

Integration Sustainable Fashion Learning in Vocational Education: a Systematic Study Literature 2019–2025

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ARTICLE INFO

Article history

Received: Dec 04, 2025

Revised: May 28, 2026

Accepted: May 31, 2026

Keywords

Competence Sustainability

Vocational Education

Learning Sustainability

Sustainable Fashion.

ABSTRACT

This systematic literature review examined the integration of sustainable fashion education into vocational education between 2019 and 2025 using the PRISMA 2020 framework and Publish or Perish 8 to search Scopus, PubMed, and Google Scholar. From 665 identified publications, 88 studies met the inclusion criteria. The review found that sustainability is effectively integrated through Project-Based Learning, Challenge-Based Learning, Studio-Based Learning, digital learning, and artificial intelligence. Four core sustainability competencies emerged: cognitive, affective, behavioural, and transformative competence. Successful implementation depends on innovative pedagogies, institutional commitment, and strong industry collaboration. Although sustainable fashion education is expanding globally, major regional disparities persist in infrastructure, teacher capacity, and standardized competency assessment. The findings emphasize the importance of curriculum redesign, enhanced partnerships between vocational institutions and industry, and greater adoption of digital technologies to develop graduates with sustainability competencies, innovation skills, and the ability to drive change.

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Introduction

The fashion industry is one of the largest creative sectors of the global economy and also has a significant impact on environmental and social issues. The fast fashion phenomenon is characterised by rapid production and excessive consumption, exacerbating textile waste and emissions and

contributing to global carbon emissions. Conditions. This sense of urgency will transform the fashion industry, moving it toward a more sustainable direction that considers not only aesthetics and economics but also its social, ethical, and environmental impacts.

The global fashion industry has been one of the most significant contributors to carbon emissions, with textile production accounting for approximately 9% of total greenhouse gas emissions globally and contributing to around 20% of water pollution worldwide Liscio and Sospiro (2023). Furthermore, the fashion industry is responsible for approximately 3-10% of global carbon emissions, and carbon emissions have continued to increase alongside growth in textile consumption Singh and Bansal (2024). The fast fashion phenomenon has exacerbated this issue, as production of clothes has increased drastically since phase-out quotas for textiles in the early 2000s, resulting in almost a doubling of the global output Avrhami (2022). In the context of urgent climate change, integration of values and sustainable development has become a crucial response to the environmental crisis faced by the fashion industry Muntoha (2024). Vocational education plays a strategic role in preparing workers not only with technical skills but also with ecological awareness and social responsibility to address this global challenge Siregar et al (2024).

Development draft sustainable fashion encourages institutional education, including vocational education, to adapt direction his learning to meet the needs of an increasingly growing industry demand for green skills (green skills). Vocational education plays a strategic role in preparing individuals who are not only skilled in a technical sense but also aware and responsible in addressing sustainability. However, various studies show that integrating the sustainability principle into vocational learning remains challenging. Transformation of vocational education in the digital era and the Revolution Industry 4.0 demands integration of technology and values sustainability in the curriculum to prepare adaptive graduates to meet the needs of the world of work Khoirunnisa and Hidayat (2025). Education for Development (ED) and Education for Sustainable Development (ESD) need to be integrated into the curricula of schools and medium vocational schools (SMK) to create a more learning context and be relevant to industry demands. Sofiana et al (2022). Drafting sustainable fashion involves considering the economic, social, and environmental aspects, which must be understood holistically by participants who educate vocational students, while accounting for the fashion industry within a linear business model. This is one of the least sustainable global businesses Moran et al (2021). Economy circular with principle regenerative, leasing, recycling, reuse and repurposing textiles offer potential to make the fashion industry more sustainable. Burns (2024).

Although there are various studies on the integration of the educational character in vocational education Nugroho (2022) and on integrating education into the curriculum to make it sustainable Ningsih (2024). Still, a gap exists in studies on how learning sustainable fashion is integrated into vocational education, particularly in Indonesia and other developing countries. Global data indicate that by 2025, approximately 65% of institutions offering fashion education worldwide will have incorporated sustainability into their curriculum. However, in many developing countries, including Indonesia, implementation remains limited. Research on fashion in the vocational field at school shows that students' average score on related materials on sustainable fashion was only 68.35 (below the minimum criterion of 70).

