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Scientific production in arts education and systemic sustainability: mapping the didactics of artistic expression area in Spanish higher education

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Abstract

Purpose – This study examines the relationship between scientific production and sustainability in the Spanish academic field of didactics of artistic expression. Its aim is to map this area, identify institutional and thematic patterns and assess how research aligns with the sustainable development goals (SDGs) within higher education from a whole-institution perspective.

Design/methodology/approach – The study is based on a database of 370 university faculty members, constructed through the cross-validation of official institutional records and major academic repositories (Scopus, Web of Science, Dialnet, and Google Scholar). Bibliometric, spatial, and thematic analyses were conducted using R, Quantum Geographic Information System, and Graphcommons to examine professional composition, territorial distribution, publication patterns, and alignment with the SDGs.

Findings – The results show a broad presence of research related to the SDGs, although it is unevenly distributed across autonomous communities and institutional profiles. SDG 4 (Quality Education) clearly dominates the research agenda, followed by SDG 9 (Industry, Innovation and Infrastructure) and SDG 5 (Gender Equality), reflecting the field's strong pedagogical, social, and innovation-oriented focus. In contrast, environmental and governance-related SDGs (12–17) remain marginal. Publication strategies reveal a dual dissemination model that combines high-impact international journals with national open-access outlets, balancing global visibility with disciplinary consolidation.

Originality/value – Overall, the findings provide actionable evidence to support sustainability governance, research policy, and strategic planning in higher education institutions. The study also offers a transferable analytical framework for identifying institutional patterns, thematic gaps, and sustainability alignments across academic disciplines, enabling comparative and cross-disciplinary assessments of contributions to the SDGs in higher education.

Keywords Sustainability, Higher Education, Didactics of Artistic Expression, Sustainable Development Goals, SDGs, Institutional Patterns

Paper type Research article

1. Introduction

Universities hold a strategic role in the transition toward sustainability but continue to face structural barriers that limit the implementation of their sustainability agendas. The ongoing

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fragmentation of disciplines and over-specialization hinder the development of truly transdisciplinary approaches capable of addressing complex socio-environmental challenges (Loorbach and Wittmayer, 2024). In addition, bureaucratic governance structures and evaluation systems focused on productivity metrics reinforce a *publish-or-perish* logic, discouraging initiatives that generate tangible social or environmental impact (Heuritsch, 2021; Bonaccorsi *et al*., 2021). Although institutional commitments to the Sustainable Development Goals (SDGs) have multiplied, evidence suggests that these rarely result in deep or transformative changes. As Andrades *et al*. (2025) note, sustainability reports often display significant heterogeneity, reflecting compliance with external demands rather than outcomes of genuine strategic planning. The absence of robust evaluation frameworks, accountability mechanisms, and effective links between research output and institutional policy sustains the gap between rhetoric and practice, limiting universities' ability to act as transformative agents (Gaudiano *et al*., 2015).

Scientific research constitutes a cornerstone of the sustainability transition, because it provides the analytical models, indicators, and applied knowledge necessary to respond to the complexity of global challenges (Sahle *et al*., 2025). The ethical framework of the SDGs fosters interdisciplinary collaboration and critical engagement with social and environmental issues (Sianes *et al*., 2022), linking theoretical insights with institutional strategies and public policies (Bettencourt and Kaur, 2011). When stakeholders participate in the design and development of research processes, findings gain practical relevance and become actionable evidence for governance and policy decisions (Erismann *et al*., 2021; Miller *et al*., 2014). Consequently, the continuous alignment of research agendas with the SDGs enables the identification of priority areas and the monitoring of universities' contributions to sustainability transitions (Kajikawa, 2008; Sahle *et al*., 2025). In this regard, sustainability-focused research networks not only deepen disciplinary understanding but also highlight emerging trends that inform institutional and educational transformation (Sianes *et al*., 2022).

Scientific journals play a pivotal role in this dynamic. Beyond serving as platforms for disseminating results, they function as legitimizing arenas that shape and direct research agendas. Editorial orientations, through thematic calls, policy guidelines, and sustainability-oriented frameworks, contribute to defining conceptual boundaries and methodological standards within academia (Schirone, 2025; Lad *et al*., 2024). By prioritizing sustainability-focused publications and fostering cross-disciplinary collaboration, journals enhance the social and political resonance of scientific output, thereby accelerating systemic change (Chew *et al*., 2024). Bibliometric analyses of academic production further allow the identification of journals that lead or marginalize sustainability discourses, offering insight into the coherence between institutional rhetoric and research practices (Alfirević *et al*., 2023; Andrades *et al*., 2025).

The urgency of rethinking the university's role arises amid unprecedented global crises, climate change, biodiversity loss, resource depletion, pollution, and widening inequality, all exacerbated by insufficiently coordinated responses (Pörtner *et al*., 2023; Tregidga and Laine, 2022). These interlinked threats generate cascading effects on ecosystems and social stability, from environmental degradation and food insecurity to health risks and displacement (González-Márquez and Toledo, 2020). Scholars such as De Marchi and Gereffi (2023) call for systemic, transformative action capable of reshaping governance, social norms, and collective values. Within this framework, higher education institutions emerge as essential laboratories for sustainability science, cultivating interdisciplinary thinking and critical reflection (Spector, 2020), while advancing policies that integrate equity, restoration, and accountability at every level (Lidskog and Standring, 2023).

The literature in the field underscores that curricular innovation alone is insufficient and that comprehensive institutional transformation is required to achieve genuine sustainability (Žalėnienė and Pereira, 2021). This involves reconfiguring university culture, governance, leadership, research, and social engagement under a holistic vision (Bohunovsky *et al*., 2020). Frameworks such as the Whole Institution Approach advocate for collective commitment,

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participatory structures, and continuous learning processes (Dzimińska *et al*., 2020), while distributed leadership and networked collaboration emerge as key drivers of deep and enduring change (Azizi, 2023). As Halmaghi *et al*. (2023) and Bien and Sassen (2020) emphasize, organizational culture acts as an internal compass that can either facilitate or obstruct sustainability implementation; thus, transforming it is vital for achieving meaningful and lasting impact within and beyond the university.

In this context, analyzing how academic research and publication practices align with sustainability goals becomes indispensable. Scientific production not only advances knowledge but also empowers academics to advocate sustainable practices, influence public policy, and extend these values into broader social and professional spheres (Abo-Kalil, 2024). The increasing collaboration among higher education institutions worldwide demonstrates a collective effort toward shared research strategies and the construction of transnational knowledge networks devoted to sustainability (Tafese and Kopp, 2025).

