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Integrating Green Fashion into Fashion Education: A Case Study on Developing a Learning Framework for Sustainability Values in Higher Education

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Abstract

The fashion industry is among the largest global sources of environmental damage, generating significant carbon emissions, intensive water consumption, and large volumes of non-biodegradable textile waste, and its environmental footprint continues to grow. One potential solution to mitigate this impact is the concept of green fashion in fashion education. However, the integration of green fashion into higher-education fashion programs has been insufficiently documented in terms of a strategic, comprehensive learning model. Previous studies over the past five years indicate a gap in the absence of an integrated framework that can be systematically implemented within the curriculum. Therefore, this study aims to develop an integrated green fashion learning framework for both theoretical and practical courses to strengthen students' sustainability values. This study employed a qualitative case study approach conducted in a fashion design education program at Universitas Negeri Yogyakarta, Indonesia. The participants were selected through purposive sampling and consisted of 1 program coordinator, 12 lecturers, and 25 students in the fashion design education program. Data were analyzed using thematic analysis (transcription, coding, categorization, and theme identification) to identify and synthesize relevant theoretical and practical aspects related to green fashion education. The findings led to the development of a Fashion Design Learning Framework integrated with green fashion principles. The framework includes a practical learning syntax that can be directly implemented in fashion education, covering both theoretical and practical learning activities. The framework is intended to help reduce the gap between sustainability concepts and educational practices while supporting the development of creative, competent, and environmentally responsible graduates. The implications of this study provide practical guidance for vocational education institutions and fashion educators on integrating sustainability values into the learning process. Furthermore, this research contributes to strengthening sustainability-oriented education in higher education, particularly in fashion.

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INTRODUCTION

The fashion industry is one of the largest contributors to global carbon emissions and textile waste, yet it also plays a major role in the global creative economy; however, its environmental footprint continues to grow significantly. The apparel and footwear industries alone account for approximately 8.1% of global greenhouse gas emissions (Quantis, 2018), and the fashion industry generates an estimated 92 million tonnes of textile waste every year, a figure projected to reach 134 million tonnes by 2030 under current consumption patterns (UNEP, 2025). The environmental

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impact of the fashion industry is driven by overproduction, chemical-intensive processes, high water consumption, and non-biodegradable textile waste (Dzhengiz et al., 2023; Olivar Aponte et al., 2024; Zhao et al., 2021). The rise of fast fashion further intensifies this problem by encouraging high-consumption, low-sustainability purchasing behavior (Bai et al., 2024; Grappi et al., 2024; Olivar Aponte et al., 2024). In this regard, efforts are needed to regulate fashion production and consumption practices to minimize the industry's environmental damage. Beyond regulating production and consumption, the education sector is a particularly strategic context for addressing this problem, because it shapes the knowledge, values, and professional practices of future designers and producers; unlike interventions targeting only industry or policy, education generates long-term, systemic change by embedding sustainability at the point where the next generation of fashion practitioners is formed.

One approach to addressing this issue is green fashion. Green fashion refers to an approach that promotes environmentally friendly, ethical, and sustainable practices in both production and consumption (Chen et al., 2021; Dzhengiz et al., 2023; Pires et al., 2024). Beyond material selection, green fashion also includes recycling practices and design innovation oriented toward sustainability (Ma, 2023; Wang et al., 2025). In this study, green fashion is used as an umbrella term encompassing related concepts such as sustainable, eco-, circular, ethical, and slow fashion, which share the goal of reducing the environmental and social harms of the fashion system while differing in emphasis. The concept of green fashion can be applied across many sectors, including education.

Fashion education integrated with the concept of green fashion is expected to create conditions that support the development of sustainability values in students, since education plays a crucial role in shaping values. This expectation is consistent with education for sustainable development, which holds that learning environments can foster rather than automatically transmit ecological awareness and responsible behavior (Sterling, 2011). In fashion education that integrates green fashion concepts, students are equipped not only with technical skills but also with critical thinking, ethics, and the ability to innovate sustainably (Abdelmeguid et al., 2024; Klemm & Kaufman, 2024; Moreira et al., 2025; Murzyn-Kupisz & Hołuj, 2021). Green fashion education contributes directly to several Sustainable Development Goals (SDGs): it advances SDG 4 (Quality Education) by equipping students with sustainability competencies and critical thinking; it supports SDG 12 (Responsible Consumption and Production) by promoting circular practices such as recycling, upcycling, and zero-waste design; and it reinforces SDG 13 (Climate Action) by building awareness of the industry's carbon footprint and encouraging low-impact design decisions.

Previous studies consistently report a gap between rising sustainability awareness and its actual integration into curricula, yet they differ in where that gap lies. Across vocational schools, universities, and design programs, awareness is increasing while systematic, curriculum-level integration lags (Purnama et al., 2022). A preliminary study among fashion design graduates in Malaysia found that most already understood the concept of sustainability. Yet, the majority reported that the curriculum they had studied had never been evaluated for its effectiveness in disseminating sustainability concepts, indicating that curricular integration lagged behind graduates' own awareness (Purnama et al., 2021). A pedagogical approach to fashion education that integrates green fashion is necessary to encourage concrete actions, such as implementing recycling and zero-waste design (Ahmad Zabidi & Jamaludin, 2024). Another study, a case study in Jakarta, also found that although instructors understand green fashion, it has not yet been fully integrated into the curriculum; more specifically, the barriers to optimal integration reported in these studies appear structural rather than attitudinal, including the absence of a systematic curriculum framework, limited instructor preparedness and training, the higher cost of eco-friendly materials and facilities, and weak collaboration between institutions and the sustainable-fashion industry (Vassalo et al., 2024). Additionally, fashion education is encouraged to incorporate ethics and sustainability values into the curriculum to produce graduates who are creative and socially and environmentally responsible (Bremner & Steed, 2025).