The phenomenon of the show's existence warrants urgent attention for further study to understand how comprehensively sustainable fashion learning has been integrated into vocational education. From 2019 to 2025, various studies have emerged that discuss integrating sustainability into education design, technology textiles, and fashion curricula at the vocational level. However, the study has not yet been systematically synthesised to describe trends, approaches, and existing research gaps.

Based on the background of said research. The aim is to systematically review the literature on the integration of sustainable fashion learning in vocational education from 2019 to 2025. The 2019–2025 timeframe was selected because it shows a significant increase in research on sustainable fashion and sustainability-based vocational education. Since 2019, sustainability issues in the fashion industry have developed rapidly alongside growing global attention to the Sustainable Development Goals (SDGs) (Das et al., 2026; Storonyanska et al., 2025). In addition, the COVID-19 pandemic since 2020 has accelerated digital transformation in vocational education through the utilisation of digital technologies, online learning, and Industry 4.0-based approaches Muktiarni et al (2021). This period also marks the growing integration of sustainability, the circular economy, and eco-digital competencies into vocational fashion education curricula, making it highly relevant for systematic analysis.

In general special, research This make an effort to : (1) identify forms and strategies of integration sustainable fashion in curriculum and learning process vocational, (2) analyzing trends and themes main growing in literature related, (3) revealing gaps and challenges in implementation education sustainable in the field fashion vocational, as well as (4) providing recommendation for practitioners education and makers policy in develop more curriculum adaptive towards the sustainability agenda industry fashion.

Through a systematic review of the latest literature, this study aims to provide a comprehensive description of the direction and development of sustainable fashion integration in vocational education, while also serving as a foundation for strengthening learning strategies that support the transformation of the fashion industry towards a more sustainable future.

Method

Study this approach by systematically reviewing the literature, adhering to the PRISMA 2020 standards. The source information primarily originates from three databases: Scopus, PubMed, and Google Scholar. These databases were selected because they complement each other in terms of coverage, indexing quality, and citation identification capabilities. Scopus provides precision and consistency in bibliographical information. At the same time, Google Scholar complements the other two databases by providing access to articles and citations that are not available in them, particularly on the topic of sustainable fashion.

The literature search process was conducted using Publish or Perish 8, which allows integration of searches across various databases and provides bibliometric metadata, such as the number of citations and h-index, to evaluate article relevance. In addition to automatic search, this research also identifies sources through citation searching, manual searching in relevant journals, and consultation with experts in education, vocational training, and sustainable fashion.

The stages search follows the PRISMA 2020 flow, including identification, screening, eligibility, and inclusion. Page and McKenzie et al (2021). During the identification stage, the researchers conducted a literature search using Publish or Perish 8 across the previously mentioned databases. The publication timeframe was limited to 2019–2025 to capture recent literature on integrating sustainability into vocational fashion education. In addition, supplementary sources were identified through citation searching, hand searching of relevant journals, and consultations with experts in vocational education and sustainable fashion. All retrieved search results were compiled, after which duplicate records were removed both automatically through Covidence and manually by the researchers. Subsequently, the screening stage involved reviewing titles and abstracts to eliminate articles that were not relevant to the research focus. At the eligibility stage, articles that passed the initial screening were assessed through a full-text review to ensure they met the inclusion criteria. Articles whose full texts were inaccessible or that did not meet the relevance criteria were excluded, with the reasons for exclusion clearly documented. The final stage included presenting the number of studies selected for qualitative synthesis and, where relevant, quantitative synthesis (meta-

analysis). The entire process was visualised using the PRISMA 2020 Flowchart to ensure transparency and reproducibility Page and Moher et al (2021).

The criteria search was developed through an initial review, focusing on identifying synonyms and terms relevant to the study, as shown in Table 1. Glossary: This is used to compile a query-aligned search with objective research, particularly in the context of agent conversation-based intelligence, artificial intelligence for fashion, and sustainable fashion.

