluation System	Utilization of evaluation results for improvement	Q15

Table 2. Variable Indicators of Green Curriculum Implementation

Table 2 presents the operationalization of the green curriculum implementation variable into five key dimensions and their corresponding indicators. These dimensions encompass both pedagogical aspects, such as curriculum integration and teaching practices, and institutional aspects, including teacher capacity, industry alignment, and evaluation systems.

The indicators were designed to capture a comprehensive view of sustainability integration in vocational education, ensuring that both classroom level practices and organizational support mechanisms are adequately represented. This multidimensional structure allows for a more nuanced analysis of implementation patterns and provides a foundation for identifying potential gaps between operational practices and institutional readiness.

Table 3. Mean Scores of Green Curriculum Implementation

No.	Dimension	Mean	Category
1.	Curriculum Integration	4.00	High
2.	Planning Documents	3.50	High
3.	Vision and Mission	4.00	High
4.	Teaching Integration	4.00	High
5.	Environmental Practices	4.00	High
6.	Eco-friendly Products	3.50	High
7.	Facilities Support	4.00	High
8.	Green Materials	4.00	High
9.	Teacher Training	3.00	Moderate
10.	Industry Collaboration	4.00	High
11.	Industry Contribution	3.50	High
12.	Green Industry Alignment	3.00	Moderate
13.	Evaluation System	3.00	Moderate
14.	Performance Indicators	3.00	Moderate
15.	Use of Evaluation Results	4.00	High

Source: Processed data (2026)

As shown in Table 3, the implementation of green curriculum in vocational education is generally categorized as high across most dimensions, particularly in curriculum integration, teaching practices, and institutional facilities. These findings indicate that sustainability principles have been incorporated into the operational aspects of teaching and learning processes.

However, several dimensions remain at a moderate level, including teacher training, alignment with green industry needs, and evaluation-related aspects. This suggests that while sustainability practices are present, the supporting institutional systems are not yet fully developed.

The variation in mean scores across dimensions highlights an uneven pattern of implementation, where pedagogical elements are more advanced than institutional mechanisms. This pattern provides empirical evidence of an implementation gap, which becomes a critical focus in the subsequent discussion.

Research Instruments

Data in this study were collected using a structured questionnaire designed to measure the implementation of green curriculum in vocational education. The instrument consists of 15 items, each corresponding to specific indicators derived from six key dimensions: curriculum integration, teaching practices, facilities and resources, teacher capacity, industry alignment, and evaluation systems.

All items were measured using a five-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), to capture respondents' perceptions of the extent to which sustainability principles are implemented within their institutions. The use of a Likert scale enables the quantification of subjective perceptions into measurable data, facilitating comparative and descriptive analysis. The questionnaire was developed based on a review of relevant literature on green skills and sustainability in vocational education, ensuring alignment between the conceptual framework and empirical measurement. Each item was carefully formulated to reflect both pedagogical practices (e.g., integration in teaching and learning processes) and institutional support mechanisms (e.g., training, industry collaboration, and evaluation systems).

To enhance clarity and response accuracy, the instrument employed concise and unambiguous statements, allowing respondents to provide consistent and reliable answers. Given the exploratory nature of the study, the instrument is intended to capture general patterns of implementation rather than detailed diagnostic measurements. Overall, the instrument is considered appropriate for capturing preliminary insights into the multidimensional nature of green curriculum implementation.

Instrument Validity

Prior to data collection, the questionnaire underwent content validity assessment through expert judgment involving two experts in vocational education and curriculum studies. The experts evaluated the relevance, clarity, and representativeness of each questionnaire item with respect to the research constructs. Based on their recommendations, several wording revisions were made to improve item clarity and ensure alignment with the conceptual framework of green curriculum implementation. The final instrument consisted of 15 items representing six dimensions: curriculum integration, teaching practices, facilities and resources, teacher capacity, industry alignment, and evaluation systems.

Instrument Reliability

The internal consistency of the instrument was assessed using Cronbach's Alpha. The analysis produced a Cronbach's Alpha coefficient of 0.87, indicating good reliability according to the criterion proposed by Nunnally and Bernstein (1994), which suggests that an Alpha value greater than 0.70 demonstrates acceptable internal consistency. Therefore, the questionnaire was considered sufficiently reliable for measuring respondents' perceptions of green curriculum implementation.