As shown above, the studies conducted in Malaysia (Purnama et al., 2021), Jakarta (Vassalo et al., 2024), and London (Gornostaeva, 2024) each independently report the same pattern: awareness of green fashion exists among students or instructors, but its curricular implementation remains confined to isolated topics or modules rather than being systematically embedded in practical learning and curriculum design. In addition, existing studies have largely stopped at conceptual

recommendations or partial curriculum suggestions; none has produced an operational, stage-by-stage learning syntax that specifies concrete instructional steps for theoretical, practical, and out-of-classroom activities and that can be directly implemented in fashion education programs. Consequently, efforts to implement green fashion concepts in educational settings remain limited, as previous studies have primarily focused on conceptual discussions rather than providing integrated instructional frameworks or practical learning syntax that can be applied systematically in fashion education in higher education. To address this gap, this study develops an integrated, implementable green fashion learning syntax that covers theoretical, practical, and out-of-classroom activities to support university lecturers in embedding sustainability values in fashion education. Thus, the novelty of this study lies in the development of an integrated, practice-oriented green fashion learning framework, accompanied by an operational learning syntax for theoretical, practical, and out-of-classroom activities in higher education. The key distinction from prior models is this operational syntax: rather than remaining at the level of principles or offering fragmented curriculum suggestions, it prescribes concrete instructional stages and methods that lecturers can implement directly in the classroom. In contrast to previous studies that predominantly address green fashion from a conceptual perspective or offer fragmented curriculum suggestions without clear implementation procedures, this study offers a comprehensive, systematically structured model designed for direct application in classroom practice, subject to contextual adaptation and further validation. It also specifies the instructional stages that facilitate the integration of sustainability principles into fashion education, making the approach more actionable for university lecturers. Accordingly, this study advances existing literature by bridging the gap between sustainability concepts and their practical implementation in fashion education contexts.

METHOD

A qualitative case study approach was used in this research, as it was deemed capable of providing a comprehensive overview of the integration of green fashion into the fashion education process in higher education, specifically within the fashion design education program in the city of Yogyakarta. Yogyakarta was purposively selected as the case study location because it is widely known as Indonesia's "city of students," hosting a dense concentration of higher-education institutions. Because it holds long-standing recognition as a centre of craft and textile heritage, including UNESCO-linked batik traditions and its designation as a World Batik City by the World Crafts Council in 2014, several of its higher-education institutions offer fashion and craft design programs, making it a relevant setting for examining how sustainability values are integrated into fashion education alongside a strong local craft economy. The research participants were selected through purposive sampling based on their direct involvement in curriculum planning and implementation. The participants consisted of one program coordinator, 12 lecturers, and 25 students from the Fashion Education Program. Participants were included if they were program coordinators or lecturers directly involved in designing or teaching courses that incorporated green fashion content, or students who had completed those courses. Research data were then collected using three techniques: semi-structured interviews, observation, and document analysis. Interviews were conducted with program coordinators, lecturers, and students to explore the strategies, perceptions, and challenges they face in integrating green fashion concepts into fashion education. Each semi-structured interview lasted approximately 45–60 minutes and was conducted face-to-face. With participants' consent, the interviews were audio-recorded and transcribed verbatim for analysis. Observations were conducted in classrooms and practical laboratories to collect direct data on the implementation of green fashion concepts in teaching and learning activities, including the use of materials and teaching methods, as well as student responses. A total of eight observation sessions were conducted, each lasting approximately 150 minutes, covering the Fashion Production and Textile Materials courses. Document analysis was used to examine curricula, syllabi, semester lesson plans, and teaching modules to identify whether and how green fashion concepts were present (explicit, implicit, or absent) in these documents. In total, 34 documents were analyzed, covering the 2022-2025 academic years.

Credibility was strengthened through methodological (between-method) and source triangulation: findings from the semi-structured interviews, observations, and document analysis

were systematically cross-checked and corroborated, and points of convergence or divergence across these sources were examined to confirm the credibility of the findings. The data were then analyzed in stages. The data were analyzed using thematic analysis (Braun & Clarke, 2006). This began with transcribing interviews and observation notes, coding the data, grouping it by category, and identifying key themes. While the initial coding frame reflected the study's focus on integration strategies, challenges, and opportunities, the analysis remained open to themes that emerged inductively from the data. The design follows Yin's (2018) case study logic. The case is bounded as a single fashion design education program, its curriculum documents, program coordinator, lecturers, and students within one institution, and is treated as a holistic single case. A single case design was chosen because the research question asks how green fashion is integrated into an ongoing curriculum within its real institutional setting, a situation in which the boundaries between the phenomenon and its context are not clearly distinguishable (Yin, 2018). The program also constitutes a typical case of Indonesian fashion design education: it is state-run, follows the national outcome-based curriculum framework, and operates within a regional craft and textile economy. This design therefore affords the curricular, pedagogical, and institutional depth required to derive an operational learning syntax that a multiple case design of comparable scale could not have supplied, whereas a phenomenological design would have foregrounded lived experience rather than curriculum structure, and an ethnographic design would have required prolonged immersion beyond the scope of this study. Coding was carried out by the first author, who transcribed and coded all interview, observation, and document data. A working codebook was compiled after an initial reading of the first three transcripts and recorded, for each code, a label, a definition, and an illustrative excerpt; it was revised iteratively as coding progressed. The second and third authors independently reviewed the codebook and a sample of coded extracts, and disagreements about code definitions and theme boundaries were resolved through discussion until consensus was reached. Because coding was performed by a single coder with peer review rather than by independent parallel coders, no inter-coder reliability coefficient was computed; consistency was instead supported by the codebook, the peer review of coding decisions, and an audit trail documenting analytic memos and the movement from codes to categories to themes.

Figure 1 illustrates the research data collection. The process began with transcribing interview results and observation notes, then coding the collected data, grouping it into categories, and finally identifying the main themes that emerged from the analysis.

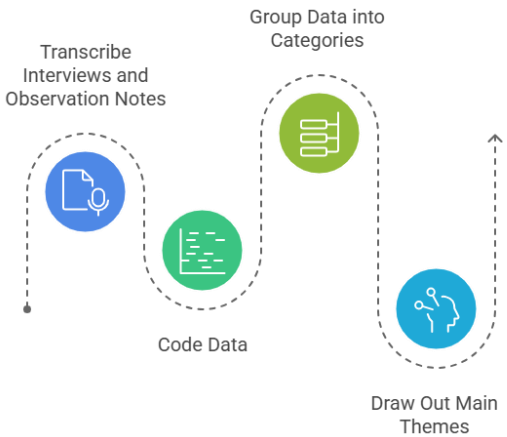

Figure 1. Research Data Collection

The research process was conducted with a focus on research ethics, including obtaining consent before conducting interviews, observations, and document analysis, and maintaining the confidentiality of participants' identities. To support the data collection process, the following section presents the interview, observation, and documentation guidelines used in this study, as shown in Table 1. This study was conducted in accordance with institutional research ethics requirements. Ethical clearance for conducting interviews, observations, and other research activities involving human participants was granted under approval number No. T/64.11/UN34.9/PT.24.01/2025, dated 1 January 2025. Written institutional permission to access and examine curriculum documents, syllabi, semester lesson plans, and teaching modules was obtained separately from the

head of the study program. Only official curricular documents were accessed, and no documents containing personal data of students or staff were included in the analysis. All participants received an information sheet and provided written informed consent before participating in the interviews and observations. Participants were informed of their right to withdraw from the study at any time without consequence and consented to the use of anonymised excerpts in the publication. To protect confidentiality, participants were identified using anonymised codes in the reporting of findings, and potentially identifiable roles or positions were not disclosed in a manner that could reveal individual identities within the single-program case.

