Evaluation of the Implementation of Green Skills in Automotive Vocational Education: The CIPP Approach

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ABSTRACT

Environmental degradation caused by industrial activities, including the automotive sector, highlights the urgent need for vocational education to equip future workers with green skills. This study aims to evaluate the implementation of green skills in automotive vocational education using the CIPP (Context, Input, Process, Product) evaluation model. A quantitative evaluation research design was employed involving 362 participants, including school principals, Adiwiyata coordinators, teachers, students, and industry partners from eight vocational schools in Yogyakarta and Central Java, Indonesia, all designated as Adiwiyata schools. Data were collected through a Likert-scale questionnaire developed based on a validated instrument blueprint, with content and construct validity and reliability confirmed through Aiken's V, factor loading, Cronbach's alpha, and AVE analysis. Descriptive statistics were used to analyze the data. The results indicate that context and input aspects were moderately adequate, suggesting initial readiness and policy support, though not yet aligned with the specific needs of the automotive sector. However, the process and product components revealed significant weaknesses in instructional implementation and student outcomes. These findings imply the need for curriculum redesign, enhanced teacher capacity, and strengthened school-industry collaboration. Theoretically, this research contributes to sustainability-oriented TVET evaluation frameworks and informs future development of green vocational education models.

Keywords: Sustainable development, green skill, vocational education, automotive engineering, CIPP evaluation

INTRODUCTION

The degradation of the environment has emerged as a global concern in the 21st century, as ecosystems face increasingly severe threats due to human activities. Rising temperatures, declining air and water quality, biodiversity loss, and unsustainable resource consumption are symptoms of an escalating ecological crisis (Cavanagh et al., 2022; Tegnan et al., 2021). A major contributor to this problem is the industrial sector, which not only consumes large volumes of energy and raw materials but also produces significant levels of pollution and waste (Dou & Han, 2019; Olajire, 2020). Among the various industrial branches, the automotive industry stands out as one of the most environmentally taxing. Its contribution to carbon emissions, hazardous waste generation, and fossil fuel dependency is well-documented (Llopis-Albert et al., 2021; Nor et al., 2020; Smith & Brisman, 2021). While technological innovations, such as electric vehicles, have been introduced to mitigate some of these impacts, the human factor, such as the lack of environmentally conscious behaviour and skills

among the workforce, remains a critical weakness (Demir et al., 2021; Onyilo et al., 2020). Workers in the automotive industry often operate without adequate training in sustainable practices, which exacerbates the sector's environmental footprint (Peters et al., 2016). This calls for a systemic rethinking of how human resources are prepared and deployed in this domain.

Vocational education plays a vital role in addressing this issue, as it is responsible for developing skilled labour that aligns with the demands of various industries, including the automotive sector (Billett, 2011; Pavlova, 2009). In light of environmental challenges, vocational institutions are expected not only to produce technically competent graduates but also to equip them with green skills, encompassing the knowledge, attitudes, and practices necessary to work responsibly and sustainably (Mutohhari et al., 2025; Wahyuni & Mutohhari, 2024). Green skills encompass waste reduction, energy efficiency, pollution control, and environmental awareness, all of which are critical for mitigating the negative impacts of industrial work (Handayani et al., 2020). In Indonesia, the importance of integrating environmental education into vocational training has been acknowledged through initiatives such as the Adiwiyata Program, a government-led effort to foster environmentally friendly school cultures (Pavlova, 2019; Sern et al., 2021). Although initially designed for general education, the program has been adopted by vocational schools, including those with automotive departments, as a means of integrating ecological values and practices into their teaching and organisational behaviour (Putri et al., 2025).

