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Digital transformation, circularity, and gendered entrepreneurship in fashion education: a state-of-the-art review conducted within the FAIR FASHION framework

Abstract

Digital transformation and sustainability imperatives have accelerated developments in *fashion* education, producing new expectations around digital fluency, circular design literacy, and entrepreneurial capacity. Immersive environments such as VR/AR, AI-assisted design, and virtual prototyping have expanded pedagogical reach, yet uneven institutional access and digital infrastructure gaps continue to constrain adoption. Parallel to these advancements, circularity has shifted from conceptual sustainability discourse to being a curricular requirement, emphasising dematerialisation, lifecycle awareness, and responsible design intervention. At the same time, gender-structured inequities persist in entrepreneurial participation: despite the predominance of women in fashion education and micro-enterprise activity, digital platform bias, funding asymmetry, and credibility hierarchies limit equitable outcomes. Digital-, institutional- and gender inequity have been identified as drivers of an effective educational program and should hence be addressed in prospective curricula development.

Keywords: fashion education, digital transformation, circularity, gendered entrepreneurship, digital inequity, sustainability integration

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Sue Rossano-Rivero,[1] Marco Mossinkoff[2]
[1]Hochschule Niederrhein, University of Applied Sciences, Germany
[2]Amsterdam University of Applied Sciences: Amsterdam, North Holland, Netherlands

Correspondence: Marco Mossinkoff PhD, Researcher and Lecturer Fashion Research & Technology, Amsterdam University of Applied Sciences: Amsterdam, North Holland, Netherlands, Tel 0621157208

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Introduction

Fashion education is currently mediated by rapid digitalisation, heightened sustainability expectations, and shifting entrepreneurial practices. Immersive technologies increasingly define design learning environments, while circularity moves from abstract principle to curricular obligation. Yet, access to digital infrastructure remains uneven, producing differentiated capacity for innovation. Concurrently, although the fashion sector reflects a high proportion of women in both education and entrepreneurial formation, gender-based power asymmetry, platform bias, and funding constraints continue to inhibit equitable participation. Understanding the present state of the field therefore requires simultaneous attention to digital systems, sustainability frameworks, and structural gender conditions. To address these issues in the building of a through fashion management curriculum an understanding is necessary

1) Digital transformation and technology adoption
2) Circularity and its role in curriculum development and
3) Gender inequality in fashion entrepreneurship are necessary.

This overview presents the main findings from a comprehensive literature review to further discuss implications for curricular redesign, platform governance, and inclusive entrepreneurial ecosystems are outlined.

Digital transformation in fashion education

Advanced digital tools—XR, VR/AR simulation, 3D development technologies, and AI-supported decision interfaces—have reoriented fashion education toward dematerialised sampling and creative prototyping. Virtualisation enables accelerated iteration and reduced waste, facilitating digital craftsmanship and hybrid creative skill formation.[1,2]

Fab labs and makerspaces similarly expand access to design experimentation, and foster innovation, collaboration, and twenty-first century skill acquisition.[3] Yet digital innovation remains conditioned by resource availability: unequal institutional access, variable infrastructure, and inconsistent digital pedagogy training reproduce stratification in learning conditions.

Access disparity must therefore be recognised not merely as a technical delay but as a digital equity problem. As Mishra et al.[4] demonstrate, constraints in digital access, onboarding, and platform operability generate barriers that mirror structural inequities evident in entrepreneurial participation.

Circularity as curricular integration

Recent integration of circularity foregrounds lifecycle accountability, reduced sampling waste, and sustainability-driven design logic. Henninger et al.[5] highlight how sustainability instruction now spans material literacy, strategic business planning, and circular performance evaluation, situating ecological responsibility as a foundational component of fashion education rather than a peripheral discussion.

Digital dematerialisation supports this curricular turn, enabling prototyping without resource expenditure and aligning learning environments with ecological objectives. Perotti et al.[6] identify circular indicators as relevant evaluative tools, though their institutional implementation remains uneven. Circularity can therefore be understood as pedagogical infrastructure rather than sourcing methodology, requiring integration across assessment, learning design, and creative research.

Gendered entrepreneurship and structural inequities

Despite high female representation in fashion micro-enterprise activity, digital gender bias persists. Wang et al.[7] demonstrate

platform-based credibility asymmetry, noting that women's entrepreneurial identity performance is frequently evaluated through masculine-coded criteria. Mishra et al.[4] describe this condition as the "Labyrinth Groove," a configuration of technological, cultural, and cognitive barriers that restrict entrepreneurial advancement even when digital access is nominally available. Arcuri et al.[8] further indicate that female-led firms show strong innovation orientation but experience limited scale potential due to capital gatekeeping and market legitimacy dynamics.

Support systems grounded in emotional intelligence and mentorship have demonstrated efficacy in skill development and resilience building,[9] though expectations of emotional labour often remain disproportionately gendered. Taken together, these dynamics illustrate that digital and entrepreneurial participation are not merely procedural, but structured through gendered systems of validation, access, and recognition.[10,11]

Conclusion

1) Digital innovation is fostered by actual access to physical and virtual infrastructure that allows continuous interaction and experimentation. Growing inequity in digital literacy can have a large impact in education quality (digital equity problem).

2) If it is true that ecosystem awareness must be brought in the center of an educational program, circularity should be part of both physical and immaterial practices in the program itself (institutional inequality).

3) A more balanced gender representativeness in the innovation adoption process leads to a more considerate, long-term development, the gender themes should get much more attention in the managerial parts of a curriculum aimed at digital and ecological innovation (gender equity).

More generally, across the domains of digital adoption, circular curriculum implementation, and entrepreneurial participation, patterns of inequity recur. While immersive tools and virtual prototyping expand creative possibilities, their benefits are shaped by institutional capacity and socioeconomic access. Similarly, circular education reframes responsibility yet reproduces labour precarity when sustainability work is disproportionately borne by women. And although digital platforms promise distributional reach, they also replicate existing valuation mechanisms that privilege dominant identities.Digital transformation and circularity constitute meaningful advances in fashion education but remain constrained by uneven access and persistent gendered inequities. Current evidence suggests that curricular innovation alone is insufficient without parallel reforms in platform governance, institutional resourcing, and inclusive entrepreneurial finance. Future research should prioritise investigations of digital equity and gender-competent curricular design to ensure that technological expansion produces systemic, rather than selective, benefit.

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Conflicts of interest

The authors declare no conflict of interest.

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