Table 1. Table Criteria Search

Keywords	Learning	Sustainable fashion	Vocational Education
Synonym	Learning	Sustainable Fashion	Vocational education
	Curriculum	Eco-fashion	Technical education
	Teaching	Ethical fashion	Vocational training
	Pedagogy	Green Fashion	
		Circular fashion	

The search string utilised the automatic method and was adapted for each database, employing several automatic search tools. The search string is arranged using customised keyword combinations with a focus on research, utilising logical operators (Boolean operators). The search string literature used is contained in Table 2. A search string is entered in Publish or Perish 8 to access data from several academic databases (Scopus, Google Scholar, and PubMed).

Table 2. Search String Literature in Publish or Perish 8

Database	Scopus, PubMed and Google Scholar
Keywords (English)	"learning" OR "curriculum" OR "teaching" OR "pedagogy" AND "sustainable fashion" OR "eco fashion" OR "ethical fashion" OR "green fashion" OR "circular fashion" AND "vocational education" OR "technical education" OR "vocational training"
Keywords (Indonesia)	"learning" OR "curriculum" OR "teaching" OR "pedagogy" AND "sustainable fashion" OR "fashion" friendly environment" OR "fashion ethical" OR "fashion green" OR "fashion circular " AND "education vocational" OR "education technical" OR "education vocational"
Boolean Operators	AND, OR
Year Filter	2019-2025
Type Document	Peer-reviewed journal
Initial Result Amount	665 articles

An early discovery revealed that as many as 665 were identified through a database search. The following article data were imported into a web-based systematic review management platform called Covidence. The inclusion and exclusion criteria for screening at Covidence are outlined in Table 3.

Table 3. Criteria Inclusion and Exclusion For Screening at Covidence

	Criteria Inclusion	Criteria Exclusion	Information
Year Publication	2019-2025	Before 2019	Ensure literature is up to date and relevant to the latest developments
Type Publication	Article peer-reviewed journal	Non-peer-reviewed, grey literature	Ensure quality study
Language	English	Other languages	Accessibility and capability interpretation researchers
Population	Student education vocational fashion	Non-education population	Focus on context, education, and vocational
Intervention	Sustainable fashion or circular economy program	Not related to sustainable fashion	Relevance to the topic study
Outcome	Knowledge, skills, or attitude related to sustainable fashion	Outcome no related	Compliance with the objective study

The election process with confidence supports the Systematic Literature Review (SLR) process in accordance with PRISMA 2020 standards, as shown in Figure 1.

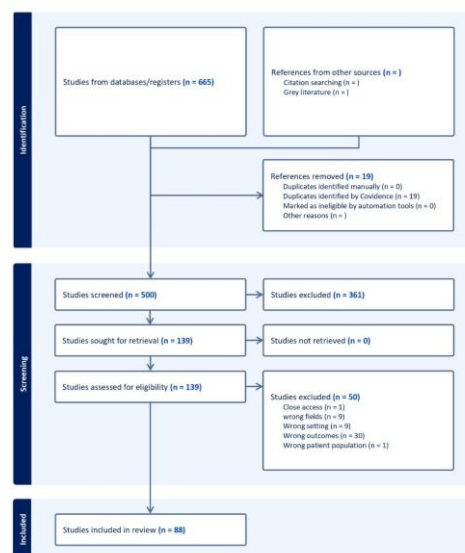


Fig 1: PRISMA Chart

Result and Discussion

This section presents a results analysis of all the literature selected through a systematic procedure in accordance with the PRISMA 2020 standards. The findings presented reflect a synthesis of selected studies and form the basis for discussion of the contributions, tendencies, and implications of research in the fields of learning, education, vocational, and sustainable fashion.

Result

The results of the systematic literature review process were compiled following the PRISMA 2020 methodology. Based on a search through the Scopus, PubMed, and Google Scholar databases, as many as 665 successful articles were identified. Articles cover various related studies on learning, sustainable fashion, and vocational education. First-stage filtering involves registering duplicate articles, with counts as high as 19. Additionally, 146 articles could not be screened due to limitations at the facility, which can process only 500 articles per day. Stage two involves filtering based on title and abstract, which are carefully reviewed to evaluate suitability, with a focus on research. As part of this process, 361 articles were eliminated for several reasons, including those that discuss sustainable learning but not in the context of the fashion field. Additionally, an article discusses sustainable fashion, but it focuses on the industry rather than on education or vocational settings.