Understanding how research aligns with sustainability is a strategic necessity for universities (Di Tullio and Rea, 2025). Mapping research output helps identify priorities, gaps, and imbalances, supporting evidence-based decisions and revealing whether sustainability commitments result in concrete academic practices (Deroncele-Acosta *et al*., 2023). In art education, sustainability is understood as a cultural and pedagogical process linked to creativity and social change (Mingzhu *et al*., 2025). Although this field is seen as strategic for sustainable development, research has rarely been examined in terms of its institutional alignment with sustainability frameworks, highlighting the need for systematic analysis. By combining international and national academic databases, the study aims to capture the range of theoretical, methodological, and applied contributions shaping research in artistic education and sustainability.

Art education is recognized as a strategic field for sustainability-oriented learning due to its capacity to promote critical thinking, creativity, and social engagement (Vázquez-Marín *et al*., 2023). Arts-based education supports sustainable development, cultural sustainability, and social justice, making it a relevant lens for examining research contributions to sustainability transitions in higher education (Tao and Tao, 2024). The Spanish higher education system provides a valuable case for examining art education and sustainability. Its public university network, decentralized governance, and recognized academic field enable analysis of regional differences and institutional strategies within a single national context, with findings applicable to similar systems elsewhere.

Within this broader panorama, the field of Didactics of Artistic Expression (DAE) within the Spanish university system offers a particularly significant case. Situated at the intersection of education, art, culture, and society, this area combines pedagogical formation with artistic research, serving as a fertile ground for examining how creativity-oriented disciplines contribute to sustainability transitions. However, it remains unclear to what extent this potential is reflected in actual academic output. Consequently, this study addresses the following research question: To what extent is the scientific production of Spanish faculty in DAE aligned with the SDGs? By answering this question, the study not only provides a diagnostic of the Spanish case but also offers a scalable framework for evaluating how specific creative disciplines contribute to the global sustainability agenda in higher education.

To address this question, the study adopts the Whole Institution Approach, viewing universities as integrated systems where sustainability depends on coherent alignment rather than isolated actions. From this perspective, research output serves as a key indicator of how sustainability principles are embedded in institutional priorities and academic orientations (Christou *et al*., 2024).

Based on this framework, the objectives of this study are threefold: to chart the scientific production of Spanish faculty in the area, to analyze its alignment with the SDGs through bibliometric and thematic indicators, and to evaluate the institutional profiles and editorial policies emerging from this analysis. By combining international and national academic

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databases, the methodology aims to capture the range of theoretical, methodological, and applied contributions shaping research in artistic education and sustainability.

Accordingly, the research question is informed by a whole-institution perspective, focusing on how scientific production in artistic education reflects institutional engagement with sustainability agendas across territories, professional structures, and thematic orientations.

2. Materials and methods

The study uses an exploratory and descriptive design based on a whole-institution perspective. The research design was structured in four sequential phases: (1) identification of the academic population, (2) compilation of scientific output, (3) analytical classification, and (4) interpretation of results in relation to sustainability frameworks.

2.1 Database and inclusion criteria

This study approached database construction as a systematic and rigorously regulated process aimed at accurately characterizing university faculty affiliated with the field of DAE within the Spanish higher education system. The procedure followed a transparent and replicable design to ensure both the reliability of the empirical framework and the traceability of data collection.

From an institutional perspective, bibliometric and thematic mapping enables the analysis of how sustainability priorities are reflected in research practices, publication trends, and thematic focus within academic fields.

The research involved the systematic compilation of publicly available institutional data between June and August 2025. Information consistency was verified through cross-validation techniques, comparing records from university websites with authoritative academic repositories such as Dialnet, which provides a specific listing for this field, alongside Open Researcher and Contributor ID (ORCID), Google Scholar, Scopus, and Web of Science (WoS). This triangulation strategy guaranteed the internal coherence of the dataset, enabling the identification and correction of potential inconsistencies or outdated institutional references. The database was built using multiple complementary sources to avoid omitting key studies. Combining international, regional, and broad-coverage databases reduced bias and ensured the inclusion of both central and marginal contributions, resulting in a representative overview of research in art education and sustainability.

Following data verification, duplicate entries were removed, retaining only active academic staff whose affiliation with the field could be corroborated by recognized scholarly sources. The final database incorporated a set of sociodemographic and bibliometric variables, including autonomous community, city, university, professional rank, gender, institutional contact, and academic profiles (Scopus, WoS, Dialnet, and Google Scholar), as well as the corresponding academic signature.

Quantitative indicators extracted from academic profiles comprised the number of publications, citation counts, and h-index values, ensuring the robustness and replicability of subsequent analyses. The resulting database provides a homogeneous, validated, and transferable empirical framework, serving as a solid foundation for future research on sustainability-oriented scientific production in the field of artistic education.

The study compiled the full body of publications rather than only those labeled as sustainability-related. Through thematic and keyword analysis, both explicit and implicit links to the SDGs were identified, reducing selection bias and revealing sustainability within broader research agendas.

2.2 Variables analyzed and faculty categorization

The constructed database encompassed a wide range of variables organized into complementary dimensions, enabling the characterization of both the structural composition of the DAE area and its scientific production in relation to sustainability. The

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variables were selected for their relevance to the study's objectives and their availability across established academic sources. The analytical dimensions were grounded in prior sustainability research and institutional assessment frameworks (Sahin, 2025; Veres *et al*., 2025). Territorial, professional, thematic, and impact analyses together provide a multidimensional view of how sustainability priorities are embedded in academic research practices.

The first dimension included sociodemographic and institutional variables, such as autonomous community, city, and university affiliation, which allowed for the analysis of the territorial distribution of the area within the Spanish higher education system. Gender information was also recorded to explore potential inequalities or imbalances in faculty composition and their correspondence with the SDGs.

The second dimension referred to professional categorization, based on the official nomenclature used by Spanish universities. The 370 identified faculty members were grouped into ten contractual categories: Full Professors, Associate Professors, Senior Lecturers, Permanent Lecturers, Assistant Professors, Interim Substitutes, Adjunct Professors, Predoctoral Researchers, Postdoctoral Researchers, and Academic Collaborators. This detailed classification enabled an analysis of job stability, academic trajectory, and the relative contribution of each category to the area's scientific output.

The analysis is based on faculty members' institutional affiliation, as defined by their official university appointment or equivalent. Full Professor (FP), a senior academic holding the highest rank at a university; Associate Professor (AP), a mid-level, typically tenured faculty member who has demonstrated significant achievement in research and instruction; Senior Lecturer (SL), a mid-level academic rank; Permanent Lecturer (PL), a faculty member with a career-long contract within a specific department; AsP, a beginning-level, tenure-track faculty member who is working toward permanent status through a balance of research, teaching, and service; Temporary Substitute Professor (SP), an educator hired on a short-term contract to cover the teaching duties of a permanent faculty member; AdjP, a part-time or auxiliary instructor, often an expert from a specific professional field; Doctoral Researcher (PhDC), a postgraduate student who is actively conducting original research to earn a Ph.D; Postdoctoral Researcher (Postdoc), an individual who has completed their doctorate and is engaged in a temporary period of mentored research to further develop professional expertise; Teaching Fellow/Instructor (TF), a junior educator.