However, there are significant concerns regarding the effectiveness of Adiwiyata implementation in vocational education contexts, especially in schools with strong industry alignment, such as automotive-focused institutions. Preliminary observations and anecdotal evidence suggest that the Adiwiyata model, despite its good intentions, may not adequately address the realities of vocational education, where the emphasis is often on technical proficiency and workplace readiness. The program tends to emphasise school-wide environmental behaviour and policy compliance, rather than practical competencies that can be directly applied to green practices in industrial settings (Saddhono et al., 2019). Consequently, a noticeable gap exists between the environmental values promoted through Adiwiyata and the actual green skills required in the automotive sector. Moreover, there is a lack of empirical research that thoroughly evaluates the strengths and weaknesses of the program's implementation in vocational contexts, particularly from the perspective of its contextual relevance, resource inputs, instructional processes, and learning outcomes.

Given these shortcomings, there is an urgent need to conduct a comprehensive evaluation of how green skills are being implemented in vocational automotive education. Such an evaluation should aim to identify gaps, barriers, and opportunities for improvement, thereby informing future educational reforms and policy interventions. This study aims to fulfil that need by employing the CIPP (Context, Input, Process, Product) evaluation model. The objectives of the research are fourfold: (1) to analyze the contextual alignment of green skills implementation with the needs of the automotive industry and the goals of vocational education; (2) to examine the input factors such as human resources, curriculum design, infrastructure, and institutional commitment that support or hinder green skills development; (3) to evaluate the processes of teaching and learning, including instructional methods, student engagement, and practice-based learning; and (4) to assess the product outcomes in terms of students' competencies, attitudes, and readiness to apply green skills in real-world automotive workplaces. Through quantitative data collection and analysis, this research aims to provide evidence-based insights that can guide the enhancement of green skill development in Indonesian vocational schools, ultimately contributing to more sustainable industrial practices.

METHOD

Research Approach and Evaluation Model

This study adopts an evaluation research approach with a specific emphasis on program evaluation, as it seeks to assess the implementation and effectiveness of green skills development within automotive vocational education. The evaluation model employed is the CIPP model (Context, Input, Process, Product) developed by Stufflebeam & Zhang (2017). The CIPP model is a well-established framework in program evaluation that enables comprehensive assessment across four key dimensions: (1) Context Evaluation (examining goals and needs), (2) Input Evaluation (evaluating resources and strategies), (3) Process Evaluation (monitoring

implementation actions), and (4) Product Evaluation (measuring results and outcomes). These four dimensions interact dynamically to support continuous program improvement, as depicted in the CIPP model diagram (see Figure 1), in which all phases are guided by core values and aligned through goals, plans, actions, and outcomes. The rationale for employing the CIPP model in this study is threefold. First, the nature of the program under evaluation, the implementation of green skills in vocational education, requires a holistic and systemic perspective that focuses on outcomes and critically analyzes the supporting contexts and processes (Kibrit et al., 2022). Second, vocational schools and their industry partners operate in complex environments, where decisions about curriculum design, resource allocation, and instructional methods are closely interrelated; thus, a multi-dimensional framework such as CIPP is essential (Yuwono et al., 2020). Third, implementing the Adiwiyata program in vocational schools, especially in automotive departments, has yet to be evaluated comprehensively using a structured and evidence-based model (Yunus et al., 2020). The CIPP model provides an analytical lens through which stakeholders can reflect on the program's relevance, effectiveness, and areas for improvement.

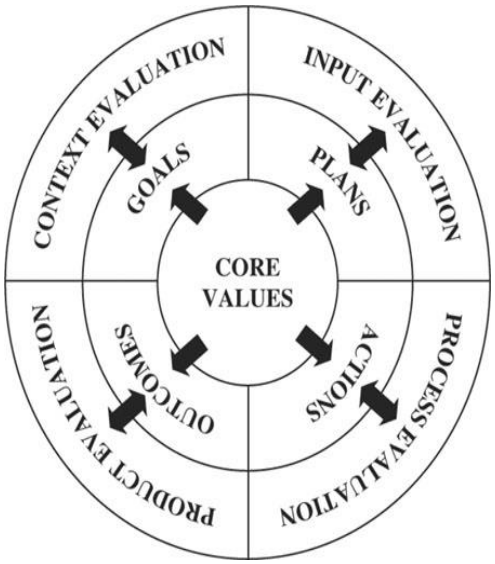

Fig. 1 CIPP Design in Research

In this study, the CIPP model is operationalized as follows, aligned with the CIPP diagram:

a) Context Evaluation focuses on identifying the environmental and institutional needs that justify the implementation of green skills in vocational automotive education. It investigates whether the current goals are aligned with the demands of sustainable industry practices.