Quotations are identified by a code combining the data source, the participant role, and the month and year of collection. KA denotes the program coordinator, D1–D12 denote the participating lecturers, and M1–M25 denote the participating students; Interview_KA_6/2025 therefore refers to an interview with the program coordinator conducted in June 2025, while Observation, 2025 refers to a classroom or laboratory observation record and Syllabus to a curriculum document. Because the case comprises a single program in which some roles are held by only one person, role labels are reported at this level of generality only; no course, teaching assignment, or personal characteristic is attached to any quotation, and identifying details within excerpts were removed or generalised before analysis.

Table 1. Interview, Observation, and Documentation Guidelines

Interview Guidelines

No	Interview Focus	Questions	References
1	Understanding of Green Fashion	What do you understand about the concept of green fashion?	(Niinimäki, 2018)
2	Integration in the Curriculum	How is the concept of green fashion integrated into the fashion curriculum at your institution?	(Purnama et al., 2021)
3	Teaching Strategies & Methods	What strategies are used in conveying sustainability values?	(Ahmad Zabidi & Jamaludin, 2024)
4	Student Experience	How do students respond to green fashion materials and practices?	(Purnama et al., 2022)
5	Implementation Challenges	What are the barriers to green fashion integration?	(Vassalo et al., 2024)
6	Opportunities and Strategies	What are the opportunities and strategies for developing green fashion in the future?	(Bremner & Steed, 2025)

Observation Guidelines

No	Observed Aspects	Observation Indicators	References
1	Curriculum & Teaching Materials	There are green fashion topics/modules in the learning documents	(Purnama et al., 2021)
2	Learning methods	Using project-based learning, zero-waste design	(Ahmad Zabidi & Jamaludin, 2024)
3	Use of Materials	Students use environmentally friendly/recycled materials	(Vassalo et al., 2024)
4	Student Engagement	Active participation in green fashion projects	(Purnama et al., 2022)
5	Learning Environment	Labs/classrooms support sustainability (energy saving, minimal waste)	(Vassalo et al., 2024)
6	Industry Collaboration	Collaboration with green fashion brands/communities	(Bremner & Steed, 2025)

Documentation Guidelines

No	Document Type	Analysis Focus	References
1	Semester Lesson Plan	Green fashion topics in learning outcomes, study materials, and methods	(Purnama et al., 2021)
2	Syllabus	Integration of green fashion material in courses	(Bremner & Steed, 2025)
3	Module/Teaching Materials	Environmentally friendly, practical content	(Ahmad Zabidi & Jamaludin, 2024)
4	Practical Documents	Implementation of green fashion in labs/studios	(Vassalo et al., 2024)
5	Collaboration Documents	Collaboration with the green fashion industry	(Vassalo et al., 2024)

RESULTS AND DISCUSSION

The integration of sustainability-oriented approaches into fashion education in the program studied is emerging but still developing. Based on interviews with lecturers and program coordinators, the concept of green fashion is generally understood to involve environmental, social, and ethical issues. One faculty member stated that *"green fashion is not just about eco-friendly materials, but also about how students are taught to think critically about the fashion industry's impact on the environment and society"* (Interview_KA_6/2025). Students also confirmed this, noting that learning that integrates sustainability makes them more creative in using waste materials in production. A student remarked, *"It was difficult at first because materials were limited, but it actually made us learn to be more innovative"* (Interview_M1_6/2025).

Findings from classroom and laboratory observations during practical sessions align with interview results. Students were observed repurposing unused fabric scraps from production into new fashion products as part of a zero-waste design collection, which served as the practical project format in this learning activity. They also applied natural dyes for textile coloration to reduce the use of synthetic chemicals and utilized digital pattern-making to minimize paper waste during pattern development. These activities reflected green fashion principles by extending the life cycle of materials through upcycling, reducing textile and paper waste, promoting environmentally friendly dyeing techniques, and encouraging more resource-efficient, sustainable fashion production practices. Learning emphasizes project-based learning methods, such as when students are assigned to create a zero-waste design collection. In the researchers' field notes, students were recorded as actively participating in discussions and presentations of their work (for example, asking questions and engaging with peers). Although waste management efforts have been made, they are not yet fully optimized. Field observations indicate that *"textile waste generated from sewing practices is still mixed with general waste, and there is no dedicated sorting system"* (Observation, 2025). Additionally, the practice rooms' conditions do not yet use energy sources that support sustainability principles.

Document analysis further confirms that sustainability elements are partially embedded in the curriculum. For example, in the Course Syllabus for Fashion Design II, one of the learning outcomes is *"the ability to identify and apply sustainability principles in fashion design"* (Syllabus, 2024). Overall, 26 courses, equivalent to 55 credit units (SKS), have integrated green fashion concepts into their syllabi. However, the document analysis still indicates that not all courses are fully integrated with green fashion. Additionally, there are teaching modules that cover zero-waste patternmaking techniques and examples of green practices in the fashion industry. The researcher also found a Memorandum of Understanding (MoU) between the university and a local fashion brand focused on implementing green fashion concepts. This evidence indicates that green fashion integration has been implemented, although not yet comprehensively. Integration was inferred from concrete indicators, namely explicit sustainability learning outcomes in syllabi, dedicated modules such as zero-waste patternmaking, the use of recycled materials in practical work, and an industry MoU. At the same time, the absence of these elements across all courses, together with the lack of a structured textile-waste management system, indicated that integration was not yet comprehensive.

In general, faculty and students already understand green fashion concepts. The curriculum has also been integrated with green fashion, supported by teaching methods aligned with learning objectives to address sustainability issues, though this integration is not yet fully optimized. Major obstacles may arise due to limited facilities, costs, and an underdeveloped institutional system. Therefore, key strategies include strengthening the curriculum, providing eco-friendly facilities, and collaborating with green fashion industries to ensure the continued integration of green fashion into fashion education. Table 2 links each strategy to the finding it addresses and specifies the actors, resources, and feasibility conditions involved. The priority ordering reflects the resources each action requires rather than its relative importance: actions that can be absorbed into existing curricular review cycles at minimal cost are placed first, whereas actions requiring capital investment are treated as longer-term.