The third dimension focused on bibliometric indicators, derived from four major databases: Google Scholar (170 valid profiles), Scopus (162), WoS (151), and Dialnet (233). For each scholar, the number of publications, total citations, and h-index were recorded, allowing cross-database comparisons and the assessment of differences in research visibility and impact according to professional category and academic rank.

Finally, a thematic and sustainability-oriented dimension was incorporated through the extraction and analysis of publication keywords. From a corpus of approximately 3,700 keywords, the ten most frequent per author were identified and semantically linked to specific SDGs.

Taken together, this variable framework offers a comprehensive and multidimensional overview of the field, integrating institutional, sociodemographic, professional, bibliometric, and thematic dimensions. It thus provides a solid analytical foundation for interpreting subsequent results and positioning the area's contribution within the broader transformation of higher education toward sustainability.

2.3 Bibliometric analysis procedure

The bibliometric analysis was structured in successive phases to ensure the exhaustiveness, internal consistency, and replicability of results.

In the first phase, the scientific production of the 370 identified faculty members was manually extracted from four major databases, Google Scholar, Scopus, WoS, and Dialnet, recording for each profile the total number of publications, citations, and h-index values.

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Subsequently, a normalization and data-cleaning process was implemented to eliminate duplicates, standardize author names, journal titles, and keywords, and supplement incomplete records. This procedure ensured a homogeneous and comparable dataset across institutions, professional categories, and databases.

The third phase involved the application of descriptive and co-occurrence analyses. Using Graphcommons, thematic network visualizations were generated to calculate keyword frequency and Total Link Strength (TLS), thereby identifying the distribution of terms across research clusters. The territorial dimension was represented in Quantum Geographic Information System (QGIS) through choropleth maps illustrating faculty density by province, while descriptive statistics and comparative charts were developed in Excel and R.

The linkage between keywords and the SDGs was conducted through a structured and conservative procedure. Keywords were first extracted from Scopus and WoS, also manual extracted to Google Scholar and Dialnet. These terms were then compared with SDG-related sustainability classifications used in Dimensions platform. Keywords were linked to the SDGs through a conservative procedure. Only terms with clear conceptual correspondence to official SDG scopes were classified, while ambiguous or generic keywords were excluded to ensure analytical accuracy. For example, terms related to teacher education, curriculum design, or pedagogical innovation were associated with SDG4 (Quality Education), while keywords explicitly addressing gender, equality, or inclusion were linked to SDG 5 (Gender Equality). Generic artistic terms (e.g. “drawing” or “art practice”) were only retained when contextualized within educational, social, or sustainability-related framings.

A dedicated stage focused on the semantic linkage of keywords with the SDGs. Each keyword was manually reviewed and assigned to specific SDGs when a clear conceptual relationship was identified, allowing for the mapping of the area’s research output against the 2030 Agenda and revealing thematic co-occurrences among sustainability-related topics.

Finally, the entire procedure underwent independent validation by the four researchers involved in the project, including faculty with diverse academic ranks and expertise in Fine Arts, who cross-verified classifications and thematic associations. This triangulation process enhanced both the reliability and transparency of the results.

2.4 Analytical techniques and tools used

The analytical design combined bibliometric, statistical, and visualization techniques to examine the territorial, professional, thematic, and impact dimensions of the DAE area. Data were processed in Excel and R to compute descriptive statistics and comparative charts, while QGIS was used to produce choropleth maps showing faculty density and regional concentration patterns across Spanish universities.

Thematic structures were analyzed through keyword co-occurrence networks generated with Graphcommons, which identified research clusters and their links to the SDGs based on TLS calculations. Scientific impact was assessed through cross-database comparisons of publications, citations, and h-index values obtained from Google Scholar, Scopus, WoS, and Dialnet, allowing the evaluation of research visibility by academic rank and institution.

All visual outputs, maps, charts, and networks underwent independent cross-validation by the four researchers involved, ensuring analytical coherence and methodological consistency.

Overall, the integration of statistical analysis, spatial mapping, and network visualization produced a robust interpretive framework that connects the area’s academic structure with its scientific production and its alignment with global sustainability objectives.

Figure 1 presents the methodological scheme adopted in this research, structured according to the Business Process Model and Notation (BPMN) framework. This approach provides a formal, standardized representation of the research process, enabling the clear visualization of sequential phases. By using BPMN, the methodology ensures transparency, coherence, and replicability, facilitating a systematic understanding of how data collection, analysis, and interpretation were articulated throughout the study.

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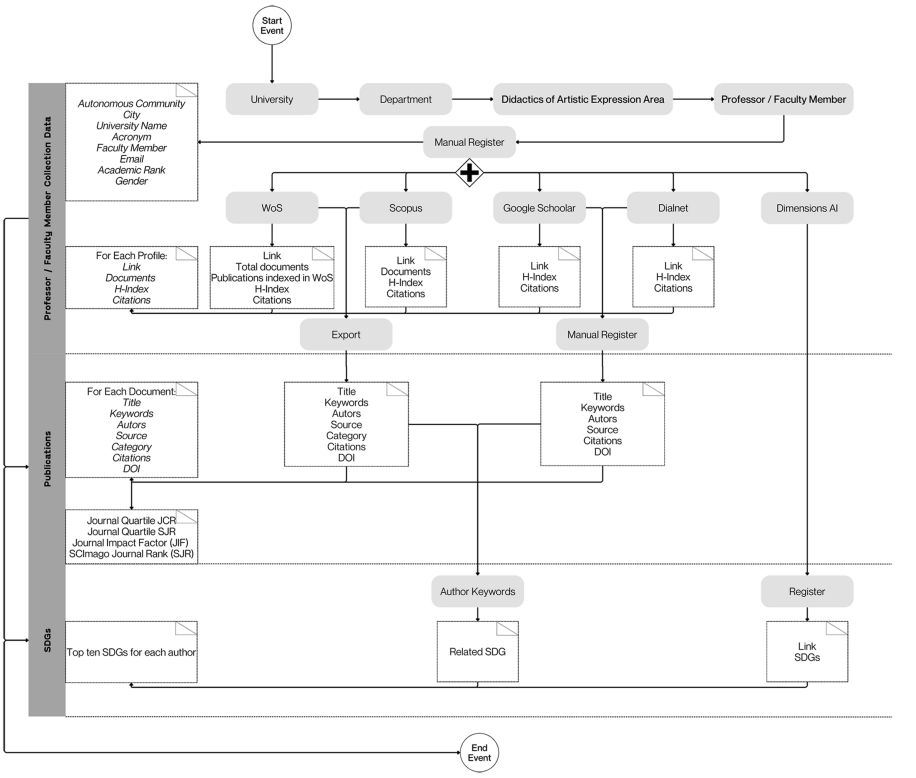

