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Circular Economy Practices in Fashion Design Education: The First Phase of a Case Study

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Abstract: With the growing significance of the circular economy (CE) agenda in the fashion industry and, consequently, in fashion design education, this work introduces the initial phase of a case study that aims to ascertain whether CE principles and sustainability are part of the curriculum and pedagogical approaches employed by educators in the Fashion Design Technician course (FDTC) (level 4, National Qualifications Framework—QNQ, and European Qualifications Framework—EQF). Additionally, it seeks to identify the methodologies, strategies, and educational activities used to address these themes. This research outlines the review of documentary sources that facilitated the definition of the study's object and sample and describes the implementation of a questionnaire survey to forty educators teaching this course across various disciplines encompassing the three training components (sociocultural, scientific, and technological) in fifteen out of the sixteen Portuguese vocational schools, during the academic year 2023/24. This phase of the case study has led to the conclusion that while the technical course curriculum may not extensively cover CE and sustainability, these topics are integral components of most pedagogical practices among the surveyed teachers. The methodologies, strategies, and activities employed display a strong commitment to fostering sustainable practices, predominantly nurturing environmental awareness among students.

Keywords: circular economy; sustainability; education; fashion design

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1. Introduction

The circular economy (CE) model has garnered significant interest in recent years [1] and is gaining global recognition as a fundamental shift is needed to address pressing issues like climate change, waste, pollution, and biodiversity loss, while aiming to establish a resilient, regenerative, and equitable economy capable of long-term sustainability [2]. In this model, "waste and pollution are designed out, and products and materials are kept in use" [3] (p. 5), with this being perceived as a mindset for solving the world's most pressing issues.

Aligned with the principles of CE—which aim to minimize environmental impact through the efficient use of resources for as long as possible [4]—is circular product design (CPD). CPD focuses on material selection and product design [5], emphasizing the creation of products intended for reuse, refurbishment, or recycling. This approach extends product lifecycles and reduces waste [6], further reinforcing the essential connection between CE and sustainable design practices.

This highlights the pivotal role of design in mitigating not only adverse social impacts but also environmental ones, as approximately 80% of a product's environmental footprint is determined during its early design stages of development [7].

Therefore, designers are inherently engaged in the preliminary conceptualization of product development, wielding significant influence over all subsequent stages of production and use, and their actions can either exacerbate or ameliorate the product's environmental footprint [8]. By playing a significant role in the sustainability crisis, as their actions contribute to both the problem and the solution, designers promote, on one hand, product obsolescence, product proliferation, material consumption, and pollution, and, on the other hand, they also propose more efficient products and services, contributing to community regeneration and empower individuals [9].

As fashion stands as one of the most polluting industries globally, there is also a rising acknowledgment of the CE agenda. It is increasingly evident that the current industrial linear model ("from cradle to grave" [10]) is not sustainable in the long run, making fashion designers recognized as focal in steering fashion towards sustainability. In a world marked by constant transition, Østergaard and Dan [11] aptly refer to designers as "agents of change", emphasizing their proactive role. It is crucial for designers to understand that the (sustainable) choices they make during the design process carry substantial implications for the entire textile chain [12]. Hence, the literature unmistakably portrays designers as key agents of change, driving the transformation of fashion design practices towards sustainability and actively contributing to the goals of sustainable development [8,11–15].

Therefore, to address the evolving paradigm of the fashion industry, it is crucial to recognize the essential need for training future fashion designers to effectively address the industry's myriad challenges [16]. Consequently, to keep pace with the rapidly fast-changing world, fashion design education must undergo significant restructuring. Today's world is vastly different from the era in which design originated: fashion design education imparts theoretical knowledge and practical skills related to the design process. These traditional design education models have prepared designers to address conventional industrial design challenges [17]. However, it is imperative for young designers to also possess literacy in sustainability [18], so fashion design education serves as a platform that equips them with the requisite knowledge and skills to integrate sustainable fashion practices into their professional endeavors and navigate an increasingly unpredictable industry [8]. Education plays a crucial role in providing future generations of product designers and their educators with the required knowledge, skills, and responsibility to make informed and conscientious decisions within their field [7]. Design education can, thus, serve as a fundamental tool in establishing an ethical fashion system and fostering social change [8].

Given these premises, the vital role that educational institutions (and teachers) play in this transition towards the CE becomes increasingly clear [8, 19]. Incorporating CE principles into education will not only provide learners with essential system-thinking skills but will also cultivate the mindsets needed to actively shape CE [19]. This incorporation narrows the divide between real-life experiences and those within the educational setting, transforming the educational system from being a barrier to being recognized as an essential part of the solution [20]. Recognizing the necessity of aligning our education systems with the evolving dynamics of the fashion industry is a good starting point for instigating change [20].

To enhance the performances of future fashion designers, it is imperative to refocus the curricula at design schools [18,20]. Traditionally, fashion design pedagogy prompts students to develop a product assortment reflecting their individual lifestyle or aesthetic preferences, often overlooking ecological considerations [18]. For this reason, it is crucial to determine

whether CE principles and sustainability are integrated into the curriculum and pedagogical approaches of the Fashion Design Technician course (FDTC) in Portugal (level 4, National Qualifications Framework—QNQ, and European Qualifications Framework—EQF).

Hence, the initial aim of this case study is to determine how CE principles and sustainability are integrated into the FDTC curriculum. This investigation goes beyond just analyzing documentary sources; it also involves gathering insights from teachers through the implementation of a questionnaire survey. Forty educators from various disciplines—encompassing sociocultural, scientific, and technological components—participated in the survey across fifteen out of sixteen Portuguese vocational schools during the 2023/24 academic year. This methodological approach not only identifies the presence of CE and sustainability themes but also sheds light on the methodologies, strategies, and educational activities used to address them.

The findings from this phase of the case study indicated that while the FDTC curriculum may not completely cover CE and sustainability, these topics are essential components of the teaching methods employed by the surveyed educators. The methods, strategies, and activities employed highlight a solid dedication to promoting sustainable practices, especially by raising students' environmental consciousness.

2. Materials and Methods

The initial phase of the presented exploratory case study is part of a broader investigation aimed at tackling the following research question: "How can teaching-learning methodologies and strategies for the CE be redesigned to promote the adoption of concern and intervention behaviors regarding textile waste among high school students?" Therefore, the primary objective of this case study is to ascertain the current practices in classroom settings with students at this educational level, specifically examining whether the CE principles and sustainability are integrated into the curriculum and pedagogical approaches of teachers instructing fashion design in secondary education. The methodology was crafted with this objective in mind, commencing with the delineation of the study's object and sample selection, drawing upon various documented sources. With these parameters clearly established, a questionnaire survey was administered to the selected sample.