Data Analysis Technique

Data analysis in this study was conducted using descriptive statistical techniques to examine the level of green curriculum implementation across identified dimensions. The primary analysis involved calculating the mean score for

each item and dimension to represent the overall tendency of respondents' perceptions.

The use of mean analysis allows for a straightforward interpretation of Likert scale data by summarizing responses into a single representative value. To facilitate interpretation, the mean scores were categorized into three levels of implementation: low (1.00–2.60), moderate (2.61–3.40), and high (3.41–5.00). This categorization provides a clear framework for assessing the extent to which sustainability principles are integrated into vocational education practices.

In addition to item level analysis, the study also examines patterns across dimensions to identify variations between pedagogical and institutional aspects of implementation. This approach enables the identification of strengths and gaps within the overall implementation process.

Given the exploratory nature of the study and the limited number of respondents, the analysis does not aim to establish causal relationships or statistical generalization. Instead, it focuses on generating initial empirical insights and highlighting emerging patterns that can inform further research and policy development. This analytical approach ensures that the findings are interpreted within an appropriate scope, emphasizing depth of insight over statistical generalization.

RESULTS AND DISCUSSION

The results of this study provide an overview of the implementation of green curriculum in vocational education based on respondents' perceptions, focusing on key dimensions of sustainability integration.

No.	Dimension	Mean	Category
1.	Curriculum Integration	4.00	High
2.	Planning Documents	3.50	High
3.	Vision and Mission	4.00	High
4.	Teaching Integration	4.00	High
5.	Environmental Practices	4.00	High
6.	Eco-friendly Products	3.50	High
7.	Facilities Support	4.00	High
8.	Green Materials	4.00	High
9.	Teacher Training	3.00	Moderate
10.	Industry Collaboration	4.00	High
11.	Industry Contribution	3.50	High
12.	Green Industry Alignment	3.00	High
13.	Evaluation System	3.00	Moderate
14.	Performance Indicators	3.00	Moderate
15.	Use of Evaluation Results	4.00	High

As shown in Table 3, most dimensions of green curriculum

implementation fall within the high category, indicating that sustainability principles have been integrated into curriculum design, teaching practices, and institutional facilities.

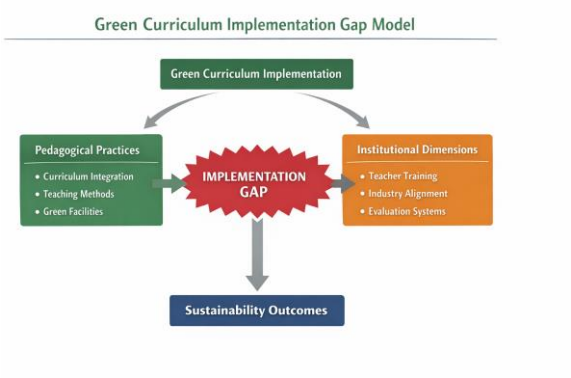
From a pedagogical perspective, curriculum integration and teaching practices demonstrate consistently high levels of implementation, suggesting that sustainability has been effectively incorporated into classroom-level activities.

However, several institutional dimensions particularly teacher training, alignment with green industry requirements, and evaluation systems are categorized as moderate, indicating that supporting structures for sustainability implementation remain underdeveloped.

Overall, the variation across dimensions reveals an uneven pattern of implementation, where pedagogical elements are more advanced than institutional components. This pattern indicates the presence of an implementation gap between operational practices and systemic readiness.

RESULT ANDA DISCUSSION

The findings of this study reveal that the implementation of the green curriculum in vocational education tends to be operationally visible but institutionally underdeveloped. While most indicators related to curriculum integration, instructional practices, and facility support fall within the high category, systemic components particularly teacher capacity development, industry alignment, and evaluation mechanisms remain at a moderate level. This pattern indicates that sustainability has been adopted primarily at the pedagogical surface, rather than being fully embedded within institutional structures.



This finding is consistent with previous studies suggesting that vocational education institutions often respond to sustainability demands through incremental adjustments rather than systemic transformation (OECD, 2025; Cedefop, 2022). In such cases, green curriculum implementation tends to manifest as fragmented practices, lacking coherence across institutional dimensions. As argued by Stephen Billett (2022), effective vocational learning requires alignment between curriculum, workplace practices, and institutional support systems an alignment that appears only partially achieved in this study.