b) Input Evaluation assesses the planning, resources, infrastructure, curriculum, and institutional readiness for implementing green skills education.

c) Process Evaluation examines the extent to which the planned activities and strategies are being implemented effectively and consistently within schools and industries.

d) Product Evaluation measures the actual outcomes in terms of students' competencies, behaviors, and readiness to apply green skills in the workplace.

This study exclusively adopts a quantitative approach for data collection and analysis. The urgency for measurable, comparable, and generalizable results in educational policy and industry partnership justifies using a structured survey method. This quantitative orientation is critical to produce statistically reliable data that can guide decision-making processes in both educational institutions and industry sectors.

Research Participants

The participants involved in this study were carefully selected from a combination of educational and

industrial settings, with a specific focus on individuals directly involved in implementing, developing, or evaluating green skills within the domain of automotive vocational education. The educational participants were drawn from eight vocational high schools (SMK) located in the provinces of Yogyakarta and Central Java, all of which had been officially recognized as Adiwiyata schools by the Indonesian Ministry of Environment and Forestry. These schools were chosen due to their formal engagement in the Adiwiyata program, which emphasizes environmentally conscious education and aligns with integrating green skills into vocational training (Mutohhari et al., 2025). From the educational setting, the study included various stakeholders: school principals who provide leadership and policy direction, Adiwiyata program coordinators responsible for overseeing environmental initiatives within the schools, automotive subject teachers who directly engage students in technical and vocational learning, and Grade 12 students enrolled in the automotive study program, who are expected to be the primary beneficiaries of green skill development efforts. Complementing this, participants from the industrial sector were selected from eight automotive companies that maintain active partnerships with the aforementioned vocational schools. These industry partners are involved in collaborative activities such as internship programs, curriculum co-design, and joint technical training schemes. The respondents from industry included heads of human resource development (HRD) divisions, who are responsible for assessing and fostering workforce competencies, and managers of production units, who oversee daily operations and are directly impacted by implementing sustainable practices in the workplace.

A two-tiered sampling strategy was employed to ensure both the relevance and representativeness of the participant sample. First, cluster sampling was used to identify groups of schools and their respective industry partners with established collaborative frameworks. This was followed by purposive sampling to deliberately select respondents within these clusters who held key roles in green skill implementation or monitoring. This methodological approach ensured that the data gathered reflected a broad spectrum of experiences, perspectives, and insights across both educational and industrial domains, thereby enriching the validity and applicability of the research findings (Campbell et al., 2020). Based on the results of systematic sample calculations, as many as 362 participants were involved as respondents in this evaluation study. Furthermore, we detailed that 239 (66%) were students, 83 (22.93%) were teachers, eight of whom were principals and Adiwiyata coordinators (4.42%), and the rest were automotive industry practitioners.

Data Collection

The data collection technique employed in this study was a quantitative survey using a structured five-point Likert scale questionnaire ranging from 1 = Very Low to 5 = Very High. This approach was chosen due to its effectiveness in capturing perceptions and evaluations from a large and diverse group of respondents, spanning eight Adiwiyata-status vocational schools and eight partnered automotive industries. As the study aimed to evaluate the implementation of green skills based on the CIPP (Context, Input, Process, Product) model, a quantitative method was considered most appropriate for systematically measuring multiple variables across stakeholder groups such as school principals, Adiwiyata coordinators, vocational teachers, students, and industrial partners. The uniform structure of the Likert scale provided clarity for respondents and enabled comparative analysis across the CIPP dimensions, supporting objective interpretations of strengths and weaknesses in green skill implementation.