2.1. Study Object

In Portugal, as outlined by the Basic Law of the Education System [21] (subsection II, Art. 9º and 10º), secondary education spans three academic years (10th, 11th, and 12th grades), culminating in the 12th grade as the final stage of mandatory, universal, and free education for all students up to the age of 18. Upon successful completion of basic education, students are eligible to enter this educational level, which aligns with Level 3 of the International Standard Classification of Education—ISCED [22], and Levels 3 and 4 of the National Qualifications Framework (QNQ) and European Qualifications Framework (EQF).

The QNQ serves as a unique reference framework for categorizing all qualifications generated within the scope of the national educational and training system, regardless of their acquisition method, valuing skills acquired through formal, non-formal, and informal channels equally. This approach stems from the adoption of "EQF principles regarding the description of national qualifications in terms of learning outcomes" [23]. With its primary aim of enhancing transparency and comparability of individual qualifications, the EQF serves as a common European reference framework that allows for the alignment of qualification systems from various countries, serving as a conversion device to make qualifications clearer and more understandable across different countries and systems in Europe [24]. In Portugal, the QNQ aligns directly with the EQF, both comprising eight

distinct qualification levels. Each level is delineated by a comprehensive set of indicators that outline the expected outcomes in terms of Knowledge, Skills, and Competencies, as detailed in Annex I of Decree n.º 782/2009 [23].

Considering the study's target audience, only levels 3 and 4 correspond to secondary education. Level 3 is excluded, as its qualifications are tailored for "secondary education aimed at preparing for higher education", whereas the educational and training pathways encompass "secondary education, route to further studies" or "level 3, without completion of secondary education" [23] (Annexes II and III). Consequently, level 4 qualification corresponds to secondary education obtained through dual certification pathways or secondary education aimed at furthering higher education with the addition of professional internships for a minimum of 6 months [23].

With the qualification level and area established, the object of study of this case study, according to the National Catalog of Classifications (CNQ) [25], falls within the domain of education and training 542—Textile, Clothing, Footwear, and Leather Industries. This sector comprises thirty qualifications, of which only two align directly with both level 4 QNQ/EQF and the specific field of study, fashion design. Among these, only the FDTC (qualification code 542107) is being taught in the academic year 2023/24 in sixteen schools nationwide, as confirmed by Moreira and Dinis [26], supplemented by the latest information available from the Educational Offer Portal [27]. Each of these educational institutions has been contacted to verify the inclusion of the FDTC in their curriculum offerings, and to initiate communication with the study participants, coordinators, and educators overseeing the diverse disciplines and short-term training units (UFCDs).

The process leading to the definition of the study object is presented in a funnel diagram (Figure 1). This diagram illustrates the progression from general to specific concepts in the educational context, starting with Secondary Education in Portugal (Levels 3 and 4 QNQ), narrowing to Level 4 (Dual Certification Pathways), and further narrowing to the FDTC Qualification (Code 542107), highlighting how the study object is defined throughout the process.

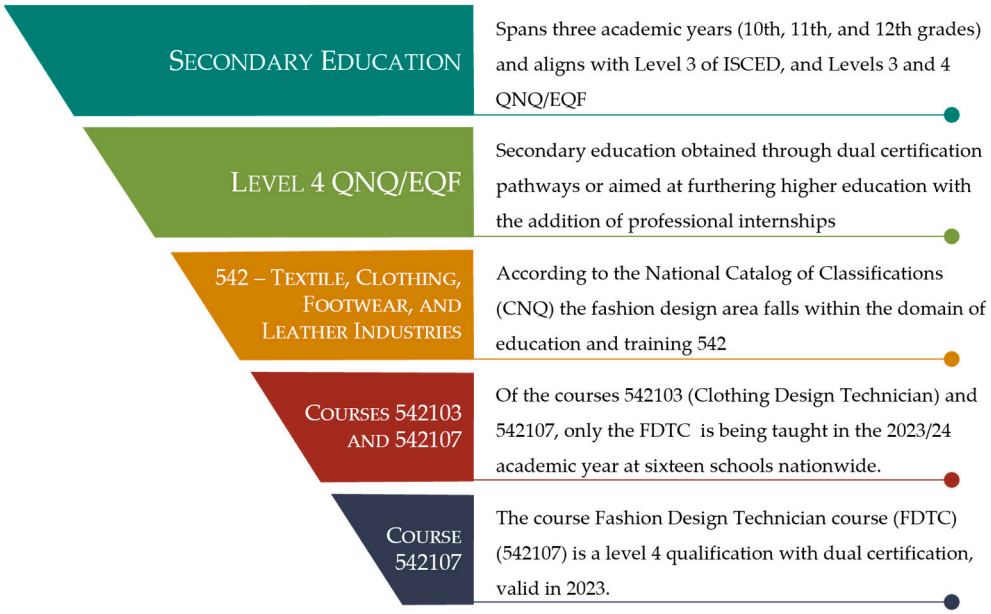

Figure 1. Funnel diagram illustrating the breakdown of the study object.

To obtain a more comprehensive understanding of the study's object, a variety of documentary sources were examined, including governmental records and the curricu-

lum framework for course 542107—FDTC, a level 4 qualification with dual certification, currently valid in 2023.

Chronologically, on 21 November 2006, Decree No. 1291/2006 was issued, which established a vocational course for fashion design technicians with the aim of providing professional training in this field. The order outlined a study plan for the course, specifying subjects for the scientific, sociocultural, and technical training components, totaling 3100 h of instruction [28].

In 2007, Decree-Law No. 396/2007 created the National Qualifications Catalog (CNQ) and assigned the National Agency for Qualification and Vocational Education, IP (ANQEP), the responsibility to elaborate upon and update this catalog. Updates to the catalog must be published in the Official Bulletin of Employment (BTE), as well as on the CNQ website [29] (Article 6, paragraph 7).

Subsequently, Order No. 13456/2008 [30], dated 14 May approved the initial version of the CNQ, which outlines the framework for technical training in fashion design within training area 542, including the professional profile of a fashion design technician. The most recent update of the CNQ can be found in BTE, n.º 27, dated 22 July 2020 [31].

Thus, according to the CNQ, this training broadly covers activities such as planning, conceptualization, and designing of new clothing products and collections for men, women, children, jeanswear, and streetwear. This comprehensive process considers various factors including international fashion market trends, quality standards, functional requirements, and technical production constraints. As for the professional role of a fashion design technician, it encompasses seven key responsibilities, spanning from analyzing market trends and fashion forecasts to planning collections and designing garments, overseeing the entire production process, presenting, and promoting products to stakeholders and buyers, and ultimately, preparing reports and documentation to monitor their activities [32].

According to the level 4 descriptors of the QNQ, the ANQEP also outlines the knowledge, skills, and attitudes necessary for the fashion design technician reference framework, all of which are to be cultivated throughout the three year study plan. This plan, as delineated in the reviewed governmental documents, is structured into five components (sociocultural, scientific, technological, complementary, and work context training), each of which includes disciplines or UFCDs with varying hourly loads and credit points. The sociocultural and scientific training components encompass fundamental subjects common to all secondary education programs, such as Portuguese, Foreign Language, and Mathematics. Additionally, these components feature subjects more tailored to the focus area of this training, including Descriptive Geometry and History and Culture of Arts. The technological training component comprises UFCDs designed to foster the technical aspects of the fashion designer profession, covering areas such as design, pattern making, project development, illustration, graphic composition, and more (Table 1).