Figure 1. BPMN flowchart of the data collection and SDG mapping process. Source: Authors' own work

3. Results

3.1 Territorial distribution and professional structure of the didactics of Artistic Expression area

A total of 370 faculty members in the area of DAE within the Spanish university system were identified across seventeen autonomous communities, confirming an extensive institutional presence. The area's concentration is particularly evident in certain regions, with Andalusia leading the distribution (76), followed by Catalonia (51) and the Community of Madrid (45). Together, these three regions account for more than half of the national total, whereas regions such as La Rioja (2), the Balearic Islands (7), Castile-La Mancha (8), and Extremadura (UEx) (8) show a more limited representation. This spatial pattern of concentration and dispersion is visually represented in the choropleth map (Figure 2). The choropleth map represents the distribution of faculty members according to their institutional affiliation across Spanish autonomous communities.

In a second dimension, the professional structure of the faculty was analyzed. The records were classified into ten contractual categories according to the official nomenclature of Spanish universities: Full Professors (FP), Associate Professors (AP), Senior Lecturers (SL), Permanent Lecturers (PL), Assistant Professors (AsP), Temporary SP, Adjunct Professors (AdjP), PhDC, Postdoctoral Researchers (Postdoc), and TF.

The results reveal a significant dependence on non-permanent profiles: Adjunct Professors (28.1%), Temporary Substitute Professors (14.3%), and Assistant Professors (13.2%). In

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Figure 2. Choropleth map of the territorial distribution of faculty members in the DAE area. Source: Authors' own work

contrast, the stable career positions (Associate Professors and Full Professors) account for only 17% of the total.

This imbalance exposes the structural fragility of the area, as the high proportion of temporary or part-time positions limits the consolidation of research lines, the acquisition of competitive funding, and the transfer of knowledge to university governance.

Finally, Table 1 summarizes the distribution of faculty by professional category and autonomous communities, offering a comprehensive overview that integrates both the territorial dimension and the contractual structure.

3.2 Thematic distribution and co-occurrence networks of scientific production according to the SDGs

This process associated 581 keywords with sustainability goals, revealing a strong presence of SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 9 (Industry, Innovation and

Table 1. Territorial distribution and professional structure of the Didactics of Visual Expression area in Spanish universities

	FP	AP	SL	PL	AsP	SP	AdjP	Postdoc	PhDC	TF	Sum
Andalusia	4	14	9	8	14	13	6	1	4	3	*76*
Aragon		13	2	2	3	2	3				*13*
Asturias		2	1		2	3					*9*
Balearic Islands				2	4						*7*
Basque country		1		4	1		7		7		*20*
Canary Islands		3	2		2	4	3				*17*
Cantabria			1		1				2		*4*
Castile and Leon	1	6	3	5	3	4	5		4		*31*
Castile-la Mancha				5	1	2					*8*
Catalonia		7	6		3	1	31		1		*51*
Extremadura		3			1	1	1		3		*8*
Galicia		5	5	1	4	1	6		1		*23*
La rioja					1		1				*2*
Madrid	1	8	7	2	7	7	10	3			*45*
Murcia		1	1	4	1		8				*14*
Navarre		1	3	1	2	3	2		3		*10*
Valencia	1	2		9	5	4	11				*32*
Sum	*7*	*56*	*42*	*34*	*49*	*53*	*104*	*4*	*18*	*3*	*370*

Source(s): Authors' own work

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Infrastructure), alongside the underrepresentation of topics connected to SDG 2, SDG 6, SDG 7, and SDGs 12–15. Such analysis established explicit connections between the area's research patterns and global sustainability frameworks, highlighting both its educational and social orientations as well as its thematic blind spots in environmental and governance domains.

Table 2 presents the distribution of keywords associated with the SDGs and their relative weight within the analyzed corpus. As expected, SDG 4: Quality Education dominates overwhelmingly (380 mentions; ∼65.4%; TLS = 224.0), reflecting the intrinsic orientation of the field toward pedagogical innovation and educational practice. It is followed by SDG 9: Industry, Innovation and Infrastructure (56; ∼9.6%), linked to educational technologies and design processes, and SDG 5: Gender Equality (49; ∼8.4%), which underscores the area's strong engagement with inclusion and equity. Intermediate levels correspond to SDG 8: Decent Work and Economic Growth (31; ∼5.3%), associated with creative employability and the cultural economy, and to SDGs 1, 10, and 11 (ranging from 3% to 4%), which connect with social inclusion, territorial identity, and heritage.

The analysis of keyword–SDG linkages reveals institutional patterns beyond journal classification. While SDG 4-related terms are widely shared, environmental and governance SDGs appear sporadically, suggesting that sustainability engagement depends more on localized institutional strategies than on publication outlets alone.

By contrast, environmental goals (SDGs 13–15) and those concerning basic services or institutional partnerships (SDGs 2, 3, 6, 7, 12, 17) show minimal representation, highlighting opportunities for thematic expansion into ecological and inter-institutional dimensions of sustainability.

The co-occurrence graph (Figure 3) deepens the understanding of the thematic configuration described in Table 2 by visually connecting the most recurrent keywords with the SDGs. The most central nodes, Teacher Training, Drawing, Contemporary Art, Gender Equality, Cultural Heritage, and DAE, form a dense, highly interconnected network that aligns primarily with SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 9 (Industry, Innovation and Infrastructure). This central cluster, structured around Teacher Training and Art Education, reveals the field's dominant pedagogical orientation and its commitment to

Table 2. Frequency (F) and Total Link Strength (TLS) of keywords associated with the Sustainable Development Goals (SDGs)

Keyword	F	TLS
SDG1: No Poverty	23	16.0
SDG2: Zero Hunger	0	0
SDG3: Good Health And Well-Being	0	0
SDG4: Quality Education	380	224.0
SDG5: Gender Equality	49	38.0
SDG6: Clean Water And Sanitation	0	0
SDG7: Affordable And Clean Energy	0	0
SDG8: Decent Work And Economic Growth	31	22.7
SDG9: Industry, Innovation And Infrastructure	56	35.7
SDG10: Reduced Inequalities	22	24.0
SDG11: Sustainable Cities And Communities	18	15.7
SDG12: Responsible Consumption And Production	0	0
SDG13: Climate Action	1	1
SDG14: Life Below Water	0	0
SDG15: Life On Land	0	0
SDG16: Peace, Justice And Strong Institutions	1	1
SDG17: Partnerships For The Goals	0	0