The development of the questionnaire items was grounded in the four research objectives, which were directly aligned with each component of the CIPP model. To ensure content validity, all indicators were formulated through a rigorous review of relevant literature on green skills in vocational education, sustainable human resource development, and environmental education policies in Indonesia. An expert panel consisting of education researchers, green TVET specialists, and psychometricians was involved to assess the clarity, representativeness, and relevance of the items. The instrument was refined through expert judgment and a pilot test involving 30 respondents to assess construct validity. Exploratory factor analysis (EFA) was performed to confirm that each item loaded significantly onto the intended CIPP components. Reliability was then tested using Cronbach's Alpha for each domain of the questionnaire, and all components exceeded the acceptable threshold of 0.70, indicating strong internal consistency and reliability of the instrument. Table 1 explains the blueprint of the questionnaire instrument, which outlines the evaluation aspects, references, operational indicators, and number of items per aspect:

Table 1 Blueprint of Questionaire Instrument

Evaluation Aspect	Reference	Indicators	N of Items
Context Evaluation	Stufflebeam & Zhang (2017), Pavlova (2009)	Alignment with national green education policy, alignment with vocational school vision, relevance to green industry demands, stakeholder commitment, environmental orientation in school policies, curriculum policy alignment.	8 items
Input Evaluation	Stufflebeam & Zhang (2017), Yang & Li (2023)	Availability of eco-friendly facilities, teacher competence in green practices, integration of green materials in curriculum, training support for green skills, industry involvement in curriculum development, budget allocation for green initiatives, strength of industry-school partnerships	7 items
Process Evaluation	Stufflebeam & Zhang (2017), Pavlova (2009)	Implementation of project-based green learning, student engagement in green activities, use of discovery-based methods, teacher facilitation of critical thinking, environmental behavior modeling, practice of mindful and meaningful learning, collaboration in green-themed tasks, monitoring and feedback on green competencies	8 items
Product Evaluation	Stufflebeam & Zhang (2017), Mohd Zubir et al. (2021)	Development of green work behavior, eco-innovation among students, environmental attitude change, application of green practices in internships, graduates' readiness in green industry, portfolio of sustainable project outputs, contribution to school's green culture	12 items

Data Analysis

In line with the nature of the research, descriptive quantitative analysis was chosen as the most appropriate data analysis technique. The goal of descriptive analysis is to summarize and interpret patterns, tendencies, and levels of implementation across the four CIPP dimensions. This approach allows researchers to identify strengths and weaknesses in implementing green skills, without requiring causal inference, which aligns with the objectives of a formative and summative evaluation study (Mardapi, 2012; Taib et al., 2020). Using descriptive statistics such as mean scores, standard deviation, frequency counts, and percentages enables a clear and structured presentation of how each indicator was perceived across different stakeholder groups (Yuwono et al., 2020). Descriptive analysis is particularly relevant when the evaluation seeks to inform program improvement, policy refinement, or capacity development, rather than testing a specific hypothesis. It also supports meaningful comparison between different respondent categories (e.g., schools vs. industries, teachers vs. students) to highlight potential perceptual gaps (Sankaran & Saad, 2022).

A five-level categorization system was used to interpret the mean scores of each item and dimension to facilitate the interpretation of findings, as shown in the table 2. This classification follows the equal-interval approach and helps describe the level of implementation from "Very Low" to "Very High." The score intervals were calculated using the following formula:

$$Interval\ Width = \frac{Maximum\ Score - Minimum\ Score}{Number\ of\ Categories} = \frac{5-1}{5} = 0.8$$

This approach, grounded in the Sturges rule and commonly applied in educational and psychometric evaluations, enables a systematic and transparent categorization of the level of implementation, allowing policymakers and practitioners to easily recognize areas that need strengthening (Mardapi, 2012).