Table 2. Strategies for Strengthening Green Fashion Integration, Linked to the Study's Findings

No	Strategy	Finding / theme addressed	Actors and resources required	Feasibility and priority
1	Strengthen the curriculum: extend explicit sustainability learning outcomes and green fashion content to the courses that do not yet contain them	Document analysis found green fashion content in 26 courses (55 SKS) but not across the full curriculum; integration was judged partial	Program coordinator and curriculum team with course lecturers; curriculum workshop time and revision of syllabi and semester lesson plans; no additional material cost	High feasibility; first priority — absorbable into the existing curriculum review cycle
2	Introduce sustainability-based authentic assessment: a shared rubric covering material choice, waste generated, ethical sourcing, and product narrative	Lecturers already assess the moral and ethical values embedded in student designs, but this is not formalised in an assessment instrument	Course lecturers with the program quality assurance unit; rubric development and one calibration meeting	High feasibility; second priority — runs in parallel with strategy 1 and needs no new facilities
3	Establish textile-waste sorting and an offcut reuse system in studios and laboratories	Observation recorded that sewing waste is still mixed with general waste and that no dedicated sorting system exists	Laboratory technicians and the faculty facilities unit with student associations; sorting bins, storage for reusable offcuts, and a short standard operating procedure with signage	High feasibility; third priority — low cost, and it aligns the learning environment with the principles taught
4	Build lecturer capacity in green fashion pedagogy (zero-waste patternmaking, natural dyeing, basic life-cycle thinking)	Integration currently depends on individual lecturers, while the proposed frameworks require stage-by-stage delivery	Program coordinator and the faculty academic development unit with external practitioners; in-house training time and a budget for resource persons	Moderate feasibility; fourth priority — depends on annual training budgets
5	Operationalise the existing MoU into scheduled learning activities: guest practitioners, industry visits, and joint student projects	An MoU with a local fashion brand exists, but out-of-class learning remains proposed rather than routine	Program coordinator with the partner brand and artisan communities; scheduling in the academic calendar, transport, and supervision	Moderate feasibility; fifth priority — the agreement already exists, so the constraint is scheduling rather than access
6	Create a shared eco-material and offcut bank to offset the cost of environmentally friendly materials	Students reported that eco-friendly materials are relatively expensive, which constrained their project work	Study program and laboratory with industry partners donating offcuts; storage space, a donation agreement, and a small revolving fund	Moderate feasibility; sixth priority — depends on securing donation commitments
7	Align laboratory energy use with the sustainability principles taught	Observation recorded that practice rooms do not yet use energy sources supporting sustainability principles	Faculty facilities unit and university management; capital investment in lighting, metering, and possible renewable sources	Low feasibility in the short term; long-term action — beyond the study program's own authority

The project map visualization shows that the main concepts in fashion education, when integrated with green fashion concepts, have strong relationships with various research data sources, namely faculty interview transcripts, documentation, and observation results. The concepts illustrated include the 3Rs, circular economy, cultural sustainability, fashion digitization, eco-fashion, ecological design, ethical fashion, green fashion, green mindset, local wisdom, slow fashion, triple bottom line, and zero-waste patterns, as presented in Figure 2.

Figure 2. Project Map of Green Fashion

As shown in Figure 2, the fairly complex relationship pattern indicates that the concept of green fashion is not merely conceptual but is also integrated within and beyond the classroom. The project map in Figure 2 is a visualization generated in NVivo from qualitative coding and concept co-occurrence analysis of interview transcripts, observation notes, and curriculum documents. Codes were organized into categories and themes, and the software was used to visualize the relationships among the identified concepts, thereby illustrating the integration of green fashion across curriculum content, teaching practices, institutional support, and industry collaboration. Based on Figure 2, the co-occurrence of green fashion concepts across the coded data (interviews, observations, and documents) suggests an integrative approach in which environmental, cultural, and technological innovation aspects complement one another to foster a comprehensive understanding among students. These results indicate that the Fashion Design Education program in Yogyakarta has begun to incorporate the concept of green fashion into its curriculum, though not yet across all courses. Furthermore, the Fashion Design Education program in Yogyakarta has, according to participants, raised students' awareness of green fashion values, preparing them to become future educators and professionals in the fashion industry. The following details the values cultivated through green fashion education for students:

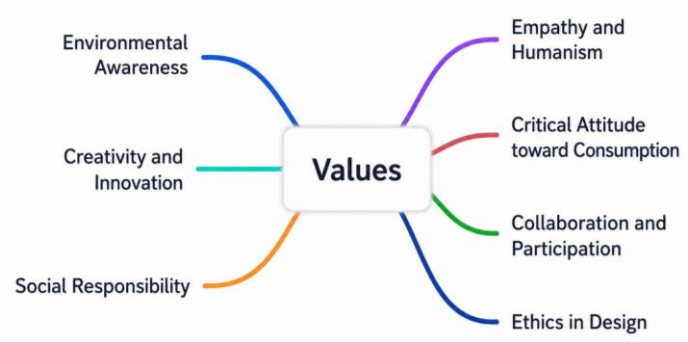

Figure 3. Values of Green Fashion

Figure 3 illustrates the mapping of foundational character values developed through green fashion education in the Fashion Design Education program. The first value is that fashion education integrated with green fashion concepts fosters environmental awareness. In the curriculum, students are encouraged to understand the environmental impacts of the fashion industry, such as textile waste, water consumption, and chemical pollution. For example, in the Subject of Fashion Production, students are guided to identify what happens to the waste generated from the production of their products. As emphasized by Fletcher (2008), green fashion education must foster ecological literacy to drive environmentally friendly design decisions. Thus, there is a strong expectation that students

will understand the impacts and the efforts that can be made to maintain sustainability. This value is grounded in the study's findings: students were observed repurposing production fabric scraps into new products. At the same time, field observations showed that sewing waste was still mixed with general waste, prompting reflection on responsible waste management. More recent scholarship supports this pedagogical claim. Wang et al. (2025) show that ecological literacy in fashion education develops most reliably when sustainability concepts are enacted through situated practice rather than delivered as declarative content, while Ma (2023) reports comparable gains in students' environmental reasoning through a challenge-based sustainable fashion design approach. Moreira et al. (2025) likewise find that circular economy principles become learnable when they are embedded in studio tasks that make material flows visible to students, which is consistent with the way waste tracing is used in the Fashion Production course reported here.

