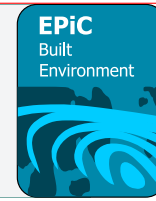




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Mapping ASC Annual Conference Publications (2007-2025): A Descriptive Bibliometric Study

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The Associated Schools of Construction (ASC) Annual International Conference is a primary venue for advancing construction-focused scholarships. This study updates and extends prior analyses with a descriptive bibliometric assessment of 1,502 ASC papers published from 2007 to 2025. We manually standardized metadata (authors, affiliations, keywords) and analyzed them with Biblioshiny and VOSviewer to examine three dimensions of ASC scholarship: authorship, institutional participation, and thematic trends. Findings show steady growth in annual output with a post-pandemic rebound to record levels; a distributed co-authorship network anchored by recurring contributors across leading programs; and institutional participation that includes both enduring and newly active universities. Keyword mapping highlights persistent themes, construction education, BIM, safety, sustainability, alongside recent emphasis on digitalization, immersive learning, and AI-integrated pedagogy. The study provides an updated longitudinal baseline that programs can be used to benchmark productivity, strengthen collaboration, and track evolving priorities in construction education.

Keywords: Bibliometric analysis, Research trends, Co-authorship networks, Institutional collaboration, Construction education

Introduction

The Associated Schools of Construction (ASC) Annual International Conference is one of the field's longest-running venues for sharing research and teaching innovations in construction education. As a central forum, the conference connects educators and practitioners to test ideas, compare pedagogical approaches, and refine the competencies expected of future construction professionals (Farnsworth et al., 2020). Over the years, the proceedings have captured classroom interventions, assessment results, technology pilots, and program reforms, offering a practical, longitudinal record of how construction education responds to industry needs (Mayouf et al., 2023). Analyzing ASC proceedings across many years reveals how the discipline evolves. Conference papers often appear earlier than journal publications, introducing emerging pedagogical and technological ideas (Qiu et al., 2023). The proceedings emphasize education-focused research, curriculum design, experiential learning, and program assessment (Aliu & Aigbavboa, 2023). Their structured metadata makes ASC a practical resource for reproducible bibliometric analysis of authorship, institutional, and thematic patterns (Zheng et al., 2019).

Against this backdrop, the present study examines nearly two decades of ASC conference papers (2007–2025) to address three questions central to understanding construction-focused scholarship:

- **Authorship patterns:** Who is doing the work? We identify prolific contributors and visualize how researchers' team, mentor, and connect across institutions.
- **Institutional productivity:** Where is the work being done? We highlight the most active universities and summarize inter-institutional collaboration.
- **Thematic trends:** What fields are discussed, and how are they changing? Using standardized author keywords, we chart topic trajectories (e.g., BIM, construction safety, sustainability, experiential learning, and accreditation) and visualize their co-occurrence over time.

This paper provides a descriptive and visual baseline of ASC publications from 2007 to 2025 that programs can use to benchmark research activity, locate collaborators, and contextualize new work. ASC's education-centered mission and broad program representation yield clearer insight than large-scale databases, illustrating how accredited programs collectively drive pedagogical and technological innovation. The study documents productivity trends, identifies prolific authors and institutions, and maps the evolving thematic focus of ASC scholarship.

Literature Review

Within ASC, bibliometric and related work traces steady growth, identifiable author/institution hubs, and recurring teams. Williamson and Burt et al. (2006) first treated ASC proceedings output as one criterion for evaluating construction programs, underscoring the proceedings as a measurable record of scholarly engagement. Farnsworth et al. (2020) then mapped 2004–2019, showing rising participation and collaboration hubs and advocating routine, data-driven tracking. Farrow and Wentz et al. (2022) captured COVID-19's disruption and the pivot to remote/hybrid pedagogy, contextualizing the post-2020 dip and rebound. Mayouf et al. (2023) offered a complementary thematic review, with clusters around curriculum, learning outcomes, safety, and technology integration, arguing that visual summaries should inform curricula and conference agendas.