Table 1. Simplified reference framework for the global training of the FDTC [32].

Component [1]	Discipline or UFCD
Sociocultural Training	Portuguese and Portuguese as a Non-Native Language (PLNM)
	Foreign Language I, II, or III
	Integration Area
	Physical Education
	Information and Communication Technology (ICT) or School Offer
	Citizenship and Development
Scientific Training	Descriptive Geometry
	History and Culture of the Arts
	Mathematics
	Moral and Religious Education

Table 1. *Cont.*

Component [1]	Discipline or UFCD
Technological Training	Basics of Jeanswear Jeanswear Design Project Basics of Streetwear Streetwear Design Project Development of Women's Classics Women's Apparel Design Project Development of Men's Classics Men's Apparel Design Project Dress Pattern Transformation Shirt Pattern Transformation Skirt and Pants Pattern Transformation Coat Pattern Making Apparel Assembly Apparel Manufacturing Bitmap Image and Vector Drawing Relationship Fashion Design Project Using CAD CAD Illustration Graphic Composition Commercial Fashion Design Project Creative Fashion Design Project Individual Collection Planning Individual Collection Development Volume Experimentation Prototype Modeling Prototype Construction Final Garment Construction
Work Context Training	Workplace training in vocational courses constitutes an autonomous component. Workplace training aims to help students acquire and develop technical, relational, and organizational skills relevant to the professional qualification to be obtained and is subject to its own regulation.

[1] The complementary training component is not included, as it consists of a variety of optional UFCDs integrated into the curriculum according to the schools' choices.

Circular Economy and Sustainability in the Fashion Design Technician Course Curriculum

To examine the incorporation of CE and sustainability topics into the FDTC curriculum, the reference provided in the CNQ [32] was consulted. For the sociocultural and scientific training components, two documents were reviewed: "Program" and the "Essential Learnings" [33]. These documents outline the subjects studied, the skills to be developed, objectives for each learning phase, learning scenarios, and suggested resources for specific activities. The analysis covered commonly attended subjects such as Portuguese, Foreign Language, Area of Integration, Physical Education, and ICT, Descriptive Geometry, History and Culture of the Arts, and Mathematics. The findings can be extrapolated to related subjects, such as Portuguese and Portuguese as a Non-Native Language, with similar outcomes. However, for the UFCDs in the technological training component, only objectives and content for each UFCD are provided, unlike the comprehensive documentation available for other subjects.

Upon reviewing all of the previously gathered information, it becomes evident that the themes of CE and sustainability are absent in the contents and objectives outlined for the UFCDs of the technological training component, which are tailored to the fashion domain [29]. This is attributed to the succinct nature of the information provided, which primarily emphasizes technical matters. Among the sociocultural training subjects, only three—Foreign Language, Area of Integration, and Physical Education—exhibit some connection to the subjects being studied, although in some instances, the connection is quite minimal and primarily associated with the environmental aspect.

The Foreign Language discipline, specifically English Continuation [33] ("Program", pp. 46–47), emphasizes the importance of enhancing fundamental skills in interpretation (listening and reading), and production (speaking and writing), as well as more broader skills such as sociocultural and learning skills. The spotlight is on Module 6, titled "The World Around Us", which focuses on environmental issues, encouraging students to adopt an environmentally conscious stance. The learning objectives of this module range from identifying environmental challenges to understanding contemporary natural resources and methods of environmental preservation, as well as recognizing the role of entities in managing these resources and using vocabulary related to environmental issues. Regarding learning situations, only one stands out, aiming to stimulate reflection on attitudes and behaviors towards ecological issues, which can be developed through comments on controversial quotations, newspaper articles, documentaries, and informational brochures on the main threats to environmental balance and proposals for environmental protection. These practices not only boost proficiency in the English language but also promote awareness and skills in environmental sustainability.

The Area of Integration discipline is structured around three main domains: "The Individual", "Society", and "The World", each subdivided into three thematic units, with each unit containing three problem-themes. In total, there are twenty-seven problem-themes, with only two standing out: problem-theme "3.3—Man-Nature: a sustainable relationship?" and "7.2—A global challenge: sustainable development".

Problem-theme 3.3 addresses the interaction between man and nature, encouraging students to reflect on environmental issues and adopt a sustainable approach. The environmental issue focuses on the depletion of natural resources and waste production. The curriculum provides a comprehensive framework outlining learning objectives, assessment criteria, and resources for this problem-theme, underscoring the significance of sustainability [33] ("Program", pp. 32–33).

Subsequently, problem-theme 7.2 examines environmental issues such as global imperatives, emphasizing the pivotal role of sustainable development in securing a dignified future for succeeding generations. It highlights the impact of increased human activities and significant damage caused to the environment, affecting the atmosphere, soil, water, and biodiversity. It also emphasizes the importance of promoting sustainable and supportive human development, preserving the physical environment, and managing natural resources rationally. Additionally, it underscores the need to respect socioeconomic, political, and cultural conditions to ensure that future generations enjoy a dignified life and have the freedom to exercise their rights [33] ("Essential Learnings", p. 73). The learning objectives for this problem-theme revolve around sustainable development, with learning situations focusing heavily on the analysis of real documents, including journalistic and governmental sources.

Finally, for the Physical Education discipline, the program is structured into three competency areas: "Body Awareness and Mastery", "Well-being, Health, and Environment", and "Interpersonal Relationships" [33]. It also lists extension areas for professional courses, covering a variety of physical activities, from team sports to dance and nature exploration. All these areas are divided into modules, with Module 9, focused on Nature Exploration Activities, and Module 14, Physical Activities, Contexts, and Health I, being particularly noteworthy. Both address concepts related to environmental quality and pollution, encouraging students to consider environmental preservation in their physical activities. For Module 14, methodological guidelines are presented, which include more theoretical content exposure sessions, although the curriculum actively promotes project-based and group activities to enrich the teaching-learning experience [33] ("Essential Learnings", pp. 36–38).

In summary, the curricula of the three analyzed disciplines, especially the Integration Area discipline, demonstrate a notable commitment to ecological matters and sustainable human development. There is a clear emphasis on raising awareness of environmental issues, such as preserving natural resources and promoting sustainable practices. This reflects an educational trend towards greater environmental awareness and social responsibility among students, preparing them to address contemporary environmental challenges. While CE is not explicitly mentioned, its foundational principles can be viewed as inherently linked to discussions on sustainability.