The second value is creativity and innovation, which form the core of upcycling and zero-waste design-based fashion education. For instance, students are challenged to create designs using limited materials, such as textile waste or used clothing. The practice of upcycling with limited materials has been shown to foster compelling innovation (Cassar, 2024). Additionally, the conceptual framework of upcycling also trains problem-solving skills, thereby enhancing students' capabilities (Elias & Wu, 2023). Consistent with this, students in this study produced zero-waste design collections from limited materials, and one participant noted that the scarcity of materials "actually made us learn to be more innovative" (Interview_M1_6/2025). The third value is social responsibility, particularly through collaboration that engages students with the community and SMEs. In this regard, students are introduced to various issues that can arise in the fashion industry supply chain, such as labor exploitation and the unequal distribution of economic value. This perspective aligns with Niinimäki (2018), who states that to create a fair and ethical fashion production system, fostering social awareness is essential in fashion education. His finding is supported by the present study, which identified a Memorandum of Understanding (MoU) between the Fashion Design Education program and a local fashion brand to implement green fashion practices. The collaboration provides students with opportunities to engage in authentic learning experiences related to sustainable production, ethical business practices, and community-oriented fashion initiatives. Interview participants also emphasized that such industry partnerships help students understand the social responsibilities of future fashion educators and professionals beyond technical design skills.

The fourth value is empathy and humanism. In this context, students gain an understanding of humanistic values in fashion production, particularly when interacting directly with artisans, consumers, or vulnerable groups. In the Subject of Textile Technology, students who collaborated with a community of waste artisans reported that the experience gave them a new perspective: that design in fashion is not merely about the product but can also serve as a vehicle for community engagement and social innovation, incorporating the values of empathy and humanism. This aligns with Sterling, (2011), who states that green fashion education should foster *empathy-driven action* that can serve as a foundation for changing human behavior.

The fifth value is a critical attitude toward consumption. In this context, students learn to evaluate the fast-fashion culture, specifically fleeting fashion trends, and the exploitation of resources in fashion production. Students also discuss the utility, lifespan, and social relevance of fashion products. Classroom observations revealed that during project presentations and reflective discussions, students critically evaluated fashion products by comparing fast-fashion items with more sustainable alternatives. They considered aspects such as material durability, product lifespan, the potential for repair and reuse, and the environmental consequences of production and consumption before making design decisions. This naturally encourages the creation of fashion designs that prioritize durability, functionality, and long-term value over short-lived fashion trends. These observations demonstrate that green fashion education fosters students' critical awareness of consumption patterns and encourages more responsible decision-making in fashion design. Joy et al. (2012) highlight that such fashion education is essential to shape fashion consumers and producers to be more critical, wise, and ethical.

The sixth value is collaboration and participation, which can be fostered through teamwork and direct interaction with other communities. Students are encouraged to learn to listen, negotiate, and adapt designs based on community needs. Classroom observations showed that students worked collaboratively in groups to develop sustainable fashion projects, sharing responsibilities, discussing

design alternatives, and making collective decisions informed by environmental and user considerations. In addition, document analysis identified a Memorandum of Understanding (MoU) between the Fashion Design Education program and a local fashion brand, which provides students with opportunities to participate in industry-based learning activities and collaborate with external stakeholders to implement green fashion practices. These learning experiences enabled students to develop communication, teamwork, and participatory problem-solving skills while responding to real-world sustainability challenges. Thomas (2008) emphasizes that *co-creation* is a key element in future fashion education, as green design cannot stand alone without social engagement.

The seventh value discussed here is ethics in design, which serves as the primary framework guiding students' design decisions. Ethical values in design encompass material selection, production techniques, and the product narrative communicated to consumers. A lecturer in Textile Technology explained that students are evaluated based on the moral and ethical values embedded in the designs they create, rather than solely on the final product. This aligns with Black's (Black, 2012) research, which states that green fashion practices are inseparable from the design phase at the beginning of the process, necessitating attention to ethical aspects from the very start of design.

The findings indicate that green fashion is partially integrated into this program: sustainability concepts are present in teaching and in some course documents and are enacted through project-based methods, while comprehensive curricular coverage and supporting institutional infrastructure remain underdeveloped. Faculty and students can understand the concept of green fashion, encompassing environmental, social, and ethical dimensions, and apply it in educational practice through project-based methods. Research (Purnama et al., 2022) indicates that although students have a positive attitude toward sustainability, its application in fashion projects remains constrained by resource limitations. This aligns with the results of this study, which showed that students were enthusiastic about completing recycling tasks but often encountered challenges due to cost constraints, as eco-friendly materials are relatively expensive. While both this study and Purnama et al. (2022) identify resource constraints as a persistent barrier, the present study extends their findings by showing that such constraints did not diminish student engagement; instead, material scarcity became a catalyst for creativity through upcycling. This difference may reflect the project-based, zero-waste pedagogy used in this setting, which reframes limitations as design challenges rather than obstacles.

Observations regarding learning methods indicate that project-based learning and zero-waste design practices can enhance students' creativity and engagement. This aligns with research (Shaya et al., 2025), which emphasizes that a green fashion learning framework based on blended learning supports creativity and fosters positive emotions among students during the learning process. However, whereas Shaya et al. (2025) locate these benefits within a blended-learning configuration, the present study shows that comparable gains in creativity and engagement can emerge from face-to-face, project- and studio-based practice, suggesting that the pedagogical driver is authentic, problem-based making rather than the delivery mode itself, a contribution that broadens the applicability of green fashion pedagogy to institutions with limited digital infrastructure. As an implementation consideration drawn from the wider literature rather than a finding of this study, instructors may also need to anticipate that some students experience anxiety under the creative demands of such projects to ensure the learning process remains inclusive and constructive.

Based on the document analysis, sustainability aspects have been incorporated into the curriculum through the course outline, syllabus, and learning modules, but only in certain courses. For example, some learning outcomes require students to identify sustainability values in fashion design. This finding aligns with research (Gornostaeva, 2024) revealing that the concept of green fashion in the curriculum has not been systematically integrated into all courses, but only into a few modules. Therefore, a more comprehensive and well-designed curriculum is a critical need at present to ensure that sustainability values become core competencies for graduates.

To strengthen the integration of green fashion concepts into university fashion education, collaboration among universities, industry, and fashion communities that uphold sustainability values is needed. This aligns with the recommendations (Sibanda et al., 2025), which emphasize the importance of cooperation between universities and the industry to bridge the gap between theory and practice observed in the field. There are numerous benefits to be gained from collaboration between higher education institutions and the industry. Such collaboration not only provides

students with hands-on experience but also strengthens educational institutions' position as agents of change in supporting the Sustainable Development Goals (SDGs) agenda in the fashion sector.