Source(s): Authors' own work

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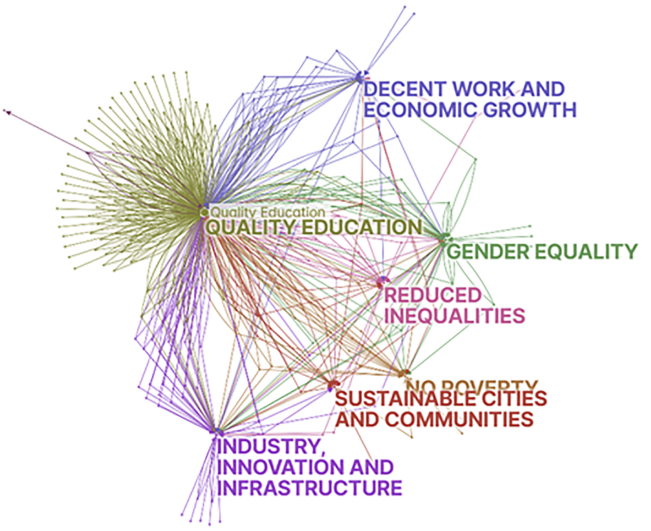

Figure 3. Co-occurrence network of keywords associated with the SDGs. Source: Authors' own work

innovation and inclusive learning, confirming the quantitative predominance of SDG 4 in the corpus.

3.3 Institutional distribution of SDG-linked production

Table 3 displays the 10 Spanish universities with the highest volume of production associated with the SDGs, based on aggregated keyword data. The overall pattern reaffirms the dominance of SDG 4: Quality Education, which concentrates most mentions across institutions, though with notable variations that reveal distinct thematic orientations.

The University of Granada (UGR), leads with 50 mentions, emphasizing SDG 4 (29) and SDG 9 (11), indicating a dual focus on educational quality and technological innovation. The Complutense University of Madrid (UCM) with 40 mentions ranks second, with a distinctive emphasis on SDG 5: Gender Equality (10) alongside teaching-related goals. The Autonomous

Table 3. Top ten Spanish universities by volume of sustainability-related research output in Art Education Didactics

Univ/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
UGR	1	0	0	29	3	0	0	2	11	2	2	0	0	0	0	0	0
UCM	7	0	0	18	10	0	0	0	5	0	0	0	0	0	0	0	0
UAM	3	0	0	25	2	0	0	2	5	1	0	0	0	0	0	0	0
UMA	0	0	0	17	2	0	0	3	1	2	2	0	0	0	0	0	0
UM	1	0	0	19	1	0	0	2	1	1	0	0	1	0	0	1	0
UPV/EHU	1	0	0	16	3	0	0	4	2	0	1	0	0	0	0	0	0
UVA	1	0	0	20	0	0	0	0	0	2	3	0	0	0	0	0	0
UJA	1	0	0	11	1	0	0	2	4	2	1	0	0	0	0	0	0
UV	0	0	0	15	2	0	0	1	2	1	1	0	0	0	0	0	0
UEx	1	0	0	13	0	0	0	1	3	0	2	0	0	0	0	0	0
Sum	*16*	*0*	*0*	*183*	*24*	*0*	*0*	*17*	*34*	*11*	*12*	*0*	*1*	*0*	*0*	*1*	*0*

Source(s): Authors' own work

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University of Madrid (UAM) with 38 mentions, reinforces SDG 4 (25) while diversifying toward SDG 9 (5) and SDG 8 (2), defining an education–innovation–employment profile.

A second group, with 26–27 mentions, includes the Universities of Malaga (UMA), University of Murcia (UM), University of País Vasco / Euskal Herriko Unibertsitatea (UPV/EHU), and University of Valladolid (UVA). This group also centers on SDG 4 but shows unique contributions: UMA connects education with SDG 8 and SDG 11 (Sustainable Cities); UM is exceptional for incorporating SDG 13 (Climate Action) and SDG 16 (Strong Institutions); UPV strengthens SDG 8 and SDG 11, reflecting a focus on employability and territorial inclusion; while UVA emphasizes SDG 4 (20) and SDG 11 (3), positioning itself within an education–heritage nexus.

Finally, Universities of Jaen (UJA), Valencia (UV), and UEx with 20–22 mentions, maintain SDG4 as their core axis but diverge in secondary emphases: UJA aligns with SDG 9 and SDG 8; UV extends to SDG 9, SDG 10, and SDG 11; and UEx presents a balanced integration of SDG 9 (3) and SDG 11 (2).

In synthesis, while Quality Education (SDG 4) acts as the unifying backbone across institutions, specific specializations differentiate their sustainability approaches. This comparative overview reveals that sustainability within the field is heterogeneously distributed, reflecting institutional strengths and thematic emphases rather than a uniform research model.

3.4 Distribution of SDGs by professional category

Table 4 summarizes the distribution of SDGs according to the professional categories of faculty in DAE. As in the institutional analysis, SDG 4: Quality Education predominates across all contractual groups, though its relative weight and associated SDGs vary according to career stage and employment stability.

Full Professors concentrate on SDG 4 (14) with moderate diversification toward SDG 5 (4) and occasional links to SDG 9 and SDG 11, reflecting an orientation toward educational excellence and cultural or territorial awareness.

Associate Professors show the highest production volume (SDG 4 = 103) and lead in SDG 9 (19) and SDG 5 (11), consolidating their central role in pedagogical and technological innovation.

Among the stable but non-tenured positions, Senior Lecturers and Permanent Lecturers emphasize SDG 4 (70; 51) while maintaining consistent contributions to SDG 9 (8 each) and

Table 4. Distribution of SDG-related scientific output by academic rank in the field of Art Education Didactics

SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FP	1	0	0	14	4	0	0	0	1	0	1	0	0	0	0	0	0
AP	8	0	0	103	11	0	0	5	19	7	2	0	0	0	0	0	0
PL	1	0	0	51	8	0	0	3	8	3	3	0	0	0	0	0	0
SL	2	0	0	70	2	0	0	2	8	3	1	0	0	0	0	0	0
AsP	4	0	0	32	6	0	0	3	6	3	3	0	0	0	0	0	0
AdjP	2	0	0	39	1	0	0	13	2	2	2	0	1	0	0	1	0
SP	2	0	0	32	8	0	0	2	9	2	1	0	0	0	0	0	0
Postdoc	2	0	0	5	3	0	0	0	1	0	1	0	0	0	0	0	0
PhDC	1	0	0	17	4	0	0	3	1	1	3	0	0	0	0	0	0
TF	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
Sum	*23*	*0*	*0*	*367*	*48*	*0*	*0*	*31*	*55*	*21*	*17*	*0*	*1*	*0*	*0*	*1*	*0*

Note(s): Full Professors (FP), Associate Professors (AP), Senior Lecturers (SL), Permanent Lecturers (PL), Assistant Professors (AsP), Temporary Substitute Professors (SP), Adjunct Professors (AdjP), Doctoral Researcher (PhDC), Postdoctoral Researchers (Postdoc), and Teaching Fellow/Instructor (TF)

Source(s): Authors' own work

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SDG 5, forming a consolidated nucleus oriented toward applied innovation and gender equality.