2.2. Questionnaire Survey

The implemented questionnaire aims primarily to ascertain, in this initial stage, whether CE and sustainability are integrated into the pedagogical approach of FDTC teachers, and to explore the methodologies, strategies, and educational activities employed in addressing these themes within the classroom setting. The more specific objectives include the following:

- Evaluating the emphasis placed on sustainability issues in the curriculum of the discipline(s) taught by teachers in the course's study program.
- Identifying sustainability concepts already embedded in the curriculum of the discipline(s) within this course's study program, as indicated by educators.
- Establishing connections between disciplines and UFCDs taught, and the integration and significance attributed to sustainability issues within this course.

These specific objectives, particularly those related to the FDTC curriculum, enable a comparative analysis with the examination of documentary sources outlined in Section Circular Economy and Sustainability in the Fashion Design Technician Course Curriculum of this document.

Hence, the questionnaire was structured into several sections, with the first section containing a brief introduction to the research project, the purpose of the survey, the study's target audience, and the data management protocols. Participation in subsequent sections of the questionnaire was contingent upon granting consent for data processing, as stipulated in the "Obtaining Informed Consent" section, ensuring compliance with ethical and legal principles.

The "Personal Identification" (Figure 2) and "Professional Identification" (Figure 3) sections aimed at delineate the study sample, featuring single-choice, multiple-choice, and open-ended questions. In the first section, the survey addressed the respondent's age group, educational level, and area of specialization, while the following section identified their teaching institution, roles held, disciplines or UFCDs taught, and academic year details for the 2023/24 academic year in the FDTC.

The subsequent section, titled "Framework", focused on questions directly related to the analyzed themes. It encompassed a range of inquiries, including rating scales (from "Strongly Disagree" to "Strongly Agree"), dichotomous queries, single-choice options, open-ended prompts, and those with conditional logic.

All survey data are available in the University of Minho Data Repository for further review and analysis [34].

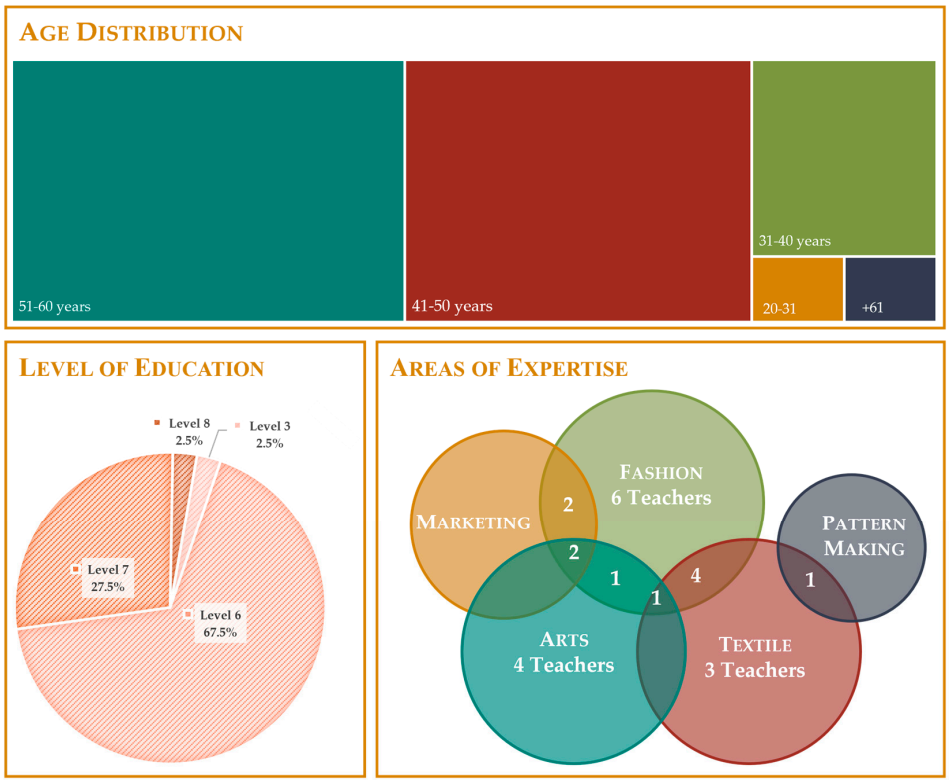

Figure 2. Descriptive analysis of the sample—personal identification information [34].

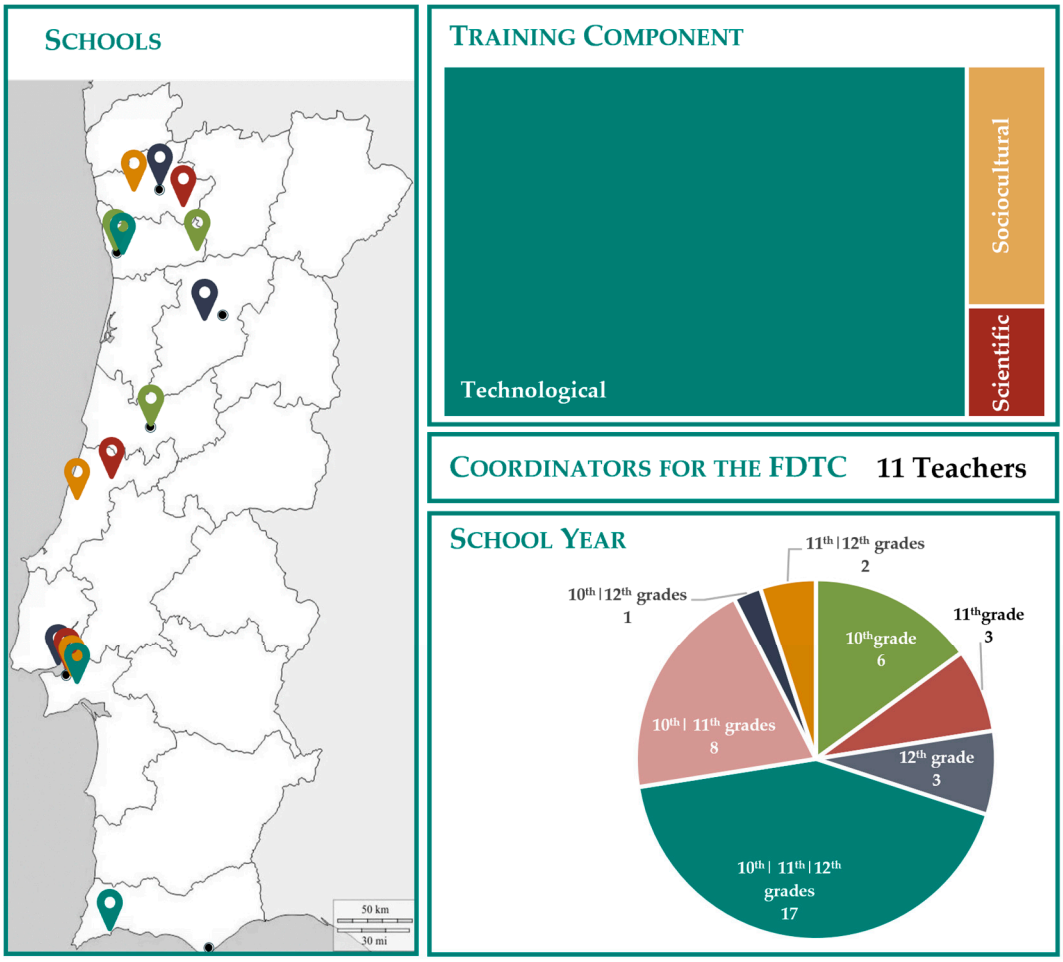

Figure 3. Descriptive analysis of the sample—professional identification information [34].