Furthermore, the stage is evaluate suitability content article in a way deep, at the stage This There were 139 articles and 50 articles were excluded because No fulfil criteria, including is several article discuss topic learning, sustainable fashion and education vocational in article separate and not in One study integrated, besides That there is articles that are not in a way explicit discuss about learning sustainable fashion in vocational education.

After rigorous screening and evaluation, we identified 88 articles that directly discuss the relationship between learning sustainable fashion in vocational education. The literature review concludes with a range of research methods, including surveys, empirical studies, and case studies from diverse regions of the world, as illustrated in Figure 2.

Distribution based on Location Geographical

Articles written by contributors from various countries reflect the global character of the academic world, where the exchange of ideas across cultures enriches analysis and the relevance of research. International collaboration has become a foundation for comprehensively understanding complex issues, while simultaneously strengthening the diversity perspective in development knowledge.

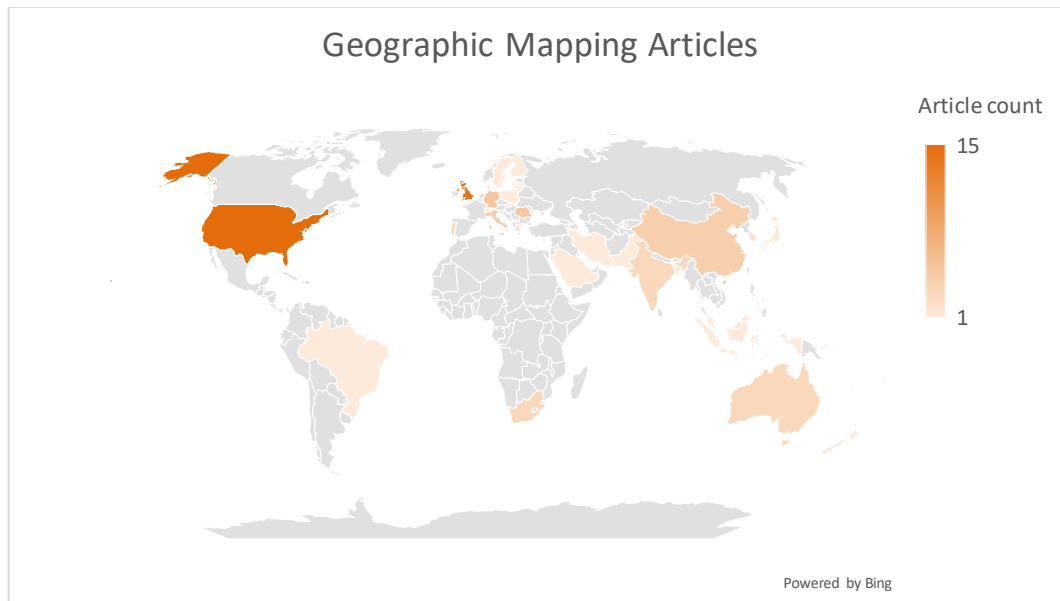


Fig 2: Mapping Geographical from Included Articles

From a geographical distribution perspective, as shown in Figure 2, many significant publications originate from Western countries, including the United States, England, and Europe, indicating a high level of research intensity in the area. However, the significance from Asia, Australia, Africa, and Oceania confirms its global reach and the increasing attention of developing countries to education, vocational training, and sustainable development. The improvement publication over the past five years, particularly the last one, is also in line with strengthening global policies related to Education for Sustainable Development (ESD) following the establishment of the SDGs, reflecting growing academic interest in implementing pedagogical sustainability in vocational education.