Table 2 Categorization and Evaluation Results

Category	Score Range (Likert Scale)	Interpretation
Very High	4.21 – 5.00	Fully implemented / Optimal
High	3.41 – 4.20	Largely implemented / Above average
Moderate	2.61 – 3.40	Moderately implemented / Sufficient
Low	1.81 – 2.60	Poorly implemented / Below average
Very Low	1.00 – 1.80	Not implemented / Critically lacking

RESULT

Validities and Reliabilities

To ensure the overall quality and robustness of the instrument employed in this study, a comprehensive series of validity and reliability tests were rigorously conducted. The initial phase involved an in-depth evaluation of content validity, which was assessed using Aiken's V formula. This approach is widely recognized for its precision in quantifying expert agreement on the relevance of assessment items. In this study, five expert judges were purposively selected based on their expertise in the fields of green education, technical and vocational education and training (TVET), environmental education, and educational measurement. Each expert independently reviewed and rated all 28 items in the instrument based on three primary criteria: relevance to the conceptual framework of green skills in vocational education, clarity of the language used, and alignment with the specific indicators outlined in the blueprint developed during the initial instrument design stage. The resulting Aiken's V coefficients for each item ranged from 0.85 to 0.97, well above the minimum acceptable threshold of 0.80. These findings confirm that all items demonstrated excellent content validity and were deemed appropriate for capturing the intended constructs.

Following the content validation process, further analyses were conducted to examine the construct validity and internal reliability of the instrument. These psychometric properties were assessed using multiple statistical indicators, including factor loading analysis, Cronbach's Alpha coefficients, and Average Variance Extracted (AVE) values. Factor loading analysis revealed that all items had loadings greater than 0.60, indicating a strong association between each item and its underlying latent construct. The AVE values for all indicators surpassed the recommended cut-off point of 0.50, confirming that each construct accounted for a sufficient proportion of variance from its items. In terms of internal consistency, Cronbach's Alpha values ranged from 0.78 to 0.91 across the four evaluation dimensions of the CIPP model (Context, Input, Process, and Product). These values suggest a high degree of reliability, indicating that the items within each construct consistently measure the same underlying concept. Table 3 presents the detailed results of these analyses, which collectively demonstrate that the instrument is both statistically valid and reliable for use in evaluating the implementation of green skills in automotive vocational education.

Table 3 Validities and Reliabilities Instruments

Evaluation Aspect	Indicator	Loading Factor	AVE	Cronbach's Alpha
Context	Alignment with national green education policy	0.79	0.56	0.84
	Alignment with vocational school vision	0.83	0.60	0.86
	Relevance to green industry demands	0.81	0.58	0.85

	Stakeholder commitment	0.77	0.52	0.82
	Environmental orientation in school policies	0.80	0.54	0.83
	Curriculum policy alignment	0.76	0.53	0.81
Input	Availability of eco-friendly facilities	0.82	0.59	0.85
	Teacher competence in green practices	0.84	0.61	0.87
	Integration of green materials in curriculum	0.79	0.55	0.84
	Training support for green skills	0.78	0.54	0.82
	Industry involvement in curriculum development	0.77	0.53	0.81
	Budget allocation for green initiatives	0.76	0.51	0.80
	Strength of industry-school partnerships	0.81	0.57	0.83
Process	Implementation of project-based green learning	0.75	0.52	0.80
	Student engagement in green activities	0.78	0.53	0.82
	Use of discovery-based methods	0.76	0.51	0.79
	Teacher facilitation of critical thinking	0.73	0.50	0.78
	Environmental behavior modeling	0.72	0.50	0.77
	Practice of mindful and meaningful learning	0.74	0.52	0.80
	Collaboration in green-themed tasks	0.76	0.53	0.81
	Monitoring and feedback on green competencies	0.75	0.52	0.80
Product	Development of green work behavior	0.74	0.52	0.80
	Eco-innovation among students	0.76	0.54	0.81
	Environmental attitude change	0.78	0.56	0.83
	Application of green practices in internships	0.77	0.55	0.82
	Graduates' readiness in green industry	0.79	0.57	0.84
	Portfolio of sustainable project outputs	0.73	0.50	0.79
	Contribution to school's green culture	0.76	0.53	0.80