Beyond ASC, journal-side syntheses and broader field reviews echo similar trajectories. Collins et al., (2024) synthesized IJ CER publications, noting maturing collaboration (larger, multi-institution teams), a persistent education core (assessment, experiential learning, safety), and rising technology themes (BIM, VR/AR, data-centric tools), alongside practical metadata cleaning steps aligned with ours. Broader field reviews echo these trajectories: Zheng, Le, and Chan et al. (2019) traced 1982–2017 emphases on experiential learning, curriculum/assessment, safety, and early BIM integration; From adjacent education outlets, Qiu et al., (2023) showed over 50 years of JEE a shift toward larger, more cross-institutional teams; themes moving from foundational pedagogy to design, teamwork, and diversity/inclusion; and methods diversifying toward mixed and qualitative designs.

Building on this foundation, the present study integrates three lenses in a single, venue-specific map through 2025, authorship networks, year-by-year institutional participation, and standardized keyword trajectories, thereby extending prior ASC snapshots (Farnsworth et al., 2020; Mayouf et al., 2023). In contrast to ranking-oriented uses of proceedings (Williamson & Burt, 2006), we emphasize reproducible science-mapping: harmonizing author and affiliation variants, applying a controlled keyword vocabulary, and reporting thresholds/parameters. This design also explicitly spans the pandemic period, enabling interpretation of the 2020 dip and subsequent rebound (Farrow & Wentz, 2022) within longer-run patterns. Collectively, the review motivates a consolidated, longitudinal baseline against which future ASC trends can be compared (Collins et al., 2024; Zheng et al., 2019; Qiu et al., 2023).

Methodology

Data source and scope

We employed a descriptive bibliometric design, using full counting and association-strength normalization to map co-authorship, institutional collaboration, and keyword co-occurrence. The overall research methodology and workflow, from data collection and standardization to analysis and visualization, is shown in Figure 1. To summarize, the authors analyzed 1,502 papers from the ASC Annual International Conference, published between 2007 and 2025. All documents were downloaded from the ASC proceedings archive, imported into Zotero for metadata management, and exported to Excel for cleaning and preparation. Inconsistent or missing fields, particularly in earlier years, were manually corrected to ensure accurate metadata across the standardized fields of Title, Authors, Affiliations, Abstract, Keywords, and Year. All datasets, synonym lists, and exported CSVs were version-controlled to maintain transparency and reproducibility. The authors performed extensive data normalization, as summarized in Table 1, to ensure consistency and accuracy.

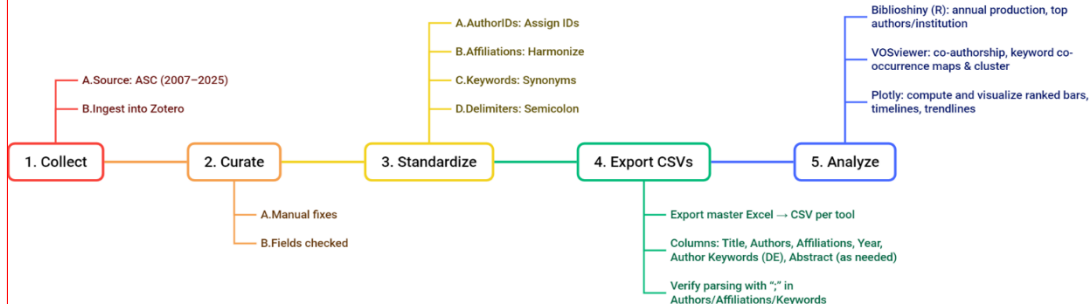


Figure 1. End-to-end workflow from data collection to analysis.

Table 1. Summary of data-cleaning and standardization rules.