Distribution based on Year of Publication

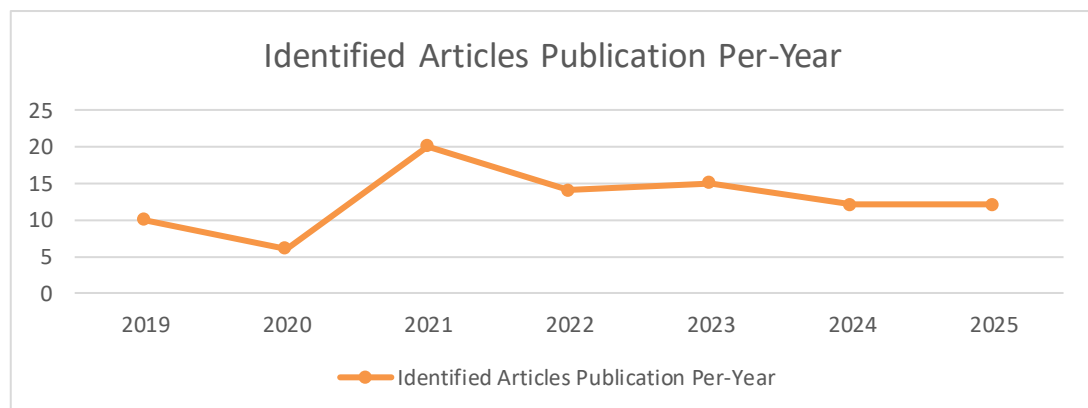


Fig 3: Identified Publications per Year

Grouping publications by year reveals 88 identified articles, with gradual improvement since 2019 and a peak in research in 2021, resulting in 20 publications. After that, the number of publications remained stable and active until 2022–2025, reflecting consistent academic interest in issuing sustainable fashion education. The surge in 2021 can be seen as a response to the increasing urgency of integrating the principle of sustainability in education, vocational training, and fashion, in line with the global agenda of the SDGs and ESD. A trend that has continued to highlight this phenomenon is not new; rather, it has become an increasingly established and strategic research area in academic discourse and educational practice.

Table 4. Articles in Review Systematic

<i>No.</i>	<i>Title</i>	<i>Year</i>
1	Education for Sustainable Development Draghici (2019)	2019
2	Consumer Perceptions Related to Clothing Repair and Community Mending Events: A Circular Economy Perspective Diddi and Yan (2019)	2019
87	Construction of a sustainable design competency assessment system for fashion designers in China Yuan et al (2025)	2025
88	Designing for Digital Education Futures: Design Thinking for Fostering Higher Education Students' Sustainability Competencies Echeverry et al (2025)	2025

Trends Approach Learning

Innovation pedagogy in vocational education is most prominent in Northern Europe, especially in Germany, Sweden, and Denmark. These countries demonstrate strong implementation of the Learning-Based Challenge-Based Learning (CBL) and Learning-Based Project-Based Learning (PjBL) approaches, which focus on addressing real-world problems in the industrial sector. Meanwhile, the Asia-Pacific region is showing increasingly dynamic development, particularly in South Korea and India. Research in this area highlights the implementation of Learning Integrated Digital, which combines technology, artificial intelligence (AI), and virtual prototypes in vocational education. Besides that, the theme of circular design, upcycling, and zero-waste becomes a focus of pedagogy that fosters not quite enough answers to the ethical issues of consumption and production in fashion (Burns, 2024; D. Jaiswal et al., 2022). A literature review of dimensions solving/approaching in the reviewed literature reveals several pedagogical themes that consistently appear in the context of sustainable education in vocational settings. Every theme describes a method that integrates sustainability principles into the learning and development process of student competence. Relationship Approach Learning and Competency Outcomes Sustainability Table 5.

Table 5. Relationship Approach Learning and Competency Outcomes Sustainability

<i>Approach Learning</i>	<i>Main Focus of Competence</i>	<i>Method Evaluation General</i>	<i>Impact Level</i>
Challenge-Based Learning (CBL)	Solution to the problem, a real and thinking system.	The project challenges the industry, and the bait comes back to give work.	Medium-High
Project-Based Learning (PjBL)	Material and design innovation circular.	Portfolio design, assessment prototype.	Tall
Experiential/Community-Based Learning	Awareness, social, and empathy environment.	Journal reflective, observational behaviour in the community.	Currently
Studio-Based Learning (SBL)	Skills: technical and reflective professional.	Mentor evaluation and review of colleagues.	Tall
Digital/AI-Learning	Efficient design and literacy technology.	Evaluation of device softness and reduction of digital waste.	Medium-High