Context Evaluation

The results of the context evaluation reveal that the implementation of green skills in automotive vocational education is built upon a reasonably adequate policy foundation. However, further strengthening and

contextual alignment with the specific demands of green automotive industries are still required. The vocational schools in this study have generally incorporated environmental sustainability into their visions and missions, reflecting an emerging institutional commitment toward fostering environmentally conscious school cultures. However, this commitment is not yet fully embedded in the curriculum in a way that explicitly addresses green competencies tailored to the automotive field. The alignment between labor market needs for green skills and vocational education content remains broad and somewhat generic, indicating a need for more detailed and operational integration of these competencies. Furthermore, while stakeholders, such as industry partners (DUDI), local governments, and community groups have shown a presence in supporting the green agenda, their roles must be further synergized to ensure that the policies and programs implemented go beyond compliance and genuinely enhance student readiness for green employment. These findings underscore the necessity for vocational schools to reconstruct their strategic direction and contextual policies to explicitly and effectively support green skills development, especially regarding the distinctive characteristics and needs of the automotive sector. Table 4 describes in detail the results of the context evaluation analysis.

Table 4 Context Evaluation Result

Evaluation Aspect	Indicator	Min	Max	Mean	Category
Context	Alignment with national green education policy	2.4	4.8	3.65	Moderate
	Alignment with vocational school vision	2.2	4.7	3.72	Moderate
	Relevance to green industry demands	2.0	4.5	3.61	Moderate
	Stakeholder commitment	2.0	4.3	3.58	Moderate
	Environmental orientation in school policies	2.1	4.5	3.66	Moderate
	Curriculum policy alignment	2.0	4.4	3.60	Moderate

Input Evaluation

The input evaluation highlights a moderate level of readiness in terms of human resources, material resources, and industrial partnerships to support the implementation of green skills in automotive vocational education. Vocational schools generally have basic infrastructures such as workshop facilities, tools, and learning resources that are moderately sufficient to facilitate green-oriented technical education. Likewise, teachers possess general pedagogical and technical competencies; however, many have not yet received specific training or professional development in environmental sustainability or green automotive technologies, limiting their capacity to deliver green-oriented learning experiences effectively. Most strikingly, the school-industry partnerships, although formally established, lack depth and continuity in their collaboration, particularly in integrating green values and practices into internship programs, curriculum co-design, and joint training. These partnerships are often limited to routine industrial work practices that do not emphasize environmentally responsible behavior or green innovations. Therefore, while the input conditions provide a usable foundation, they require significant improvements, particularly in strengthening partnerships with green-oriented industries and equipping teachers with specific green skills to fully support the contextualization and integration of green skills in line with the evolving demands of sustainable automotive sectors. Table 5 describes in detail the results of the input evaluation analysis.

Table 5 Input Evaluation Result

Evaluation Aspect	Indicator	Min	Max	Mean	Category
Input	Availability of eco-friendly facilities	2.1	4.6	3.68	Moderate
	Teacher competence in green practices	2.3	4.8	3.70	Moderate

	Integration of green materials in curriculum	2.2	4.5	3.61	Moderate
	Training support for green skills	2.1	4.2	3.55	Moderate
	Industry involvement in curriculum development	1.9	4.0	3.38	Low
	Budget allocation for green initiatives	2.0	4.1	3.49	Moderate
	Strength of industry-school partnerships	2.0	4.0	3.33	Low