Aspect	Goal	Rule / Action Applied	Example / Note
Author names	Ensure consistent identification of contributors.	Standardized capitalization, initials, punctuation; merged name variants; assigned internal author IDs	“Smith J.” → “Smith, John”; “Farrow B.” + “Ben Farrow” merged
Affiliations	Normalize institutional names for collaboration analysis	Unified abbreviations (“Univ.” → “University”); removed state/country suffixes; replaced “/” with “;” delimiters	“Univ. of Florida / Gainesville, USA” → “University of Florida”
Keywords	Consolidate related terms and remove noise	Applied synonym-mapping and stop-word lists; standardized separators	“Building Information Modeling” + “BIM” → “BIM”; removed “study,” “paper,” etc.
Quality check	Validate dataset integrity	Checked duplicates (Title + Year + Author); spot-checked records in Biblioshiny/VOSviewer	Confirmed correct parsing of authors and affiliations

Tools and Analysis Settings

Descriptive and network analyses were conducted using Biblioshiny (RStudio) and VOSviewer. Full-counting methods were applied, along with association-strength normalization, to identify co-authorship, institutional, and keyword relationships. Thresholds were set at a minimum of two papers per author, three per institution, and five keyword occurrences to ensure clarity while retaining representativeness. Analyses were designed to address three guiding questions:

1. Who contributes to ASC research, and how do co-authorship patterns form?
2. Where are the main institutional and collaborative hubs?
3. What thematic trends characterize ASC scholarship over time?

Findings

Publication Output Over Time (2007–2025)

The ASC Annual International Conference demonstrates a consistent upward trajectory in research output over the study period. Figure 2 presents annual publication counts (orange bars), cumulative totals (blue bars), and a fitted linear trendline for annual output (dotted line). The results reveal moderate year-to-year variation, accompanied by a clear long-term upward trend. Early years averaged around 70–80 papers, followed by a pandemic-related dip in 2020 (57 papers) and a strong recovery, culminating in a record 106 papers in 2024. The cumulative progression surpassed 1,500 papers by 2025, illustrating sustained community engagement and expanding scholarly capacity. The fitted linear indicates a steady increase of roughly one additional paper per year, confirming continued momentum in ASC research activity.

Overall, this trendline and cumulative trajectory highlight ASC's enduring role as the primary platform for disseminating construction-education scholarship, resilient through disruption and responsive to evolving educational and technological priorities.

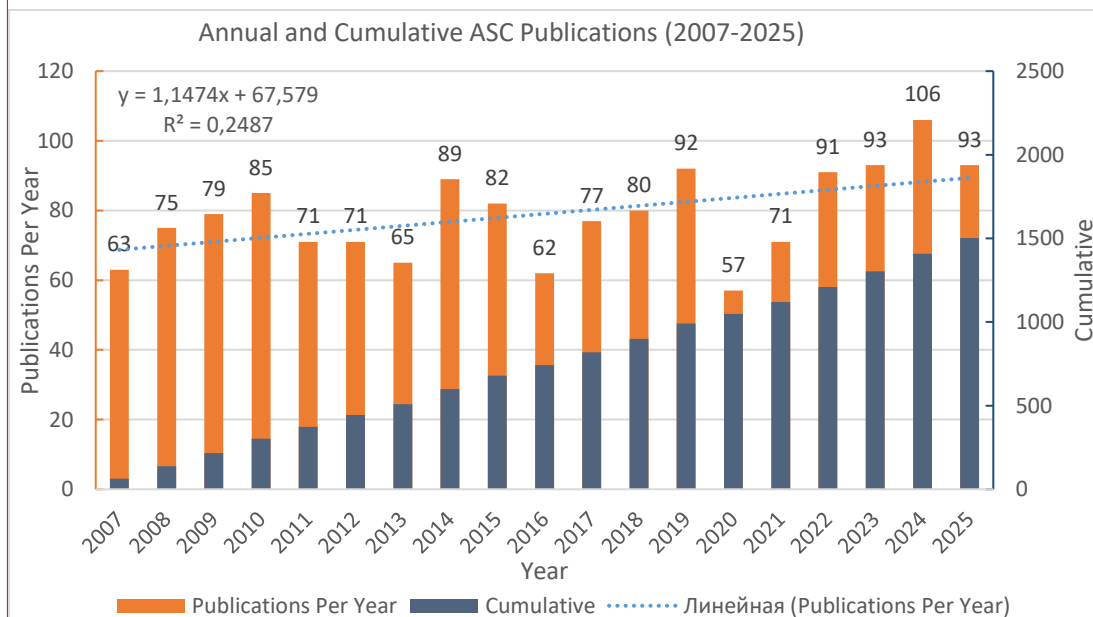


Figure 2. Annual and cumulative ASC publications, 2007–2025, with fitted linear trendline