Data synthesis reveals that PjBL and SBL have the most substantial impact on development competence sustainability, as they involve deep, reflective, and iterative processes that yield tangible results that can be measured and evaluated. Additionally, CBL and experiential learning strengthen social values and awareness. New themes, such as digital and AI-integrated learning, are beginning to enrich sustainability by enabling efficient virtual design and simulation, thereby reducing waste. In a way, overall learning through active methods (CBL, PjBL, SBL) is more effective than learning theoretically in building competence and sustainability. The duration and depth of intervention are influential in large, full-semester programs, which produce more potent effects compared to short-term workshops. Context integration, both local and industrial, becomes highly relevant in education and vocational work, as it connects with reality.

Framework Competence Sustainability

Based on the 88 articles reviewed, four dimensions central to the sustainability of competence in education, fashion, and vocational fields can be identified. Dimension cognitive covers the ability to think systematically and analyse material (Alves et al., 2024b; G. Jaiswal et al., 2023). Dimension affective emphasise awareness, ethical, empathy, social and values sustainability (Kuusisaari et al., 2025; Lapolla and Copeland, 2025). Dimensions behaviour covers skills practical in upcycling, zero-waste design, and sustainable materials experiments (Burns, 2024; Grundmeier et al., 2023). Temporary, that dimension transformative has started to appear in the literature lately, placing graduates as agents driving change sustainably in the industry (Braithwaite and Trencher, 2024; N. Singh and Rani, 2025).

Table 6. Framework Competence Sustainability

<i>Dimensions Competence</i>	<i>Main Focus</i>	<i>Example Implementation in Studies</i>	<i>Relevance For Vocational</i>
Cognitive	Thinking system, analysis cycle life, understanding the impact of production-consumption.	Students analyse waste textiles and assess the impact on the environment from the chain supply (Alves et al., 2024b; G. Jaiswal et al., 2023)	Develop analytical and decision-making skills based on environmental data.
Affective	Sustainability values, ethics, professionalism, and empathetic socio-environmental.	Activity-based community and reflection ethics social (Kuusisaari et al., 2025; Lapolla and Copeland, 2025)	Growing awareness of social attitudes and ethical practices in fashion.
Behavior	Skills: technical and application, practical, and sustainable design.	Project upcycling and zero-waste design in studio learning (Burns, 2024; Grundmeier et al., 2023).	Enhance practical and creative technical skills in vocational students.
Transformative	Leadership and advocacy change the industry.	Graduates become change agents in the implementation of policy sustainability (Braithwaite and Trencher, 2024; N. Singh and Rani, 2025)	Growing ability for lead changes in the environment.

Four dimensions of competence sustainability form a mutual unity, and studies show that a project-based approach to projects and studios not only increases students' technical skills but also enhances their mark sustainability and systemic thinking capabilities. The majority of studies report an improved understanding of the analysis cycle for life products, efficient material design, and upcycling and zero-waste practices, with an approach that strengthens the ability to reflect on the impact on social and ecological design in the fashion industry. Besides that, some articles highlight the need to strengthen collaborative competence and communication across disciplines, especially when a project involves external partners Alves et al (2024). Digital integration is also reported to increase the efficiency of idea exploration and prototyping Lee and Suh (2024), although the capacity for technology in institutional education still needs reinforcement.

Discussion

Integration Framework

Study results show that the successful integration of learning sustainable fashion in vocational education depends on three main dimensions:

a. Innovation pedagogical

Innovation pedagogy serves as the foundation for integrating sustainable fashion learning into vocational education. The Project-Based Learning (PjBL) approach has been proven to increase engagement and quality learning Yeri and Baylon (2025), at a time allows students to apply the principle of sustainability through a project, such as zero-waste Gam and Banning (2020) design and upcycling. Studies show that involvement in zero-waste projects can increase awareness of environmental issues and enhance students' understanding of the impact of textile waste. The studio-based learning approach also contributes through an environment of collaborative and creative learning, where integration marks sustainability in studio activities, helping students develop technical skills with a sensitivity to the impact of their decisions on social and ecological impacts Zabidi and Jamaludin (2024).