Sample

Before delving into the sample itself, it is important to note that participants in the survey's initial section acknowledge the study's objectives and consent to the handling of their data. They understand that their participation is voluntary and confidential, with responses kept anonymous and aggregated for educational, academic, and scientific purposes.

The sample comprised forty teachers teaching the FDTC during the 2023/24 academic year. Their age distribution was as follows: one instructor fell within the 20 to 30 age bracket (2.5%), six were aged between 31 and 40 (15%), fifteen fell between 41 and 50 (37.5%), seventeen were between 51 and 60 (42.5%), and only one was over 61 years old (2.5%) (Figure 2). The majority of educators held qualifications equivalent to level 6 or higher on the QNQ. Twenty-seven had a bachelor's or undergraduate degree (level 6 QNQ), eleven possessed a master's degree (level 7 QNQ), and one held a doctorate (level 8 QNQ). Only one instructor held qualifications at level 3 of the QNQ, which is secondary education aimed at further studies at a higher level.

In terms of their areas of training, twenty educators identified fashion and textiles as their exclusive or combined area, while the remaining twenty were spread across eight diverse areas: arts, psychology, sports, philosophy, product design, communication design, social studies, and mathematics.

Among the sixteen schools offering the FDTC this academic year, fifteen took part in the study, representing most of the Portuguese institutions [34]. The distribution of schools in mainland Portugal was concentrated along the coast, primarily in the municipalities of Porto and Braga (North) and in Lisbon (Center) (Figure 3). The sample distribution was quite varied, with one school having a notable presence with seven teachers.

Regarding the thirty-seven disciplines or UFCDs included in the course, various combinations were reported, resulting in 312 recorded responses. Of these, 270 were exclusively related to UFCDs in the technological training component, involving 27 teachers. Interestingly, the UFCD "Commercial Fashion Project" garnered the highest number of responses, with 15 teachers. Also, of the forty respondents, eleven held multiple roles, including coordination of the FDTC.

As for the distribution of responses by school year, the majority lied within the three school years (10th, 11th, and 12th grades), with seventeen responses. Eight responses were from the 10th and 11th grades, while six were specific to the 10th grade.

3. Results and Discussion

3.1. Circular Economy and Sustainability in the Fashion Design Technician Course Curriculum—Perspective of the Surveyed Teachers

To explore the perspective of the surveyed teachers regarding the integration of CE and sustainability principles in the curriculum of the FDTC, they were prompted to select just one subject or UFCD they teach, considering the expectation that teachers would teach more than one subject/UFCD. As a result, 10 educators were responsible for teaching subjects within the sociocultural training component, 4 within the scientific training component, and 26 UFCDs within the technological training component.

The initial query posed to educators aimed at gauging the incorporation of diverse sustainability-related themes within the curriculum of the subjects/UFCDs under their instruction. A total of twenty-one themes/concepts were outlined, asking teachers to indicate, with a single response, whether each should be integrated into the curriculum of the subject/UFCD they teach, selecting from the options "Yes", "No", or "Already present in the curriculum" (APC).

Overall, the surveyed educators predominantly advocated for the inclusion of the majority of the presented topics within the curriculum of the subjects and UFCDs they teach.

The "Yes" option garnered 471 out of 960 responses obtained (49.06%). The remaining responses were divided between the "No" and "APC" options, comprising 24.06% and 26.88% of the total, respectively. In the most specific case of the CE, it garnered 19 positive responses, 7 negative responses, and 14 "APC" (Table 2).

Table 2. Surveyed teachers' views on including the presented themes in the subjects/UFCDs they teach [34].

Theme	Yes	No	Already Present in the Curriculum
1. Sustainable development and its goals (SDGs)	18	6	16
2. Climate change	20	10	10
3. Global warming	19	12	9
4. Pollution	20	9	11
5. Release of microplastics into water resources	21	11	8
6. Biodiversity loss	18	13	9
7. Renewable/alternative energies	23	12	5
8. Circular economy	19	7	14
9. Polluter-pays principle	20	16	4
10. Fast fashion	16	9	15
11. Excessive consumption	23	3	14
12. Destruction of natural resources	20	9	11
13. Excessive use of pesticides and insecticides	17	16	7
14. Textile waste	17	10	13
15. Reuse	23	2	15
16. Recycling	23	3	14
17. Redoing	23	2	15
18. Product repair	23	9	8
19. Upcycling	18	11	11
20. Eco-products	21	8	11
21. Greenwashing	18	12	10
22. Slow design	21	9	10
23. Product durability	17	9	14
24. Composting	13	23	4
Total	471	231	258

Notably, several themes and concepts closely tied to the fashion and textile domain emerged, including "Fast Fashion", "Textile Waste", "Upcycling", "Greenwashing", and "Slow Design". Across these topics, a similar distribution of data was evident, with a prevalent trend of positive responses, underscoring the necessity of incorporating these themes into the curriculum. However, the response already available in the curriculum also presented significant relevance, even though the inclusion of these topics had not been verified in the official documents of the subjects/UFCDs

To deepen the understanding of the teacher's perspectives on sustainability, three statements (numbered from AF1 to AF3) were presented:

- AF1. Sustainable development is integrated into the curriculum of the subject(s) or UFCDs I teach;

- AF2. The integration of environmental issues (environmental protection) should be a fundamental component in all subjects I teach;
- AF3. Sustainable development should be addressed not only within the subjects of my specific area but also integrated into all curricula as a cross-cutting theme;

Educators were requested to position themselves in response to each statement using the following scale: 1. Strongly Disagree | 2. Disagree | 3. Neither Agree nor Disagree | 4. Agree | 5. Strongly Agree (Figure 4).