Authorship patterns

Figure 3 visualizes the co-authorship network of the ASC Annual International Conference papers between 2007 and 2025, where each node represents an author and each link represents at least one shared paper. Node size corresponds to total publication output, and node color indicates the author's primary collaboration cluster. The visualization reveals a multi-cluster structure anchored by several highly productive scholars who serve as focal points for collaboration. Prominent clusters can be observed around Kenneth Sullivan, Jake Smithwick, and Brian Lines (orange cluster), Somik Ghosh and Mark Shaurette (red cluster), Sandeep Langar, Tulio Sulbaran, and Sanjeev Adhikari (blue cluster), Ben Farrow and Mark Tatum (green cluster), Salman Azhar (purple cluster), and Masoud Gheisari (brown cluster). These authors serve as key connectors, coordinating multi-institutional research and often co-authoring with early-career faculty and doctoral students, which indicates mentoring dynamics within the ASC community.

A single central node does not dominate the network; instead, it reveals several moderately sized hubs connected by bridging ties, suggesting a distributed leadership and cross-institutional teaming approach. Thin linking edges between illustrate overlapping partnerships and thematic overlaps across institutions. This structure is characteristic of a mature and collaborative research community, where multiple centers of expertise coexist rather than a single dominant group. Overall, the figure demonstrates that ASC research is sustained by a distributed, multi-institutional network of scholars whose repeated partnerships strengthen knowledge transfer, mentorship, and continuity across nearly two decades of conference activity.

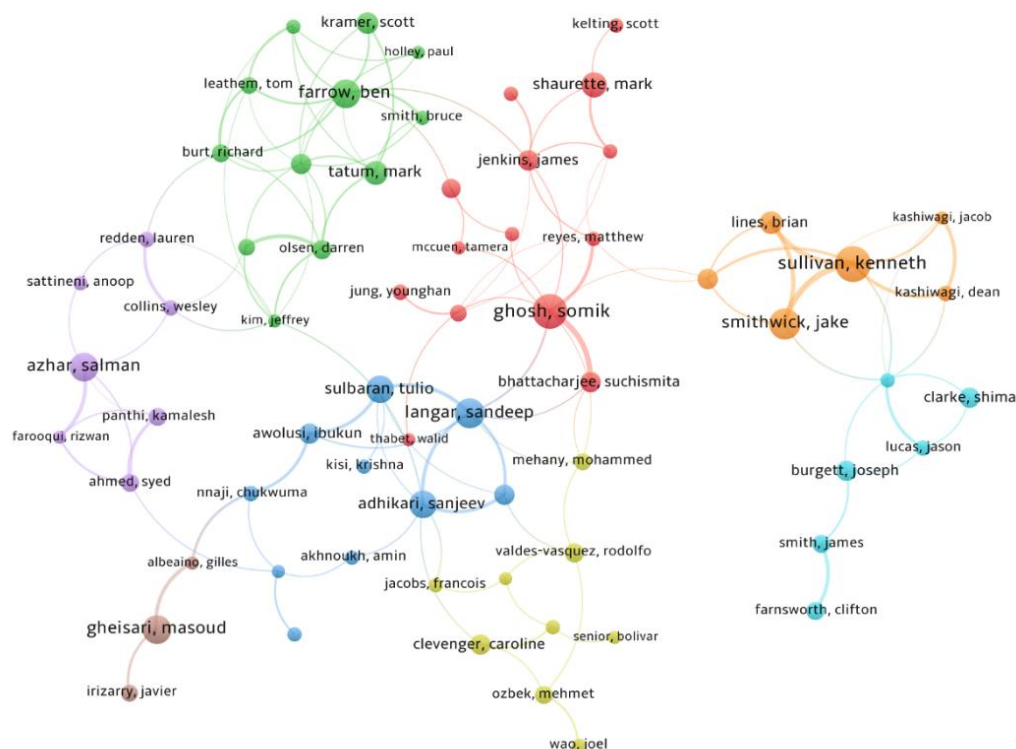


Figure 3. Author co-authorship network

Complementing the co-authorship network, Table 2 ranks the most active contributors across three dimensions: first authorship, first- or second-authorship, and overall publication output. Ben Farrow leads as the top first author (17 papers), followed closely by Somik Ghosh, Gustavo Maldonado, Mark Tatum, and Salman Azhar, indicating consistent leadership in initiating ASC research. When first and second positions are combined, Somik Ghosh and Ben Farrow again emerge as central figures, each exceeding twenty publications, with Mark Shaurette, Salman Azhar, and Tulio Sulbaran forming a strong secondary tier.