Additionally, digital integration through technologies such as 3D design, virtual prototyping, and AI is opening up new opportunities in sustainable fashion education. Proven 3D technology increases spatial ability, critical thinking, and sustainability awareness in students Papahristou and Tatsi (2024), while AI is capable of reducing material waste and increasing design process efficiency Lee and Suh (2024). The AI-based curriculum also encourages the development of digital competence, initiative, entrepreneurship, and problem-solving abilities Jung and Suh (2024). The CLO3D implementation even shows potential for a substantial reduction in material waste of 35–40 per cent and an increase in diversity design of up to 23 per cent. However, challenges related to infrastructure and teacher training still need to be overcome Widiyawati et al (2024).

b. Support institutions

The integration of sustainable fashion learning into vocational education depends heavily on institutional support, curriculum restructuring, and teacher training. Studies show that successful institutions apply sustainability, building a comprehensive curriculum framework that combines knowledge, attitudes, behaviour, and practices as core elements Kamis et al (2025). Although the curriculum technically does not yet comprehensively cover the economic circle, practice effective teacher pedagogy precisely succeeds in making the topic an integral part of learning Moreira et al (2025). Teacher training becomes a crucial aspect because educators need to update their knowledge with sustainable, relevant content and innovative methodologies Hugar et al (2025). Studies have shown that structured project-based training leads to improved understanding and the development of high-quality teaching tools.

Policy supporting institutional innovation, as well as the pedagogical provision of power and collaboration across stakeholder interests, has proven to be a prerequisite for success in implementation. Aligning education and vocational training with the SDGs, strengthening a global perspective, and equipping students with the necessary skills creates a solid foundation for a transformational curriculum by combining knowledge, sustainability, teaching capability, and institutional support.

c. Partnership industry

Partnership between industry and academia plays a vital role in connecting theory and practice, while ensuring relevance of the curriculum to job market needs, as shown by research that confirms that collaboration meaningfully increases harmony in education with the industrial world Tong (2024). In fashion, work the same with designers and companies, sustainability-oriented allows students to understand and practice the real industry, while prospective professionals emphasise the need for a more comprehensive curriculum connected with the technical and practical field Zanu et al (2024). Collaboration with the local community also opens opportunities to preserve traditional crafts while strengthening the local entrepreneurship and the sustainable local economy Thakur and Atre (2024). Models like Teaching Factory are proven to increase readiness of Work students through experience in the industry directly, and approaches similar to this can be applied to fashion education, ensuring sustainability is at the heart of collaboration Suhansa et al (2025).

The integration of sustainable fashion requires a comprehensive transformation so that sustainability becomes an integral part of the curriculum's DNA, not just an addition to the college experience. This covers the integration of sustainability into design, management, production, business, and soft skills Agarwal (2021), as well as a deep understanding of the environmental, social, and economic dimensions Nithyashree et al (2024). Technology such as AI, 3D printing, and blockchain can strengthen practice green when combined with an understanding of draft economy, circular and responsible social approaches. The most effective pedagogical approach is learning-based projects and experiences, in which students are directly involved in creating sustainability solutions Zabidi and Jamaludin (2024). To achieve this, the system assessment must also be revised to comprehensively assess competence sustainability, covering skills, technical awareness, environmental responsibility, and social and ethical dimensions Bedor et al (2024).

Integration Depth Model

Implementation levels can be depicted in four layers. The main points are listed in Table 7.

Table 7. Level of Sustainability Integration in Vocational Education Fashion

<i>Integration Level</i>	<i>Main Features</i>	<i>Competency Results</i>	<i>Example Context</i>
Surface Integration	Sustainability is not just an add-on or an eye-catching choice.	Increase general awareness, but do not yet develop technical skills.	Many institutions are in the Asia-Pacific and North America.
Integrated Implementation	Sustainability values are being integrated into the Big Eye study of the technical and design studio.	Push for change in attitudes and behaviour among beginning students.	UK and some Northern European programs.
Transformative (Transformative Integration)	Sustainability is embedded throughout the curriculum; industry collaboration is strong.	Develop competence with solid cognitive, affective, and technical skills.	Germany, Sweden, Denmark, and South Korea.
System-Level Integration	Sustainability is embedded in policy, networked across institutions, and tracked for graduates.	Give birth to a graduate as an agent in the change industry.	System vocational Advanced Northern Europe.