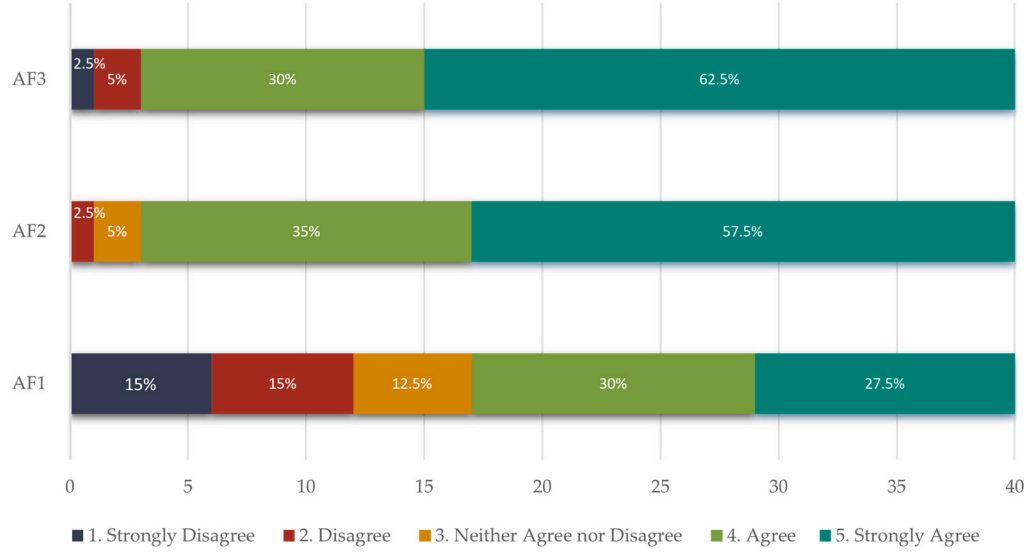

Figure 4. Bar chart illustrating the surveyed teachers' positions on three curriculum-related statements [34].

For all statements, the majority of teachers expressed agreement (options 4 and 5), with 57.5% confirming that sustainable development (SD) is integrated into the curriculum of the subjects and UFCDs they teach (AF1). Furthermore, a significant 92.5% advocated for SD to be a pervasive theme across all curricula (AF3), and an equal percentage, 92.5%, affirmed that environmental protection should be a fundamental component of the subjects they teach (AF2).

Dissenting viewpoints (options 1 and 2) were minimal, except for AF1, where 30% of respondents recognized that SD was not included in the curriculum of the subjects and UFCDs they teach. Although it can be considered a relatively high percentage (30%), when analyzing the official curriculum programs, this value did not align with that information, as only 15 out of 40 teachers (4 Foreign Language, 6 Integration Area, and 5 Physical Education) taught subjects whose programs included information related to sustainability. Therefore, only 37.5% of the respondents should have answered affirmatively to AF1, which lead us to conclude that despite not being present in the curriculum, teachers incorporated this theme into their pedagogical practices.

3.2. Circular Economy and Sustainability in the Pedagogical Practice of the Surveyed Teachers

The exploration of how CE and sustainability are incorporated into the teaching methods of educators in the FDTC was carried out in two stages, featuring two types of questions: a dichotomous inquiry and a conditional open-ended query. In the first question, teachers were asked to specify if sustainable development (SD) forms part of their teaching practices. The majority of respondents, 33 out of 40, affirmed this inclusion. Among the seven teachers that responded negatively, the breakdown by disciplines and UFCDs was as follows: Physical Education—1; Portuguese—3; Descriptive Geometry—1; Mathematics—1; and Graphic Composition—1. Thus, only one instructor from a UFCD within the technological training

component reported that SD was not incorporated into their teaching practices, while the remaining six were from disciplines within the sociocultural and scientific components.

The subsequent question was conditional, requiring educators who answered affirmatively in the previous question to elaborate on how SD was integrated into their teaching methods. This was achieved through the following open-ended prompt: "What methodologies, strategies, and/or tools do you employ in the classroom?" Due to its conditional nature, not all respondents were required to answer this question, leading to only 31 responses being collected, instead of the anticipated 33.

The initial analysis of the responses involved creating a word cloud with the key terms, showcasing the most frequently used words by the surveyed educators in response to this question (Figure 5). A strong emphasis on sustainable behaviors was evident, with words like "Reuse" (26 occurrences), "Sustainability" (14), "Upcycling" (8), and "Waste" (3) being the most prominent.

Figure 5. Word cloud depicting the most frequently mentioned concepts from teachers about the methodologies, strategies, and tools (for SD) used in the classroom.

This information also facilitated the categorization of the responses into five key concepts: 'Pedagogical Strategies', 'Cultural, Social, and Environmental Impact', 'Innovation and Creativity', 'Resource Management', and 'Practical Application'. This classification helps in understanding the various facets of how sustainability and responsible practices are integrated into teaching methods and classroom activities. Before delving into the five concepts, it is important to note that, due to the open-ended nature of the responses, many educators' answers were incorporated across multiple concepts. For this reason, the responses were often edited to highlight only the parts relevant to each concept. Additionally, all responses were collected in Portuguese and translated into English while striving to maintain their integrity as much as possible.

Therefore, the concept 'Pedagogical Strategies' encompassed the methods and approaches educators used to impart knowledge and foster critical thinking among students. This included diverse techniques such as problem-based learning, interactive discussions, and the use of multimedia resources. Educators often employ debates, videos, and practical activities to deepen students' understanding of sustainability issues (Table 3). These strategies also involved making use of interdisciplinary practices and encouraging research and reflection on real-world problems. By incorporating these methods, teachers aimed to enhance students' engagement and comprehension of the subject matter.

Table 3. Educators' responses organized by the key concept 'Pedagogical Strategies' [34].

Pedagogical Strategies
"Research, debate, and reflection"
"Viewing documentaries and critical assessments of them. Completing practical assignments on various topics, all with oral presentations (. . .)"
"Dialogue with students (. . .)"
"Videos, discussion, and written and oral activities"
"Dialogue with students, (. . .); Presentation of informational content (. . .); Prioritization of design solutions with a digital focus; Regular dialogue with students (. . .); Encouragement of analysis and critical reflection on current affairs."
"Upcycling project (. . .) Study of textile materials (. . .) Workshops and lectures on sustainability, circular economy, and slow fashion. (. . .) Presentation of projects to the school community (. . .)"
"Research on specific situations, visits to exhibitions, documentaries, etc."
"(. . .) project on textile fibers and research eco-sustainable fibers (. . .)"
"Researching materials, seeking sustainable raw materials at fashion fairs, (. . .)"
"Debates on the topic, viewing videos, sharing projects and designers (. . .)"
"Providing information, study visits, application projects, interdisciplinary teaching practices"
"Viewing and analyzing case studies on the impact of fashion and the textile industry, documentaries, films"
"Guidance in researching and practicing sustainable options in fashion design and execution of projects"
"Problem-Based Learning methodology. Practical activities. Socio-emotional education"
"Case analysis, workshops on upcycling"
"Diverse information, research, and application of knowledge to practice"
"Explain the linear economy and its problems. (. . .) Recommend authors and/or sources for consultation."
"I try to give examples (. . .)."
" (. . .) In the classroom, I suggest and sometimes we watch parts of programs related to sustainable fashion, such as 'Wardrobe' on RTP 2; reports, such as 'The Clothes of Dead White Men', where the journalist has visited our school. (. . .) As exercises, I propose many from the book 'Sustainable Fashion' by GG."