By contrast, early-career and temporary positions reveal more diversified patterns. Assistant Professors combine SDG 4 (32) with active engagement in SDG 5 (6), SDG 9 (6), and SDG 10 (3), integrating inclusion and social innovation. Temporary Substitute Professors display similar emphases (SDG 4 = 32, SDG 5 = 8, SDG 9 = 9), reinforcing a gender–innovation profile. Doctoral and Postdoctoral Researchers extend their focus toward SDG 8 (3) and SDG 11 (3), signaling openness to employability and territorial development, while maintaining the education–equity nexus characteristic of the field.

Finally, Adjunct Professors, the most numerous group, accumulate 39 mentions in SDG 4 and the highest relative contribution to SDG 8 (13), linking university teaching to creative employment and the cultural economy.

Overall, the analysis confirms SDG 4 as the structural axis of the field, with thematic variations shaped by professional hierarchy:

(1) Tenured positions: prioritize educational quality, expanding toward gender equality and innovation.

(2) Stable non-tenured positions: emphasize applied innovation and gender perspectives.

(3) Temporary and early-career: display broader transversality toward inclusion and equity.

(4) Adjunct positions: highlight the education–employment connection through SDG 8.

This configuration suggests that career consolidation fosters specialization in teaching and innovation, whereas emerging profiles contribute greater diversity and social sensitivity, expanding the area's engagement with the broader sustainability agenda.

3.5 Keyword Co-occurrence and thematic constellations

The co-occurrence map of sustainability-related keywords (Figure 4) reveals a dense core centered on art education (98 occurrences; TLS = 93) and didactics (65; TLS = 55), closely linked to teacher training (42; TLS = 41) and creativity (43; TLS = 43). Alongside this educational nucleus, two additional clusters emerge: a heritage axis, incorporating museums (29; TLS = 16), cultural heritage (17; TLS = 6), and museum education; and an equity axis, grouping gender (22; TLS = 15), feminism, gender-based violence (5), and social inclusion (21; TLS = 15).

These associations delineate three thematic constellations:

(1) Teaching and teacher education (didactics–training–creativity–innovation),

(2) Heritage and museum mediation, and

(3) Equity, gender, and inclusion.

Together, they indicate that the sustainability discourse within the area integrates educational quality and innovation with social justice and cultural management.

Peripheral clusters reflect more specific articulations of sustainability: the Drawing– DAE axis relates to SDG 4 through creative and methodological innovation in visual learning; the Gender Equality–Body and Representation block links explicitly to SDG 5, addressing social justice and equality through art education; and the Cultural Heritage–Contemporary Art cluster connects to SDG 11 (Sustainable Cities and Communities) by integrating heritage preservation and cultural regeneration.

After normalization and lemmatization (Table 5), dispersion decreases and semantic concentration increases. Art education (170 occurrences; TLS = 83.0) consolidates its structural centrality, while didactics (51; TLS = 25.0) maintains prominence. The equity

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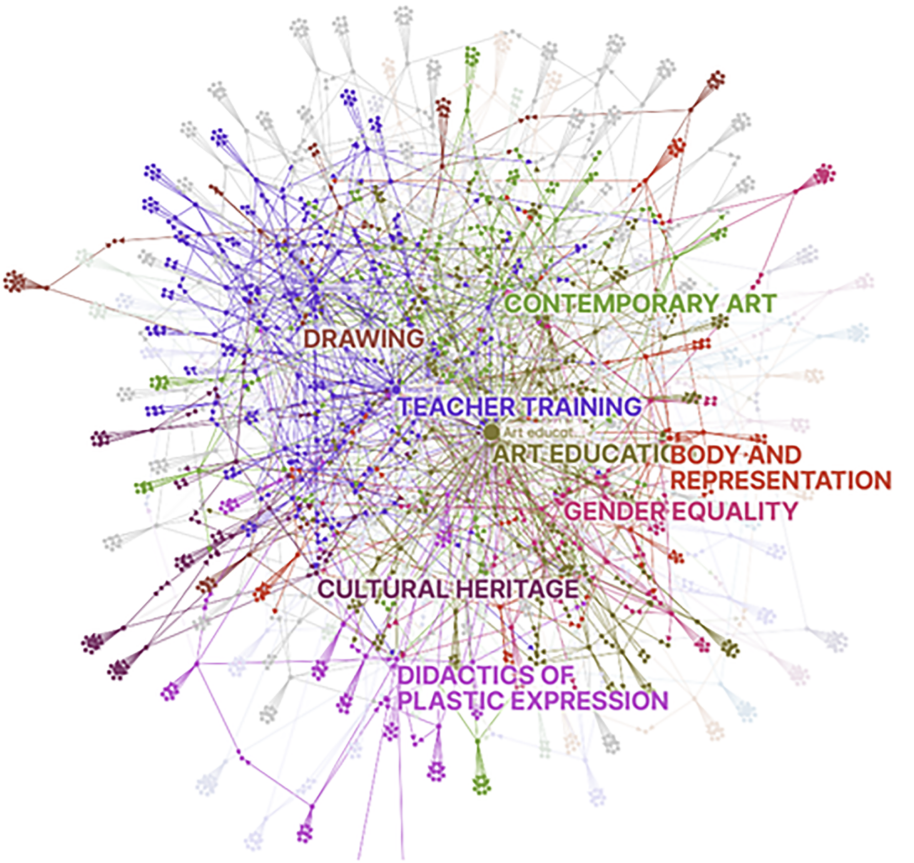

Figure 4. Network map of interconnections among SDGs in the field's scientific production. Source: Authors' own work

cluster becomes more cohesive, with gender equality (22; TLS = 25.0) emerging as the canonical term, absorbing feminism and gender-based violence, and inclusion (18; TLS = 25.0) serving as a transversal bridge between educational and social domains. Meanwhile, the heritage axis, though less frequent, retains relevance through museums (13) and cultural heritage (17).