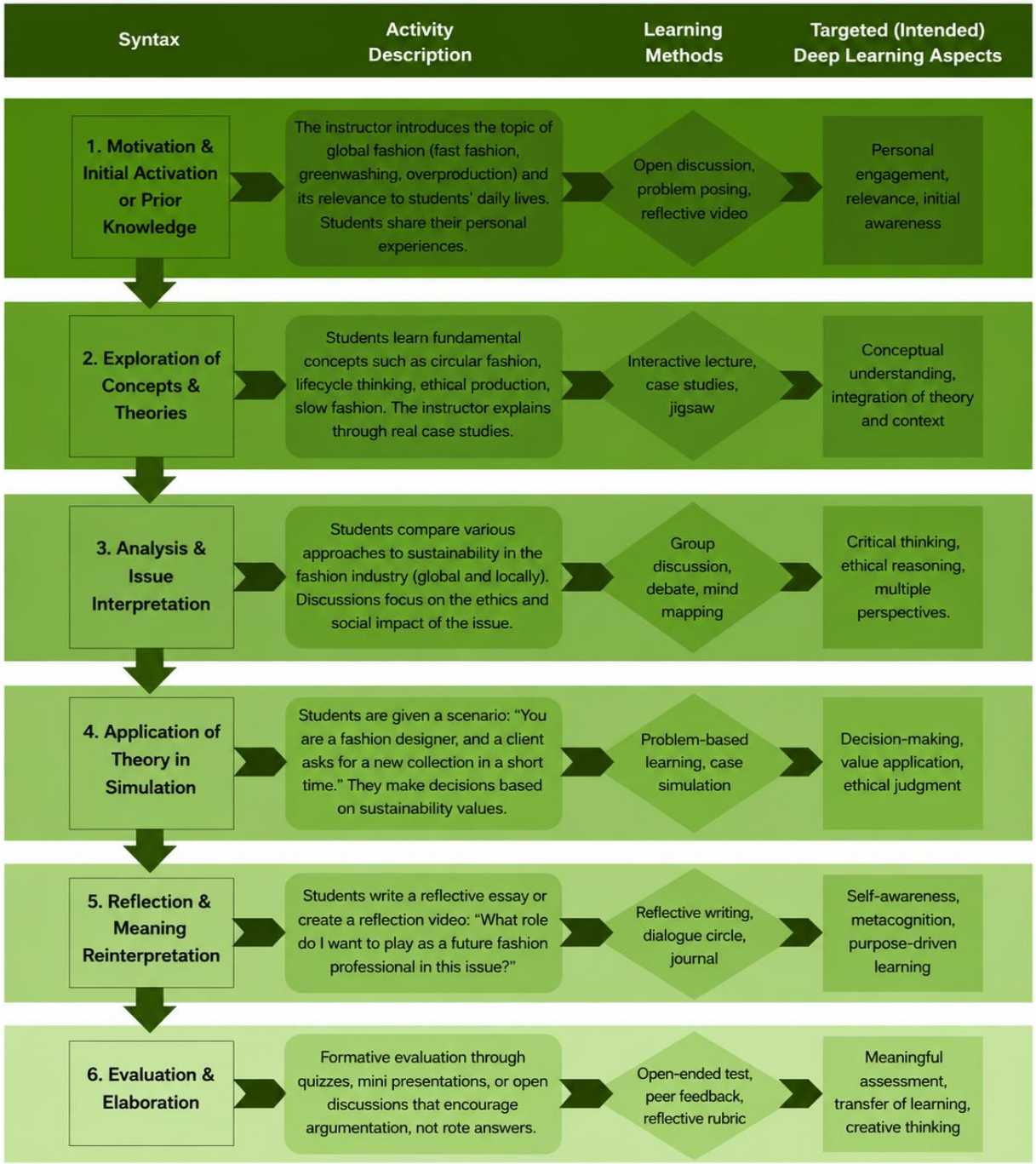

Figure 4. Stages and Methods of The Theory Learning Framework

This research produced a six-stage integrated green fashion theory learning framework. The first stage begins with providing motivation and foundational knowledge regarding green fashion. Instructors facilitate discussions with students by connecting their experiences to global fashion issues. In the second stage, students are asked to explore the theories and basic concepts of green fashion based on case study results. In the third stage, students are asked to analyze, interpret, and compare green fashion issues. At this stage, students are also asked to discuss ethical issues related to green fashion. In the fourth stage, the theories students have learned are applied by creating fashion designs based on green fashion. Next, in the fifth stage, students engage in reflection and reinterpretation to identify the roles they can play in supporting sustainability within the fashion industry. The final stage involves evaluation and elaboration. In this stage, instructors place greater

emphasis on assessing learning through student engagement and the outcomes of creative and innovative product designs, so that fashion education can proceed in depth and holistically. Each stage and learning method within the integrated green fashion theory learning framework can be seen in Figure 4.

The derivation of each stage from the study's empirical themes and from the supporting literature is summarised in Table 3. Stages 4 to 6 adapt the concrete-experience, reflective-observation, and active-experimentation phases of the experiential learning cycle (Kolb, 1984), while stages 1 to 3 follow the problem-oriented sequence recommended for sustainable fashion curricula by Ahmad Zabidi and Jamaludin (2024). The framework is therefore an adaptation of established models rather than an original sequence; its contribution lies in specifying, for each phase, the fashion-specific activity, method, and targeted learning aspect.

Table 3. Derivation of the Six Stages of the Theory Learning Framework

Stage of the theory learning framework	Empirical theme from the case that informed the stage	Literature and model adapted
Stage 1 — Motivation and foundational knowledge	Lecturers and students described green fashion in environmental, social, and ethical terms, yet awareness preceded curricular integration (interviews; document analysis)	Sterling (2011) on learning environments that foster ecological awareness; orientation phase of the problem-oriented sequence in Ahmad Zabidi and Jamaludin (2024)
Stage 2 — Exploration of theory and concepts through case study	Green fashion content was present in some syllabi and modules but was treated as isolated topics rather than a connected body of concepts	Niinimäki (2018) and Chen et al. (2021) on circular economy concepts; case-based exploration in Ma (2023)
Stage 3 — Analysis, interpretation, comparison, and ethical discussion	During project presentations and reflective discussions, students critically compared fast-fashion items with more sustainable alternatives (observation)	Joy et al. (2012) on the critical evaluation of fast fashion; Black (2012) on ethics at the design stage
Stage 4 — Application through green fashion design	Students produced zero-waste design collections from limited materials, and material scarcity acted as a catalyst for creativity (observation; Interview_M1_6/2025)	Concrete-experience phase in Kolb (1984); zero-waste and project-based practice in Ahmad Zabidi and Jamaludin (2024) and Cassar (2024)
Stage 5 — Reflection and reinterpretation	Field notes recorded active participation in the discussion and presentation of work, and students reflected on the waste generated by their own production	Reflective-observation phase in Kolb (1984); Fletcher (2008) on ecological literacy
Stage 6 — Evaluation and elaboration	Lecturers reported assessing the moral and ethical values embedded in designs rather than the final product alone (interview, Textile Technology)	Active-experimentation phase in Kolb (1984); values-oriented authentic assessment discussed by Bremner and Steed (2025) and Wang et al. (2025)