The 'Cultural, Social, and Environmental Impact' key concept involved understanding and addressing the broader implications of fashion and design on society and the environment. Educators integrated this concept by discussing the cultural significance of fashion, its social implications, and its environmental footprint. This included analyzing the impact of textile production, promoting sustainable practices, and raising awareness about environmental issues (Table 4).

The concept 'Innovation and Creativity' highlighted the role of creative approaches in solving sustainability challenges. Educators encouraged students to explore innovative solutions through practices such as upcycling and the development of new materials. This concept included using creative processes to address environmental issues and enhanced the functionality and aesthetic appeal of fashion items. For instance, students might have engaged in projects that repurposed waste materials into new products or explored novel design concepts that contribute to sustainability (Table 5). All responses that included upcycling were considered within this concept; however, they were not transcribed again as they can be consulted in Tables 3–6.

The key concept 'Resource Management' referred to the practices and principles applied by educators to optimize the use of resources within their teaching environment. This included efforts to minimize waste, such as reusing materials like paper and textiles, and implementing strategies for efficient resource utilization. Examples of this concept comprised the avoidance of paper use where possible, the reuse of textiles and other materials in creative projects, and the careful management of equipment and energy (Table 6).

The 'Practical Application' concept focused on how theoretical knowledge is translated into real-world practices. This involved implementing sustainability concepts in practical scenarios, such as through project-based learning and hands-on activities. Educators guided students in applying sustainable practices in their work, from the initial design phase to the final product. This incorporated activities like creating new textiles from waste materials, participating in community-based projects, and conducting research on sustainable materials and practices (Table 7).

Table 4. Educators' responses organized by the key concept 'Cultural, Social, and Environmental Impact' [34].

Cultural, Social, and Environmental Impact
"(. . .) all students can be aware of the topics, raise awareness of the problems, and discuss what can be done for individual and global improvement."
"Dialogue with students about the importance of preserving nature and the environment we are in, as well as the harmful consequences of exercising in areas with high levels of pollution."
"Dialogue with students, based on consumption estimates, about optimizing resource management in each developed project; Presentation of informative content on material production and its implications in terms of raw materials and extraction processes; Prioritization of project solutions focusing on the digital aspect; Regular dialogue with students about environmental, developmental, geopolitical, production, and consumption issues; Encouragement of analysis and critical reflection on current affairs."
"(. . .) Study of textile materials and understanding of their environmental impact (from cultivation or collection to the design of the pieces and their distribution). Workshops and lectures on sustainability, circular economy, and slow fashion topics. (. . .) Presentation of the projects to the school community to raise awareness of the topic."
"All work proposals always have a related question. For example, in the last proposal, students were asked to do a project on textile fibers and research eco-sustainable fibers, specifying characteristics, origin, and application. We also utilize our textile waste to create new fabrics later. This year we will create new materials with classroom leftovers to make objects to be sold at a circular economy fair we will have at the school in May."
"Research of materials, searching for sustainable raw materials at fashion fairs, monitoring the market for fashion trends related to sustainability."
"Debates on the topic, viewing videos, sharing projects and designers who integrate sustainable development in their practice, (. . .), etc."
"Reuse of fabrics/clothing practicing the Upcycling technique. (. . .) Reuse of denim presented in a parade in partnership with the Vouzela City Council."
"Viewing and analyzing case studies on the impact of fashion and the textile industry, documentaries, films."
"I incorporate, whenever possible, topics directly related to environmental sustainability issues in work proposals, such as upcycling strategies, reuse, recycling, and new product construction. Fashion with added value based on extending its life cycle."
"Projects developed with material reuse; waste separation in the classroom."
"Explaining the linear economy and its problems. Emphasizing 'knowledge is power'. Suggesting more sustainable alternative paths. (. . .)"
"(. . .) In more practical work, we reuse all the scraps from cutting pieces to make new fabrics or new pieces. We have our project 'Trocas e Baldrocas', which involves bringing clothes we no longer use, and students exchange them among themselves. (. . .)"

Table 5. Educators' responses organized by the key concept 'Innovation and Creativity' [34].

Innovation and Creativity
"Utilizing materials (e.g., fabrics and others) for more creative work"
"Reusing fabrics/clothing using the upcycling technique. Coordinated development/dresses on mannequins with dried plants in a forest environment. Reusing denim presented in a fashion show in partnership with the Vouzela City Council"
"Upcycling as a form of creative unlocking"
"Explain the linear economy and its problems. Link 'knowing how is power'. Suggest more sustainable alternative paths. Recommend authors and/or sources for consultation."

Table 6. Educators' responses organized by the key concept 'Resource Management' [34].

Resource Management
"I don't use paper."
"Reuse of materials (paper, writing materials), sharing of manuals."
"Utilizing materials (e.g., fabrics and others) for more creative projects."
"Dialogue with students, based on consumption estimates, about optimizing resource management in each developed project; (. . .) Prioritization of project solutions focusing on the digital aspect; (. . .)"
"Upcycling project (. . .), we collect all the waste, gathering and using them in future projects. (. . .) Many of the textile materials used in the creation of our pieces are second-hand (. . .)"
"Alert to waste, reuse of materials with an understanding of the process, multiple use of created pieces."
"(. . .) We also utilize our textile waste to create new fabrics later. This year we will create new materials with classroom leftovers to make objects to be sold at a circular economy fair we will have at the school in May."
"Reuse of fabrics/clothing practicing the Upcycling technique. (. . .) Reuse of denim (. . .)"
"Avoid paper and fabric waste. Reuse fabrics. When not necessary, avoid leaving tools and devices plugged in. Avoid water waste. Keep materials clean."
"(. . .), such as upcycling strategies, reuse, recycling, and new product construction. (. . .)"
"Upcycling (. . .)"
"Reuse of materials and equipment, alteration of existing models, and transformation into new products."
"Projects developed with material reuse; waste separation in the classroom."
"Reuse, zero waste, recycling."
"Reuse of fabrics for garment making."
"(. . .) In more practical work, we reuse all the scraps from cutting pieces to make new fabrics or new pieces. We have our project 'Trocas e Baldrocas', which involves bringing clothes we no longer use, and students exchange them among themselves."

Table 7. Educators' responses organized by the key concept 'Practical Applications' [34].