The overall ranking reinforces this pattern: Kenneth Sullivan (31 papers) and Somik Ghosh (30 papers) stand out as the most prolific contributors, followed by Jake Smithwick, Sandeep Langar, Ben Farrow, and Masoud Gheisari. These results show that ASC scholarship is driven by a stable, interconnected group of researchers who combine leadership and collaboration across institutions. Their recurring presence across multiple authorship categories reflects a mature and cooperative community that sustains long-term scholarly engagement within construction education.

Table 2. Authorship ranks by role and total output (2007–2025)

<u>Top First Authors</u>		<u>Top First or Second Author</u>		<u>Top Overall Authors</u>	
Name	n.	Name	n.	Name	n.
Ben Farrow	17	Somik Ghosh	29	Kenneth Sullivan	31
Somik Ghosh	14	Ben Farrow	22	Somik Ghosh	30
Gustavo Maldonado	11	Mark Shaurette	17	Jake Smithwick	26
Mark Tatum	11	Salman Azhar	17	Sandeep Langar	25
Salman Azhar	11	Khalid Siddiqi	16	Ben Farrow	24
Sanjeev Adhikari	11	Tulio Sulbaran	16	Masoud Gheisari	24
Scott Shuler	11	Mark Tatum	15	Salman Azhar	24
Amin Akhnoukh	10	Sanjeev Adhikari	15	Sanjeev Adhikari	22
Bruce Smith	9	Darren Olsen	14	Tulio Sulbaran	22
Darren Olsen	9	Joseph Burgett	14	Mark Shaurette	20
Joel Wao	9	Scott Kramer	14	Mark Tatum	19

Institutional productivity and collaboration

Institutional participation in ASC publications demonstrates both continuity and diversification over time. Figure 4 presents the inter-institutional collaboration network, where each node represents a university and each link denotes at least one co-authored paper between institutions. Node size corresponds to total publication output, and color indicates cluster membership based on collaboration frequency. The network reveals that several universities act as central hubs, including Auburn University, Colorado State University, Purdue University, Texas A&M University, and Arizona State University, which form dense linkages that connect many other programs.

Auburn University and Colorado State University stand out for their large node sizes and extensive cross-links, signifying both high productivity and sustained multi-institutional cooperation. Peripheral nodes such as East Carolina University, Virginia Tech, and the University of Oklahoma indicate steady engagement but more focused collaborative circles. Overall, the network suggests a mature and distributed structure in which a small number of anchor institutions foster cross-campus partnerships, reinforcing ASC's cooperative character.