In addition to the theoretical learning framework, this study developed a practical learning framework comprising seven stages to support integrated green fashion education. The first stage is the initial phase, where instructors provide an orientation, after which students identify fashion-related problems, specifically environmental and social aspects, for example, by conducting a case study of textile waste and the impacts of fast fashion. In the second stage, students are encouraged to develop creative, innovative project ideas to mitigate the negative impacts of the issues previously analyzed. The third stage involves material exploration and research. During this phase, students are encouraged to study eco-friendly materials as alternatives to non-biodegradable textiles. In the fourth stage, students begin to develop product designs based on the established project ideas and material research findings. Throughout the design process, students are consistently encouraged to consider ethical, aesthetic, and functional aspects. The fifth stage involves prototype development and actual production. This stage emphasizes environmentally friendly methods. The sixth stage is a key learning process where instructors ask students to present their production outcomes. At this stage, students are also asked to reflect on their own products in terms of green fashion. The seventh stage is an evaluation of the entire process, focusing on potential impacts and future planning actions aligned with green fashion principles. This practical learning framework also fosters sustainable

environmental and social awareness. The seven stages and methods of the practical learning framework integrated with green fashion are presented in Figure 5.

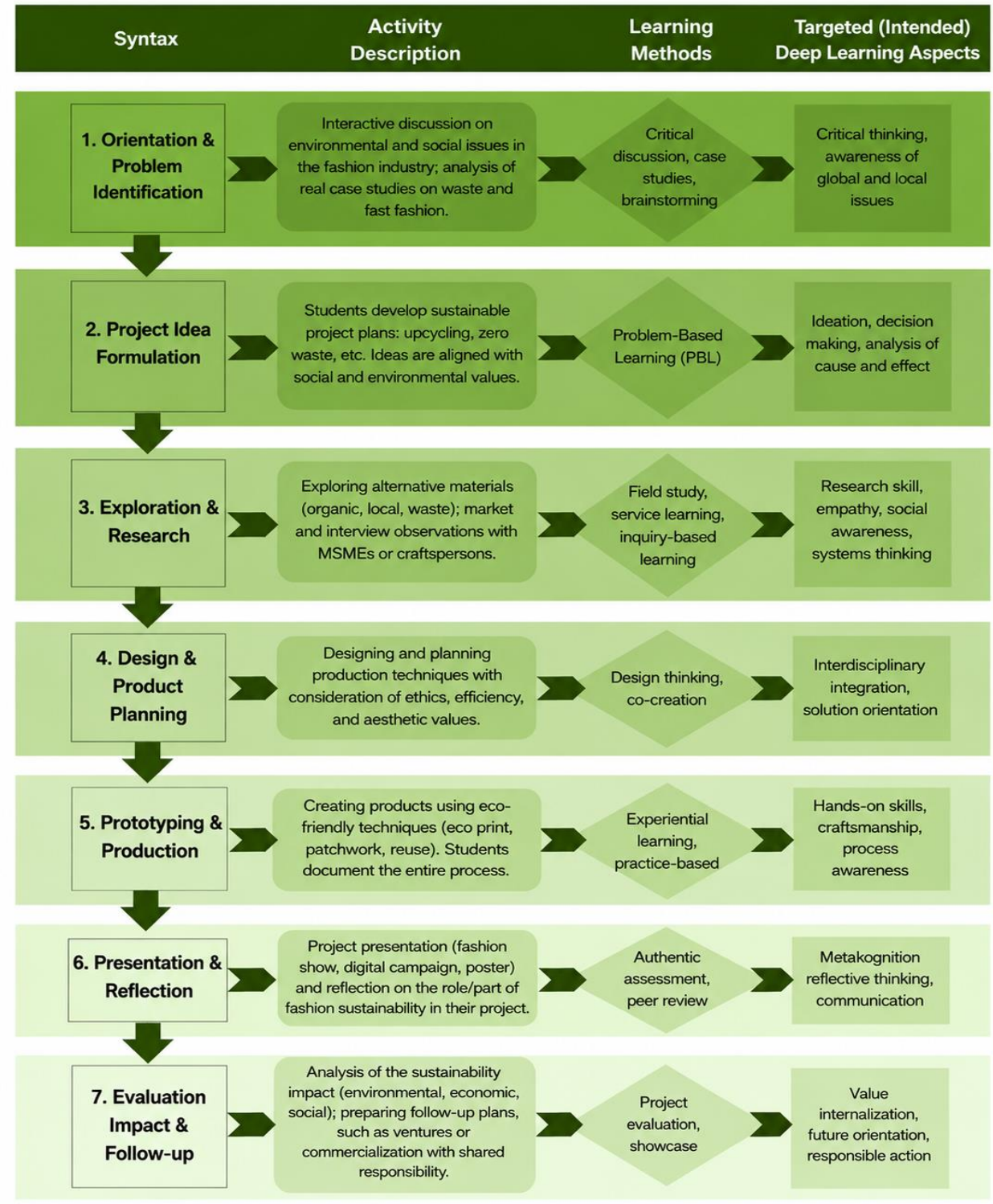

Figure 5. Stages and Methods of the Practical Learning Framework

The seven practical stages were derived from the same case evidence as the theoretical framework and from established experiential models. Stage 1 (problem identification) reflects the interview finding that lecturers frame green fashion through concrete industry impacts, and adapts the orientation phase of problem-based learning. Stage 2 (project idea formulation) and Stage 3 (material exploration and research) were derived from the observation that students in the Fashion Production and Textile Materials courses worked from available fabric scraps and natural dyes, and from the reported cost barrier to eco-friendly materials; they adapt the ideation and investigation

phases of project-based learning as applied to sustainable fashion by Ahmad Zabidi and Jamaludin (2024). Stage 4 (design and product planning) and Stage 5 (prototyping and production) correspond to the concrete-experience phase of the experiential learning cycle (Kolb, 1984) and were derived from the zero-waste collection task documented in the observations. Stage 6 (presentation and reflection) was derived from the field-note record of student presentations and reflective discussion and adapts Kolb's (1984) reflective-observation phase, while Stage 7 (evaluation, impact, and follow-up) was derived from the lecturers' reported emphasis on the values embedded in the design process and adapts the active-experimentation phase.