The more integration is done, the greater the students' ability to apply principles of sustainability professionally. This surface awareness, in contrast, takes a transformative form that fosters a professional and sustainable identity.

Effectiveness Pedagogical

Analysis of results from the literature shows that the approach to learning specific effects differs from developing competence and sustainability. Based on Table 8, methods based on projects and studios proved to be the most effective in a vocational context due to the balance between theory, practice, and values. Digital integration adds efficiency and innovation, but needs readiness infrastructure and teacher training.

Table 8. Comparison Effectiveness Approach Learning

<i>Approach Learning</i>	<i>Main Power</i>	<i>Effect Competence</i>	<i>Suitable For</i>
Project-Based Learning (PBL)	Practice creativity, collaboration, and problem-solving in real-world situations.	Effectively high (0.75–1.1) against technical and material skills awareness.	All-level vocational.
Digital & AI-Integrated Learning	Increase efficiency, simulation design, and digital literacy.	Effect medium-high (0.65–0.95).	Context of the modern and digital industry.

Disparity Geographical

The analysis comparison of inter-regional distribution, shown in Table 9, reveals a variation in the level of maturity in implementing sustainable education fashion. Northern Europe occupies the most advanced position, marked by strong support policies, comprehensive teacher training programs, and an established industry collaboration. On the other hand, the UK and Southern Europe are at a medium stage of development, with pedagogical integration that has been progressing but not yet evenly across the institution. The Asia-Pacific region, particularly Korea and India, is experiencing rapid growth through strengthened digital integration and industry-focused projects. Meanwhile, Latin America and Africa are still at an initial stage of development, characterised by limited infrastructure, access to power sources, and a lack of training for power teachers, resulting in suboptimal education implementation in a sustainable manner. An analysis comparison between the regions is presented in Table 9.

Table 9. Summary of Implementation Patterns Geographical

<i>Region</i>	<i>Maturity Implementation</i>	<i>Focus Main Pedagogy</i>	<i>Major Obstacles</i>
Northern Europe	Very advanced	Transformative integration, Design Thinking, and AI emerge	Need improvement in pedagogy and longitudinal evaluation.
English / Irish	Under development	PBL & experiential	Limitations of source power and standardisation.
Asia-Pacific	Develop rapidly	PBL & digital learning	Limitations: infrastructure, limited teacher training.
North America	Currently	Design Thinking & blended learning	Fragmentation policy interregional.
Southern Europe	Beginning	Project small and learning community	Support policy is weak.
Africa / Latin America	Minimum	Training technical base	Lack of source power and research.

Conclusion

Based on a systematic literature review of the period 2019–2025, it can be concluded that integrating sustainable fashion learning in vocational education can increase students' technical competence, ecological awareness, and creativity. Active approaches to learning, such as Project-Based, Challenge-Based, and Studio-Based Learning, have proven to be the most effective. Because

it emphasises experience as direct, reflective, and collaborative. Successful implementation is highly dependent on support from institutions and industry partnerships, as well as on teachers' readiness, especially in utilising digital technology and AI in the learning process. With strengthening-oriented policies and curriculum sustainability, vocational education becomes a driving force for the main transformation towards an ethical, innovative, and sustainable fashion industry environment. Although this, the challenge still lies in limitations, such as source power, readiness power, and the lack of an existing indicator standard for evaluating competence sustainability. To strengthen the foundation of empirical research, advanced recommendations focus on longitudinal evaluation of the impact of integrating learning and development curricula in industry, as well as on the connection between digital literacy and the sustainability of awareness in vocational contexts. With support policies, industry collaboration, and ongoing teacher training, vocational education becomes a catalyst for transforming the fashion industry towards an ethical and sustainable model. Effective integration is expected to produce graduates who are not only technically competent but also possess ecological and moral awareness in building a sustainable fashion industry for the future.

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