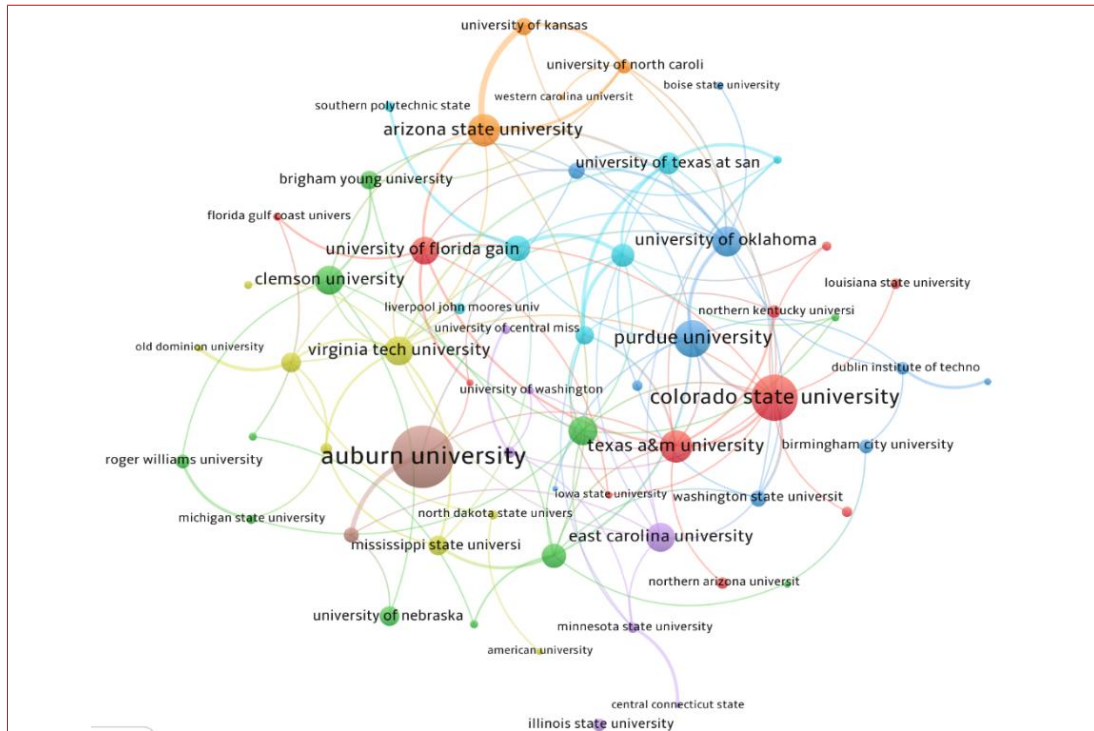


Figure 4. Inter-institutional collaboration network (node size = output; color = cluster)

Complementing this network view, Figure 5 tracks annual output for the top ten contributing universities between 2007 and 2025. Each cell shows the number of papers produced by a given institution in a specific year, with darker shading indicating higher publication counts. The longitudinal pattern reveals that Auburn University and Colorado State University have maintained consistently high productivity throughout the period. At the same time, institutions such as Texas A&M University and East Carolina University demonstrate significant growth in later years. Meanwhile, universities such as Arizona State and Virginia Tech exhibit cyclical participation. The heatmap illustrates how ASC participation has expanded over time, with new institutions joining in the 2010s and sustaining their contributions into the 2020s, demonstrating the conference’s growing academic reach.

AF / Year	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
Auburn University	9	11	9	12	6	19	9	13	7	4	9	8	7	6	10	7	6	12	9	173
Colorado State University	4	7	7	7	9	2	6	7	6	2	6	6	9	4	3	5	6	8	5	109
Purdue University	5	2	5	3	3	5	1	2	3	4	5	11	3	4	2	7	2	7	3	77
Arizona State University	4	4	1	2	2	1	3	2	10	6	7	1	5	0	2	4	0	5	4	63
Texas A&M University	4	7	8	0	1	1	0	1	3	3	5	5	6	2	4	1	5	3	4	63
University of Oklahoma	3	2	1	0	0	0	1	4	6	6	6	3	4	3	2	4	2	4	5	56
California State University	2	3	1	2	4	4	4	4	5	2	2	1	2	2	3	1	3	2	7	54
Clemson University	4	1	3	1	2	1	2	2	2	1	3	4	4	4	3	3	8	1	5	54
Virginia Tech University	2	1	2	10	2	2	3	4	1	1	1	0	2	1	8	3	5	5	0	53
East Carolina University	1	2	3	3	4	0	3	3	3	2	2	0	2	3	2	3	6	6	3	51

Figure 5. Annual institutional output for top ten universities, 2007–2025

To complement this, Figure 7 displays a heatmap showing annual frequency trends for the ten most prevalent keywords. The figure confirms that construction education dominates across all years, followed by BIM, construction safety, and sustainability. Notably, BIM and sustainability exhibit steady upward trajectories, while newer digital and human-centered terms emerge only in later years, signaling a broadening of thematic scope. Together, these analyses depict ASC's intellectual progression, from early emphasis on curriculum design and safety education to a contemporary focus on digitalization, immersive learning, and skill development, illustrating how construction education research has adapted to new tools, technologies, and pedagogical demands over nearly two decades.