This study also proposes an out-of-class learning framework for green fashion, comprising four interconnected stages. The first stage begins with preparation and planning. Students are asked to prepare for the learning process. In the second stage, students are required to participate in field visits, such as to industries or fashion communities. Students then conduct observations by examining on-site realities. Students can also get directly involved to enhance their practical experience. The third stage involves reflecting on and analyzing the field-collected data. Students are also asked to relate the data to green fashion theory. The final stage involves follow-up and action, where students can apply the knowledge they have gained through concrete actions that support green fashion. This out-of-class framework is a proposed extension rather than a documented component of the case studied. During the observation period, out-of-class engagement was limited to the collaboration with a community of waste artisans in the Textile Technology course and to the cooperation established under the Memorandum of Understanding with a local fashion brand; structured field visits to industry sites or fashion communities were recommended by lecturers and the program coordinator during the interviews but had not yet been scheduled as a routine curricular component. The four stages are therefore derived from participants' recommendations and from the partnership infrastructure already in place, and they require piloting and evaluation before any claim about their learning effects can be made.

This out-of-class learning approach encourages students to deepen their understanding of how to apply green fashion concepts in the field and to put them into practice themselves, as shown in Figure 6.

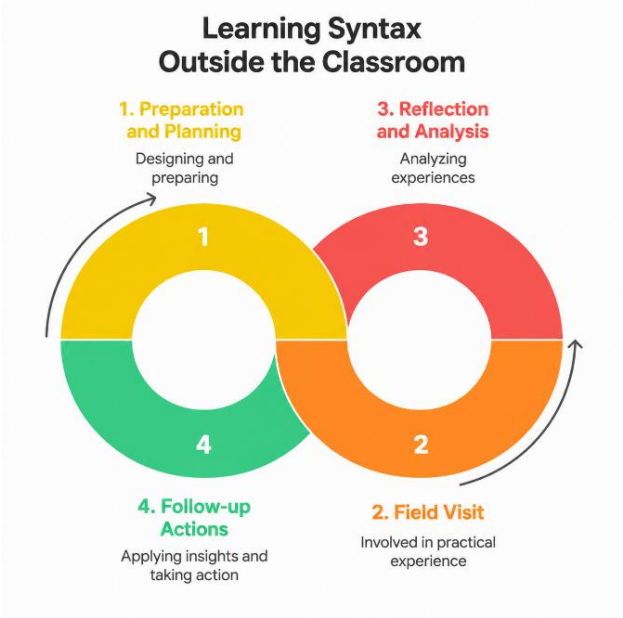

Figure 6. Learning Syntax Outside the Classroom

Overall, the learning frameworks developed in this study form a holistic learning cycle that helps students understand green fashion concepts through tangible actions they can take. Therefore, this series of fashion learning syntaxes is intended to help graduates develop a broad understanding of green fashion, competence in designing and producing green fashion products, and the capacity to address future environmental and social challenges; empirical validation of these outcomes remains a task for future research.

LIMITATION

This study has several limitations. It was conducted in a single fashion design education program at Universitas Negeri Yogyakarta, so the findings should be interpreted in terms of transferability rather than statistical generalization; readers can judge applicability to their own settings using the contextual details provided. As a single-site case study, it draws on a bounded set of participants and observation sessions, relies partly on translated interview excerpts, and depends on the documents available for analysis, which introduces potential selection and social-desirability considerations; researcher positionality was also not formally reported. Finally, the proposed framework has not yet been piloted or validated and should therefore be treated as preliminary; its effects on students' sustainability competencies were not measured.

CONCLUSION

This study indicates that, in the single program studied, the integration of green fashion into university-level fashion education is beginning to take shape, particularly through project-based learning practices such as zero-waste design and the use of recycled materials. The findings indicate that students and faculty members are already aware of sustainability issues in the fashion industry. At the same time, several courses have incorporated green fashion concepts into their learning activities. However, the integration remains partial and has not yet been systematically embedded across the curriculum.

The main contribution of this study is the development of a green fashion integration framework that combines sustainability values, project-based learning, industry collaboration, and experiential learning in fashion education. Unlike previous studies that primarily focused on conceptual discussions of sustainable fashion, this framework offers a more practical and contextually applicable approach for higher education institutions by integrating environmental, social, cultural, and economic dimensions into both curriculum design and learning practices. Specifically, its novelty lies in translating these dimensions into an operational learning syntax, an explicit sequence of instructional stages and methods spanning theoretical, practical, and out-of-classroom activities, which previous conceptual or curriculum-recommendation studies have not provided. The framework is also designed to be consistent, at a conceptual level, with the Triple Bottom Line (people, planet, profit) and with selected Sustainable Development Goals (SDG 4, 12, and 13), rather than claiming to achieve them.

To strengthen the implementation of green fashion education, universities are encouraged to address the specific gaps identified here: extending sustainability content beyond the courses that currently include it, aligning institutional facilities such as waste sorting and energy use with the principles taught, and formalizing industry and community collaboration so that agreements translate into learning activities; in resource-constrained settings, revising existing course outlines to embed sustainability may be the most feasible first step. In addition, innovative pedagogical approaches and authentic sustainability-based assessments should be further developed to improve students' ecological competencies. Future studies are recommended to validate and refine the proposed framework through qualitative pilot implementation, design-based research, usability testing, and mixed-method or quantitative evaluation, in order to assess its usability and effects on enhancing students' sustainability competencies.

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AUTHOR CONTRIBUTIONS

DR contributed to the conceptualization and research design, data collection through interviews, observations, and document analysis, transcription, data coding, thematic analysis,

interpretation of the findings, development of the integrated green fashion learning framework, and preparation of the original manuscript. LN contributed to the methodological review, validation of the qualitative analysis, review of the codebook and coded extracts, interpretation of the identified themes, refinement of the learning framework, and writing–review and editing. AN contributed to the validation of the data analysis, review of the codebook and theme construction, interpretation of the research findings, refinement of the theoretical, practical, and out-of-class learning frameworks, and writing–review and editing.

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