The relatively high link strength of gender equality and inclusion despite their lower frequency highlights their bridging function across subareas (teaching ↔ museums ↔ community), evidencing genuine transversality within the research landscape.

Overall, the field's conceptual architecture centers on educational quality, teacher training, and innovation, complemented by distinct yet interconnected domains of heritage mediation and equity, which collectively frame the contribution of artistic education to sustainability.

3.6 Publication and impact patterns

The sample includes works published between 2016 and 2025 (Table 6), with a clear expansion from 2020 onward and consistent continuity through 2023–2025. Citation impact is concentrated in a small group of Q1 international journals, particularly Sustainability

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Table 5. Normalized frequency and co-occurrence strength of sustainability-related keywords

Keyword	F	TLS
Art education	170	83.0
Didactics	51	25.0
Didactics of visual expression	23	9
Gender equality	22	25.0
Teacher training	22	16.5
Creativity	22	12.0
Social inclusion	21	18.0
Inclusion	18	25.0
Cultural heritage	17	6
Teacher education	13	12.0
Museums	13	4
Teaching innovation	13	2
Art didactics	11	2
Educational innovation	9	1
Arts-based research	9	1
Artistic research	6	1
Educational research	6	1
Gender	6	1
Gender-based violence	5	1
Innovation	5	1

Source(s): Authors' own work

(Abad-Segura *et al*., 2020a,b,c: 339 Scopus; 217 WoS; 719 Google Scholar, 2020:89/55/136) and the Journal of Cleaner Production (Abad-Segura and González-Zamar, 2021: 157/98/267). Additional Q1 contributions stand out in Education Sciences (Soto-Solier *et al*., 2023: 5/4/7) and Environmental Sciences Europe (Uribe-Toril *et al*., 2022: 14/12/33), consolidating the international projection of the field.

In contrast, Spanish-language journals in arts and education, *Arte, Individuo y Sociedad*, Educación Artística Revista de Investigación (Art Education Research Journal, *EARI)*, *AusArt, Tercio Creciente, Estudios Pedagógicos*,show moderate or low visibility in Scopus/WoS but achieve higher citation rates in Google Scholar, consistent with their regional reach and open-access diffusion.

Across outlets and quartiles, three publication profiles coexist:

(1) International Q1 journals in environmental science and education, predominantly open access and highly cited, serving as vehicles for research on circular economy, sustainable digital transformation, and university sustainability governance.

(2) Q2–Q3 disciplinary journals in arts and education (EARI, AusArt), oriented toward eco-art, art didactics, gender equality, and heritage mediation, combining moderate bibliometric visibility with strong disciplinary relevance.

(3) Book chapters and conference proceedings (Dykinson, Peter Lang, Asociación Española de Psicología Conductual (Spanish Association of Behavioral Psychology, AEPC)/Asociación Nacional de Investigadores en Artes Visuales (National Association of Visual Arts Researchers, ANIAV) / University of La Rioja (UR) congresses), valued for training and knowledge transfer despite their lower formal impact.

Thematically, the most cited works align with SDG 4 (Quality Education) and SDGs 9 and 8 (Innovation, Decent Work), addressing circular economy, digital transformation, and higher education learning. Research on heritage, museums, gender equality, and eco-art (SDGs 5 and 11) deepens the cultural and social dimensions of sustainability, reinforcing the area's educational orientation.

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Table 6. Most influential publications on sustainability: citation metrics and dissemination channels

Author	Year	Citations			Source	Journal Citation Reports (JCR), SCImago Journal Rank (SJR) quartile	Journal Impact Factor (JIF)/ SJR	Category	University
		Scopus	WoS	Google Scholar (GS)					
Abad-Segura *et al*.	2020b	339	217	719	*Sustainability*	Q1/Q1	3.3/ 0.688	Environmental Science	UAL
Abad-Segura and González-Zamar	2021	157	98	267	*Journal of Cleaner Production*	Q1/Q1	10/ 2.174	Environmental Science	UAL
Abad-Segura *et al*.	2020a	20140	130	202	*Sustainability*	Q1/Q1	3.3/ 0.688	Environmental Science	UAL
Abad-Segura *et al*.	2020c	89	55	136	*Sustainability*	Q1/Q1	3.3/ 0.688	Environmental Science	UAL
Ibañez-Etxeberría *et al*.	2019	25	16	53	*Revista Electrónica Interuniversitaria de Formación del Profesorado (Interuniversity Electronic Journal of Teacher Training, REIFOP*	Q3/Q1	1.1/ 0.648	Education	UPV/ EHU + UVA
Gillate *et al*.	2017	17	–	47	*Estudios Pedagógicos (Valdivia)*	–/Q3	–/0.228	Education	UPV/ EHU + UVA
Uribe-Toril *et al*.	2022	14	12	33	*Environmental Sciences Europe*	Q1/Q1	6/1,561	Environmental Science	UAL
Antonio Parrilla-González and Ortega-Alonso	2022	14	–	13	*New Medit*	Q3/Q2	1.4/ 0.349	Agriculture, Multidisciplinary	UJA
Gómez-Redondo	2017	–	–	12	*Museus e estudos interdisciplinares (Museums and Interdisciplinary Studies Journal, MIDAS)*	–	–	–	UVA
Soto-Solier *et al*.	2023	5	4	7	*Education Sciences*	Q1/Q1	2.6/0.73	Education	UGR

Note(s): Google Scholar (GS), Journal Citation Reports (JCR), Journal Impact Factor (JIF), Museus e estudos interdisciplinares (museums and interdisciplinary studies journal, MIDAS), Revista Electrónica Interuniversitaria de Formación del Profesorado (Interuniversity Electronic Journal of Teacher Training, REIFOP), SCImago Journal Rank (SJR), University of Almeria (UAL), University of the Basque Country (UPV/EHU); University of Jaen (UJA); University of Granada (UGR), University of Valladolid (UVA)

Source(s): Authors' own work

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4. Discussion

The results enable an interpretative understanding of how the DAE area contributes structurally to sustainability transitions in higher education.

Its broad institutional presence across more than thirty-five universities evidences the field's consolidation, though the concentration in metropolitan regions contrasts with its emerging presence in peripheral provinces. This spatial dynamic illustrates both the enduring influence of established institutions and the field's capacity to foster more inclusive, decentralized knowledge networks.

Nevertheless, the professional structure reveals persistent challenges. The prevalence of non-permanent positions, particularly Adjuncts, Interim Substitutes, and Assistant Professors, limits long-term research continuity, access to competitive funding, and participation in university governance. This aligns with Dzimińska *et al*. (2020) and Halmaghi *et al*. (2023), who argue that coherent and stable employment frameworks are essential for embedding sustainability within higher education. In this context, academic precariousness undermines the field's potential to act as a transformative force.