Keyword / Year	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
Construction Education	10	10	14	14	10	7	9	10	6	5	8	11	16	11	18	15	10	20	23	227
BIM	3	4	6	12	7	4	5	12	8	4	13	7	7	2	5	1	7	8	4	119
Construction Management	1	3	5	6	5	1	3	3	7	5	4	8	8	2	6	8	3	6	4	88
Construction Safety	4	3	5	3	5	1	1	5	4	3	5	2	5	3	2	7	10	8	9	85
Sustainability	2	5	3	4	6	5	5	5	5	2	8	4	5	1	4	4	6	3	3	80
Curriculum	4	5	3	3	3	5	7	5	3	4	2	3	7	2	3	3	2	5	3	72
Construction Industry	2	2	3	5	5	1	1	0	3	2	3	3	1	0	3	6	2	1	2	45
Project Management	0	1	5	3	2	1	0	4	3	3	0	2	0	1	1	3	3	6	2	40
Accreditation	2	2	3	3	2	2	3	1	1	3	5	3	0	1	1	1	2	2	2	39
Soft Skills	2	2	2	0	1	1	1	2	2	2	1	1	1	2	2	2	0	2	5	31

Figure 7. Annual frequency of top ten author keywords, 2007–2025

Discussion of Findings

The findings collectively portray a research community that has grown not only in volume but also in maturity and coherence. The steady increase in annual publications confirms that ASC has become a principal venue for construction education research, while the post-pandemic recovery underscores its resilience and adaptability. Rather than signaling short-term fluctuations, these patterns suggest that construction education has achieved a stable scholarly base capable of sustaining long-term inquiry. These multi-hub networks promote mentoring, continuity, and co-learning, which are critical for innovation in applied fields such as construction education. Institutionally, the emergence of new, consistently active universities reflects a broadening of research capacity across the academic landscape. Earlier ASC participation was concentrated in a handful of established programs; the more recent inclusion of additional universities demonstrates that the field's research culture is diffusing outward, strengthening both curricular diversity and geographic representation.

The thematic evolution identified in the keyword analysis mirrors these social dynamics. ASC scholarship has transitioned from a focus on pedagogy and safety to a broader integration of digitalization, immersive learning, and sustainability, aligning educational research with technological shifts in the construction industry. This progression reflects not only changes in tools but also a redefinition of what constitutes 'competence' in construction education, moving from content mastery to experiential, technology-enabled learning. It also demonstrates that ASC continues to serve as a bridge between academia and industry, adapting to external innovations while maintaining its pedagogical core. Overall, the findings reveal a scholarly ecosystem characterized by growth, diversification, and adaptability. ASC's community has matured into an interconnected network that produces collaborative, practice-relevant research. The conference's evolution over nearly two decades illustrates how disciplinary cohesion and openness to technological change can coexist, maintaining educational values while embracing innovation.

Conclusion, Limitations, and Future Work

This descriptive bibliometric study consolidates 1,502 ASC Annual International Conference papers (2007–2025) to map how authorship networks, institutional participation, and thematic focus have evolved alongside pedagogical and technological change. The results show steady growth in annual output (with a clear post-pandemic rebound), broader institutional participation, and a multi-hub co-authorship structure. Keyword patterns retain an education-centered core while expanding toward digitalization, immersive learning, and data-driven practices. Together, these trends provide a replicable baseline that programs can use to benchmark productivity, identify collaborators, and align curricular innovation with emerging themes.

Several limitations qualify these findings. The dataset relies on proceedings metadata that vary in completeness, especially in early years, and our analyses are descriptive rather than citation-based measures of impact. Building on this baseline, future work should (i) incorporate citation, co-citation, or bibliographic coupling to trace influence and intellectual structure across ASC and related journals (e.g., *IJCER*, *JEE*); (ii) apply abstract/full-text topic modeling to deepen thematic resolution; and (iii) replicate the workflow periodically to track post-2025 trajectories and assess alignment with national accreditation and industry priorities.

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