A critical issue emerging from the findings is the limited emphasis on teacher capacity as a driver of sustainability integration. Although sustainability principles are introduced into classroom practices, the absence of structured and continuous professional development may constrain the depth and consistency of implementation. This supports the argument by David Jackson (2023) that green skills development is highly dependent on educators' competencies, not merely on curriculum design. Without adequate teacher preparation, sustainability risks being reduced to symbolic inclusion rather than transformative learning.

Furthermore, the moderate level of alignment with green industry requirements highlights a persistent disconnect between

vocational education and labor market transformation. This gap suggests that industry engagement remains limited or conventional, rather than strategically oriented toward emerging green sectors. In line with World Bank (2022), effective green skills development requires strong collaboration between education providers and industries to ensure relevance and responsiveness to evolving sustainability demands.

Another important finding relates to the weakness of evaluation systems, which indicates the absence of structured mechanisms for assessing the effectiveness of green curriculum implementation. Without clear indicators and feedback loops, institutions may struggle to monitor progress and sustain improvements. This reinforces the notion that sustainability integration must be supported by institutional governance and accountability frameworks, rather than relying solely on instructional practices.

Taken together, these findings suggest that current implementation reflects a transitional stage, where sustainability is recognized and partially implemented but not yet institutionalized. As such, the transformation toward a fully integrated green curriculum requires a shift from isolated pedagogical initiatives to system-wide reform involving policy, capacity building, and industry collaboration.

Theoretical Contribution

This study offers a theoretical contribution by conceptualizing green curriculum implementation in vocational education as a multi-level institutional process, rather than a purely pedagogical intervention. While existing literature tends to emphasize curriculum design and instructional innovation, the findings of this study highlight the importance of distinguishing between operational adoption and institutional embedding.

Specifically, this study proposes that green curriculum implementation consists of at least two interconnected dimensions:

1. Pedagogical Dimension
   - Curriculum integration
   - Teaching practices
   - Learning activities
2. Institutional Dimension
   - Teacher capacity development
   - Industry alignment
   - Evaluation and governance systems

The empirical evidence demonstrates that these two dimensions may develop unevenly, leading to what can be termed as an implementation gap a condition in which sustainability is present in practice but not fully supported by institutional structures.

By introducing this distinction, the study extends current discussions on green skills and vocational education by framing sustainability integration as a systemic transformation process rather than a set of isolated educational practices. This perspective aligns with emerging scholarship emphasizing the need for holistic and ecosystem-based approaches in vocational education reform.

CONCLUSION

This study demonstrates that the implementation of the green curriculum in vocational education has progressed positively, particularly in curriculum integration, teaching practices, and the provision of sustainability-supporting facilities. However, institutional dimensions—including teacher professional development, alignment with green industry requirements, and evaluation systems—remain only moderately implemented. These findings indicate that green

curriculum implementation in Indonesian vocational schools is still in a transitional stage, where sustainability has been integrated into instructional practices but has not yet been fully institutionalized through comprehensive governance and support systems.

From a theoretical perspective, this study contributes to the literature by conceptualizing green curriculum implementation as a multidimensional institutional process rather than solely as a pedagogical innovation. By distinguishing between pedagogical implementation and institutional readiness, the study introduces the concept of an implementation gap, providing a broader analytical framework for understanding sustainability integration in vocational education. This perspective extends existing discussions on green curriculum and offers a foundation for future empirical and theoretical research in Technical and Vocational Education and Training (TVET).

From a practical perspective, the findings provide evidence-based implications for school leaders, teachers, and policymakers. Vocational schools should strengthen continuous professional development programs related to green competencies, establish sustainability-oriented evaluation systems, and expand strategic partnerships with green industries to ensure curriculum relevance. At the policy level, educational authorities should develop integrated frameworks that support the institutionalization of green curriculum implementation through capacity building, governance mechanisms, and quality assurance systems.

Although this study provides valuable preliminary insights, its findings should be interpreted within the context of its exploratory design and limited sample size. Future studies are encouraged to involve larger and more diverse samples across different vocational sectors and regions to validate and extend the proposed multidimensional framework of green curriculum implementation.

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