Process Evaluation

The process evaluation reveals that implementing green skills within the instructional and pedagogical processes in automotive vocational schools remains suboptimal and lacks consistency across learning environments. Although several educators have made initial efforts to integrate environmental themes into their teaching, they are often superficial and unsupported by a structured instructional design that explicitly embeds green competencies into the learning objectives, methods, and assessments. Teaching approaches such as project-based learning, inquiry-based learning, and reflective learning, proven effective in developing sustainability-oriented thinking and behavior, are applied sporadically and often without proper scaffolding or integration with core technical content. As a result, students may be aware of green issues in general. Still, they are not systematically trained to apply green problem-solving skills or innovate within the context of automotive technology. Furthermore, classroom culture and school-wide learning environments still prioritize technical performance and output over environmental responsibility, reflecting a gap between policy aspirations and everyday pedagogical practices. These findings suggest a critical need for professional development programs, curriculum redesign, and stronger instructional leadership to ensure that green skills are included in lesson plans and meaningfully enacted in teaching and learning processes aligned with vocational goals. Table 6 describes in detail the results of the process evaluation analysis.

Table 6 Process Evaluation Result

Evaluation Aspect	Indicator	Min	Max	Mean	Category
Process	Implementation of project-based green learning	1.8	4.2	3.30	Low
	Student engagement in green activities	1.9	4.1	3.29	Low
	Use of discovery-based methods	1.7	4.0	3.21	Low
	Teacher facilitation of critical thinking	1.6	3.9	3.10	Low
	Environmental behavior modeling	1.8	4.0	3.12	Low
	Practice of mindful and meaningful learning	1.9	4.2	3.25	Low
	Collaboration in green-themed tasks	1.7	4.1	3.28	Low
	Monitoring and feedback on green competencies	1.6	3.8	3.14	Low

Product Evaluation

The product evaluation indicates that the outcomes of green skills development in automotive vocational education are still limited in scope and depth, particularly when measured by students' observable behaviors and competencies. While some students show a basic awareness of environmental issues, they have not consistently demonstrated eco-friendly behaviors or the capacity to innovate sustainable solutions during school-based learning or workplace internships. This suggests that the green competencies targeted in

educational objectives have not yet translated into meaningful, measurable outcomes at the Learner level. Moreover, there is minimal evidence that students internalize green values or apply them independently in authentic industrial contexts, such as using eco-efficient work habits, material-saving practices, or environmentally conscious decision-making. Internships, which could serve as key moments for students to apply their green skills, often focus on conventional production goals, with little emphasis on sustainability outcomes. Furthermore, long-term tracking or post-graduation monitoring mechanisms are absent to assess how vocational alums perform regarding environmental responsibility in their professional roles. This highlights a critical gap between the intentions of green education and its actual impact, underscoring the need for strengthened curriculum-outcome alignment, ongoing evaluation of behavioral change, and stronger collaboration with industry to ensure students are equipped and expected to apply green practices in real-world settings. Table 7 describes in detail the results of the product evaluation analysis.

Table 7 Products Evaluation Result

Evaluation Aspect	Indicator	Min	Max	Mean	Category
Products	Development of green work behavior	1.8	4.1	3.22	Low
	Eco-innovation among students	1.7	4.0	3.19	Low
	Environmental attitude change	1.9	4.2	3.27	Low
	Application of green practices in internships	1.8	4.0	3.20	Low
	Graduates' readiness in green industry	1.6	3.9	3.15	Low
	Portfolio of sustainable project outputs	1.7	4.0	3.18	Low
	Contribution to school's green culture	1.7	4.1	3.25	Low