Practical Applications
"I don't use paper."
"Utilizing materials (e.g., fabrics and others) for more creative projects."
"Upcycling project (. . .); in the development projects of new pieces, we collect all the waste, gathering and using them in future projects. (. . .) Many of the textile materials used in the creation of our pieces are second-hand. (. . .)"
"Alert to waste, reuse of materials with an understanding of the process, multiple use of created pieces."
"(. . .) For example, in the last proposal, students were asked to do a project on textile fibers and research eco-sustainable fibers, specifying characteristics, origin, and application. We also utilize our textile waste to create new fabrics later. This year we will create new materials with classroom leftovers to make objects (. . .)"
"Research of materials, searching for sustainable raw materials at fashion fairs, monitoring the market for fashion trends related to sustainability."
"Viewing and analyzing case studies on the impact of fashion and the textile industry, (. . .)."
"Avoid paper and fabric waste. Reuse fabrics. (. . .)"
"Guidance in researching and practicing sustainable options in the creation and execution of fashion projects."
"I incorporate, (. . .), such as upcycling strategies, reuse, recycling, and new product construction. Fashion with added value based on extending its life cycle."
"Upcycling as a form of creative unlocking."
"Case analysis, (. . .)"
"Projects developed with material reuse; waste separation in the classroom."
"(. . .) In more practical work, we reuse all the scraps from cutting pieces to make new fabrics or new pieces. We have our project 'Trocas e Baldrocas', which involves bringing clothes we no longer use, and students exchange them among themselves. (. . .)"

4. Conclusions and Future Recommendations

After a review and interpretation of the documentary sources regarding the presence of CE and sustainability in the FDTC curriculum and after analyzing the perspectives of the educators on this matter, several conclusions and future recommendations emerged.

Firstly, it was evident that there is a significant gap in the explicit inclusion of CE and sustainability in the curriculum documents of the disciplines in overall. This discrepancy has been documented by Sousa, Marques, and Broega [35], who analyzed the curricula of diverse Fashion Design courses, spanning from the professional level (level 4 QNQ/EQF) to higher education levels (levels 6, 7, and 8 QNQ/EQF). Their findings revealed that sustainability often emerges sporadically as a peripheral or isolated topic within specific subjects, rather than serving as the guiding principle that shapes the overall structure of these courses. This analysis can be extrapolated to the study, where only a few disciplinary curriculum documents addressed the theme in a shallow manner.

This incongruity becomes even more pronounced within the UFCDs of the technological training component of the FDTC curriculum, where references were notably absent. With the direct connection to fashion design in these short-duration units, one would expect a more thorough integration of these themes. However, juxtaposing this, the viewpoints of the educators revealed strong support for the inclusion of various subjects related to these themes in the curriculum, indicating a solid commitment to promoting sustainability in Fashion Design education. Additionally, the majority of the surveyed educators had already integrated these issues into their pedagogical practice, as evidenced by the testimony of one educator that teaches various UFCDs in the technological component, and highlights that: "In all the UFCDs I teach, I emphasize to students the importance of contributing to a more sustainable fashion. However, despite this emphasis, it is not very evident in the proposed curriculum objectives, leading me to believe that the program is quite outdated" [34].

As such, concerns have also arisen regarding the lack of alignment between teachers' expectations and the content of existing curriculum documents. Therefore, it can be asserted that promoting greater collaboration between educational policy makers and teaching professionals is essential to ensure that the curriculum truly meets the needs and expectations of the teaching community. It may even be suggested that there is a need for a curriculum review to incorporate these themes more comprehensively and inclusively, ensuring that students receive a holistic education that prepares them to face the contemporary challenges of the fashion industry in a more sustainable manner. With this curriculum review, it is also crucial to emphasize the importance of providing the

necessary resources to encourage the adoption of sustainability practices and ensure their effective implementation by educators. This includes securing funding for sustainability-focused initiatives and providing updated teaching materials. While academia plays a pivotal role in preparing professionals and fostering responsible citizenship [36], its success depends on strong support from both governmental and school-level institutions to turn these objectives into tangible outcomes.

Regarding the methodologies, strategies, and tools used in the classroom to address these themes, as previously mentioned, the majority of educators asserted that sustainable development is an integral part of their pedagogical practice. This demonstrates their dedication to fostering sustainable practices within the fashion industry and cultivating environmental awareness among students. Notably, there is an emphasis on material reuse, the use of recycled materials, the repurposing of textile waste, and upcycling techniques to create products, thereby minimizing textile waste. Furthermore, there was a clear focus on researching more sustainable materials, monitoring sustainable fashion trends, and exploring alternative, more conscientious approaches. In addition to waste reduction efforts, educators also emphasized energy consciousness, advocating for the reduction of not only fabric waste but also paper, water, and electricity consumption, thereby encouraging more efficient and mindful practices.

Given the interest and commitment demonstrated by educators in providing a more holistic perspective on the fashion industry, it is clear that continuous training opportunities are essential to support their efforts. The findings highlight the need to integrate CE principles into the curriculum, which, in turn, underscores the importance of equipping teachers with the necessary skills and knowledge in this area. Tailored workshops or formal professional development programs could significantly enhance educators' understanding of CE practices, enabling them to incorporate these concepts more effectively into their teaching. Aligning the curriculum with CE principles would not only empower educators but also foster greater student engagement, increasing awareness of sustainable practices and their importance within the fashion design industry and beyond.

Education and raising awareness among students were central aspects, utilizing a variety of educational methods such as debates, lectures, documentary screenings, practical activities, field trips, case study analysis, and oral presentations. Some of these methods for teaching sustainable design, as suggested by Watkins et al. [7], include both generic and specific approaches, such as seminars, workshops, flipped classrooms, lectures, videos, and online classes. The goal is to deepen comprehension of the environmental, social, political, ethical, and economic challenges within the fashion industry and encourage reflection on possible solutions. Teachers also addressed the incorporation of sustainability principles into fashion projects presented to students, encouraging critical analysis and the pursuit of more conscientious solutions. Instruction centered on practical project development emerges as the predominant approach, fostering an advancement in various skills [7].

Dialogue was also presented as a strategy, with teachers reinforcing open communication with students about the importance of environmental preservation and the consequences of fashion industry practices, thus motivating them to contribute to a more sustainable future. Utilizing seminars as a teaching method also facilitates interactive presentations and discussions, thereby enhancing subject assimilation and nurturing critical thinking abilities [7].

The reported pedagogical approaches exhibit an interdisciplinary orientation, incorporating knowledge from various areas to address sustainability in fashion, including environmental, socio-emotional, economic, and ethical considerations. The integration of interdisciplinary methodologies seeks to stimulate curiosity, exploration, critical thinking, intercultural understanding, environmental awareness, and a problem-solving mindset

among students [12,37]. Finally, it is worth mentioning that some teachers involved the school community by presenting projects to the community, organizing fairs, and initiatives that encouraged active student participation and raised awareness among community members.

While valuable initial insights have been gained regarding the integration of CE and sustainability within the pedagogical framework of the FDTC, additional exploration is warranted. Engaging in interviews with teachers and course coordinators, especially those overseeing the UFCDs of the technological training component, may offer deeper insights into the methodologies, strategies, and activities relevant to CE and sustainability in fashion design education. Ultimately, these findings will have a practical application in the subsequent action research phase, guiding the development of more targeted and effective sustainable teaching-learning strategies.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su17030951/s1, and the DataRepositóriUM: https://doi.org/10.34622/datarepositorium/GVGTRK [34].

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