Viewed through the Whole Institution Approach, the results show that sustainability engagement in the DAE area focuses mainly on education, equity, and innovation, whereas environmental and governance dimensions remain weakly embedded at the institutional level.

From a systemic perspective, the results show that sustainability-oriented research is shaped by institutional capacity and regional academic ecosystems. Its concentration in consolidated universities highlights structural asymmetries that constrain the diffusion of sustainability-driven innovation across higher education.

Under this prism, and taking into account the urgency of global challenges for an education oriented to sustainable development (Ge *et al*., 2023) the dominance of SDG 4 (Quality Education) confirms the area's coherence, centered on pedagogical innovation, teacher training, and cultural mediation. The significant presence of SDG 5 (Gender Equality) and SDG 9 (Industry, Innovation, and Infrastructure) highlights its integrative focus on equity and technological creativity. In contrast, the scarce engagement with environmental SDGs, also noted by Žalėnienė and Pereira (2021) for the humanities and arts, marks both a limitation and a strategic opportunity. Expanding research toward eco-materiality, visual eco-literacy, and collaborative projects with local actors would enhance its contribution to the 2030 Agenda.

Institutional comparisons further reveal differentiated specialization profiles: some universities emphasize gender and equity (UCM, University of the Basque Country), others focus on innovation (UGR, UAM), heritage and territory (Universities of Valladolid and UEx), or environmental and governance dimensions (University of Murcia). This heterogeneity reflects how local histories and strategic orientations shape sustainability engagement across institutions.

Publication patterns reinforce a dual dissemination model: international Q1 journals provide visibility and integration into global sustainability debates, while Spanish-language outlets strengthen disciplinary identity and community impact. This balance supports Bien and Sassen's (2020) argument that university sustainability thrives through the synergy between global excellence and contextual engagement.

SDG 4's prominence confirms educational alignment but reveals a narrow sustainability focus. Limited environmental and governance integration suggests room for interdisciplinary growth through eco-art, environmental visual literacy, and place-based artistic inquiry, enhancing contributions to broader sustainability transitions.

Differences among professional categories reflect structural factors rather than personal sustainability commitments. Secure academic positions enable higher research output through time, funding, and leadership access, while early-career and temporary roles show broader themes but less visibility, revealing institutional dynamics at play.

Besides the dominance of SDG 4 reflects a structural trait of DAE. Rooted in teacher education and pedagogical innovation, the field integrates sustainability mainly through

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educational practice, with education acting as the enabling axis for wider sustainability transitions rather than one goal among many.

In sum, the DAE area acts as a connector discipline in the sustainability transition, linking education, culture, and innovation, yet its transformative capacity remains constrained by employment instability, limited environmental engagement, and the need for stronger interinstitutional collaboration. Addressing these structural and thematic challenges will be crucial for the field to fully realize its potential as a driver of systemic change in higher education.

Regarding the research questions, the findings clearly support that scientific output in DAE aligns strongly with the SDGs, dominated by SDG 4 across contexts. This educational core is reinforced by SDG 5 and SDG 9, while environmental SDGs remain marginal, partially confirming on uneven thematic distribution.

5. Conclusions

This study shows that DAE plays a structurally significant, though unevenly developed, role in sustainability-oriented research within Spanish higher education. The findings demonstrate that this field constitutes a key instrument in the transition toward more equitable and sustainable societies, particularly through its contributions to Quality Education, Gender Equality, Innovation, and Cultural Heritage Preservation.

The area exhibits a wide institutional presence and plays a pivotal role in teacher education and cultural mediation, yet its activity remains concentrated in major urban centers, limiting visibility and development in peripheral regions. The heterogeneity observed among universities reveals distinct institutional pathways toward the 2030 Agenda, underscoring the need to strengthen inter-university collaboration through networks that promote shared learning and complementary expertise.

A central structural challenge lies in the high proportion of temporary academic positions, which constrains research continuity and weakens the field's influence on institutional policies. Enhancing employment stability is therefore essential to ensure sustained impact and strategic alignment with sustainability goals.

Thematically, the field's strong association with SDG 4 (Quality Education) confirms its contribution to pedagogical innovation, while engagement with SDG 5 (Gender Equality) and SDG 9 (Industry, Innovation, and Infrastructure) highlights its integration of equity and technological advancement. Conversely, the limited connection with environmental SDGs (12–15) signals a strategic gap that could be addressed through the inclusion of eco-material practices, eco-art projects, and visual eco-literacy training, fostering a more balanced and ecological perspective.

The dual publication strategy identified, combining international Q1 journals with national arts and education outlets, proves effective in merging global visibility with disciplinary identity and social impact. Expanding open access and adopting open science practices (repositories, preprints, and datasets) would further enhance dissemination and usability of research outputs.

The DAE area possesses significant potential as a catalyst for sustainability, innovation, and social engagement in higher education. Realizing this potential requires addressing structural precarity, integrating environmental perspectives, and strengthening interinstitutional cooperation to consolidate the field's role as a driver of transformative change in higher education and society.

Beyond description, this research delivers actionable insights for governance and research policy. By revealing dominant orientations and structural gaps, it can guide funding strategies, faculty stabilization, and interdisciplinary initiatives. It also offers a transferable method to assess sustainability alignment across disciplines. Strengthening environmental and governance dimensions is crucial for positioning artistic education research as a driver of systemic change in higher education.

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Overall, the findings meet the study's expectations. Research in DAE within Spanish higher education is firmly rooted in education- and equity-oriented sustainability agendas, notably SDG 4 and SDG 5, while environmental and governance goals remain marginal.

These findings can directly shape institutional decision-making in higher education by underpinning evidence-based research policies, guiding strategic funding priorities, and fostering the integration of sustainability criteria into academic governance and curriculum design.

From a practical standpoint, enhancing sustainability-oriented research in artistic education demands institutional strategies beyond individual efforts. Career stabilization, inter-university collaboration, and interdisciplinary support could mitigate territorial imbalances and strengthen underrepresented environmental and governance SDGs. Future comparative and longitudinal studies may clarify how institutional structures influence sustainability orientations.

Ethics approval (if applicable)

Not applicable. The study did not involve human participants, personal data, or ethical procedures requiring institutional review.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Aggregated and anonymized bibliometric data can be accessed through public repositories (Scopus, WoS, Dialnet, and Google Scholar).

AI use note

Portions of this manuscript were linguistically refined using GPT-5 under the authors' supervision, exclusively for copy-editing and language clarity purposes. No content was generated beyond the authors' original intellectual contribution.

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