DISCUSSION

Based on the evaluation results conducted using the CIPP (Context, Input, Process, and Product) model, several key findings have emerged that provide critical insights into implementing green skills in automotive vocational education. Overall, the context and input components were moderately adequate, with schools demonstrating a general commitment to environmental sustainability through policy documents and basic resource readiness. However, these components lack a specific focus tailored to the automotive sector, and industry partnerships have yet to be fully optimized. More significantly, the process and product components revealed substantial weaknesses. Green skills have not been meaningfully integrated into teaching and learning practices, and the resulting student outcomes have not reflected strong environmental competencies. This situation indicates a discrepancy between policy ambitions and the actual practices and results within the schools. It suggests that the implementation of green education, particularly in the vocational automotive sector, remains more aspirational than operational. The findings also imply a pressing need to bridge the gap between green policy mandates and tangible instructional and behavioral changes among educators and students alike.

These results align with and, in some cases, contrast with existing scholarly literature. Studies such as those by Pavlova (2019) and Handayani et al. (2020) emphasize that vocational education must be a key driver in equipping youth with green competencies, especially in high-impact industries like automotive manufacturing and repair. Research by Majumdar (2012) also highlights the role of contextualized green curricula and teacher preparedness as essential enablers for effective implementation. Supporting the current study's findings, several empirical studies report that while policies and vision statements in vocational schools often align with sustainable development goals (SDGs), the translation into classroom pedagogy and assessment remains limited (Cledumas et al., 2020; Jaeger, 2014; Li et al., 2023; McGrath & Powell, 2016). Conversely, studies, such as those by Lamichhane et al. (2022) in Nepal and Karpudewan & Kulandaisamy (2018) in Malaysia,

provide evidence that when teacher capacity-building and industry collaboration are systematically embedded, green skills implementation can become more tangible and practical. These differing results underscore the influence of local institutional cultures, teacher competencies, and industry responsiveness in shaping green TVET (Technical and Vocational Education and Training) outcomes. Notably, the current study's finding on the weak integration of green skills in internships contrasts with literature emphasizing internships as crucial arenas for applied green learning, highlighting a critical missed opportunity in this context.

The study offers a diagnostic reflection of current practices and a roadmap for reform in green skill development within automotive vocational education. A key limitation of the research lies in its reliance on quantitative self-reported data, which may not fully capture the depth of green behavior or pedagogical complexity. Future research should incorporate qualitative methods such as classroom observations, curriculum document analyses, and stakeholder interviews to triangulate and deepen understanding. Despite this limitation, the study has practical implications for school leaders, policymakers, and vocational educators. The results call for revising existing vocational curricula to explicitly include green competencies aligned with industry standards and continuous professional development programs that prepare teachers to embed sustainability into their instruction. Strengthening partnerships with green-oriented industries is vital to ensure that internships and workplace learning reflect green standards and foster eco-responsible student behavior. Theoretically, this research contributes to applying the CIPP model in sustainability education by illustrating how each component interrelates and impacts overall implementation. It also opens up pathways for future theoretical explorations of green skill integration across different vocational disciplines and regions, encouraging comparative and longitudinal studies to assess the effectiveness of various strategies over time.

CONCLUSION

This study concludes that the implementation of green skills in automotive vocational education, when evaluated through the CIPP (Context, Input, Process, Product) framework, reveals a moderate level of readiness in terms of contextual and input factors, yet faces significant challenges in the domains of instructional processes and measurable learning outcomes. Although vocational schools have shown initial commitment to environmental education through policy alignment and basic resource availability, this commitment has not been adequately translated into pedagogical practices or student competencies that align with the demands of green industries. The lack of deep integration of green values into curricula, weak industry collaboration, insufficient teacher capacity, and limited focus on behavioral and performance outcomes suggest that current efforts are inadequate to produce graduates who are truly equipped with green skills. Therefore, it is imperative to reconstruct the approach to green vocational education by strengthening policy-practice alignment, enhancing professional development, redesigning learning processes, and deepening school-industry partnerships. This study contributes to the ongoing discourse on sustainable vocational education. It highlights the need for a more systemic and targeted effort to develop environmentally responsible human resources in the automotive sector.

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