Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/SA07.20260134
Published: August 4, 2026

Artificial Intelligence Integration in Architecture, Engineering, and Construction (AEC) Education: A Review

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Abstract

The Architecture, Engineering, and Construction (AEC) industry is undergoing a radical digital shift driven by Artificial Intelligence (AI) and automated data analytics. Despite this industrial shift, university-level curricula often continue to rely heavily on static spreadsheets and manual legacy methodologies. This paper presents an extensive methodological framework for integrating AI into construction and engineering education courses through an enhanced paradigm. To justify the proposed integration of pedagogy, a comprehensive bibliometric mapping analysis was conducted using the Web of Science (WoS) core collection database spanning the last decade. Using VOSviewer, a visual co-occurrence network of 67 peer-reviewed articles was developed, uncovering six distinct thematic intellectual clusters: (1) Intelligent Integration and Modular Construction Systems, (2) Digital Twin Architectures and Intelligent Field Management, (3) Advanced Deep Learning Methods and Immersive Visualization, (4) Core Framework and Pedagogy Methods in AEC, (5) Industrial Evolution and Emergent Technologies, and (6) Predictive Modeling for Sustainable Controls. Building on these trends, this paper proposes an instructional methodology where students move beyond conventional deterministic software toward stochastic, AI-driven applications. Leveraging generative AI for quantity takeoffs, neural networks for historical price prediction, and genetic algorithm-based engines for automated parametric scheduling optimization. The integration will enhance the dynamic Project-Based Learning (PBL) environment, where students interact with realistic, data-rich scenarios that mirror modern commercial settings. Ultimately, this comprehensive curricular evolution bridges the gap between academic theory and emergent industrial practices, fostering a workforce highly skilled in tech-driven project delivery and strategic data literacy.

Keywords

Artificial Intelligence, Curriculum Innovation, Deep Learning, Digital Twin Systems, Machine Learning, Project-Based Learning, Predictive Modeling

1. Introduction

The contemporary Architecture, Engineering, and Construction (AEC) industry faces unprecedented challenges, ranging from severe structural labor shortages and global supply chain volatility to tighter margin distributions and regulatory carbon constraints. Simultaneously, the construction industry is undergoing a profound digital

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transformation driven by artificial intelligence (AI), machine learning (ML), automation, and data-centric project delivery (Baduge et al. 2022, Pan and Zhang 2021a). To thrive in this complex operational environment, commercial construction firms are aggressively adopting digital workflows anchored in AI, deep neural network modeling, computer vision, and building information modeling (BIM) data cycle (Makabate et al. 2022). These advanced analytical frameworks allow firms to replace historical rule-of-thumb guesswork with probabilistic, high-fidelity data forecasting models (Ning et al. 2020, Pan and Zhang 2021b). Consequently, modern construction professionals are increasingly expected to perform beyond the role of administrative coordinators, serving as data-literate managers who can guide automated design engines, optimize algorithmic logistics, and evaluate machine-generated schedules. However, a critical institutional disconnect persists between these industry realities and university-level education paradigms. While AI adoption in construction and engineering operations, such as automated progress tracking, predictive safety analytics, and intelligent scheduling, has accelerated (Rabbi and Jeelani 2024), education has not kept pace. Within many higher education programs, foundational courses continue to be taught using static, deterministic frameworks. Students are frequently trained to perform manual and electronic 2D takeoffs, input linear quantities into disconnected software packages, and build critical path method (CPM) networks that assume static environmental parameters (Becerik-Gerber et al. 2012). While these traditional training models establish baseline mechanical understanding, they fail to develop the high-level cognitive competencies needed to manage multidimensional data models or to leverage predictive analytics amid real-world project uncertainties.

As construction and engineering projects become increasingly complex and data-rich, students must develop competencies in AI-enhanced decision-making, probabilistic forecasting, and automated project analysis. Integrating AI into AEC education curricula can strengthen project-based learning by enabling students to work with real datasets, simulate dynamic project conditions, and evaluate multiple cost-schedule scenarios (Abioye et al. 2021, Baduge et al. 2022). This shift aligns with industry expectations for graduates who can leverage digital tools to improve accuracy, efficiency, and strategic planning (Sacks et al. 2020).

1.1 Objectives

The primary objective of this study is to systematically analyze the global research landscape on artificial intelligence in construction education and the AEC industry through bibliometric and scientometric analyses to identify emerging themes, technological trends, and knowledge gaps that can inform the development of an AI-driven curriculum for construction estimating and project scheduling. To establish a rigorous scientific foundation for this curricular restructuring, the paper employs an extensive bibliometric analysis of data retrieved from the Web of Science (WoS) core collection and visually mapped in VOSviewer. This methodology enables the systematic identification of mature industrial technology applications and underserved educational pathways, ensuring that the proposed curriculum closely aligns with global technological research trajectories and industry readiness metrics.

2. Literature Review

The convergence of advanced computation and project management metrics has accelerated over the past decade, driven by the expanding availability of high-fidelity sensors, unified cloud-based BIM repositories, and affordable computing power (Baduge et al. 2022, Han and Golparvar-Fard 2015). Understanding how these technologies affect construction and engineering education requires examining both technological developments and the learning models used to teach them. Contemporary research identifies four interconnected thematic domains that characterize this transformation: the integration of BIM and AI, predictive project controls, automated field monitoring, and modern construction educational pedagogy.

Historically, Building Information Modeling served primarily as an object-oriented geometric database for spatial coordination and clash detection. However, recent scholarly literature indicates a major paradigm shift toward "Cognitive BIM," which embeds machine learning algorithms directly into the architectural model's data layer. Research demonstrates that when deep semantic learning models are applied to BIM files, the extraction of architectural parameters becomes fully automated, bypassing traditional manual workflows (Baduge et al. 2022, Makabate et al. 2022). This advancement allows multi-family residential structures or heavy civil highway designs to be parsed by computer vision algorithms that match geometric objects against localized historical master format databases, achieving near-instantaneous material takeoffs with lower error rates than human technicians (Abioye et al. 2021, Pour Rahimian et al. 2020). These advancements demonstrate AI's potential to enhance accuracy and reduce human error in project planning, while transforming the nature of estimating.

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Traditional estimating courses emphasize manual measurement, historical cost analysis, and spreadsheet modeling. However, AI-enabled tools can automate quantity takeoff, classify cost items, and generate probabilistic cost forecasts (Baduge et al. 2022, Hakami and Hassan 2019). Studies show that students who engage with AI-supported estimating tools develop stronger analytical skills and improved confidence in cost modeling (Rabbi et al. 2024). Machine learning models have been successfully deployed for cost prediction and risk assessment in professional practice (Abioye et al. 2021, Brilakis et al. 2010). Despite these documented benefits and industrial applications, few construction programs have formally integrated AI into estimating curricula, creating a significant disconnect between educational practice and industry expectations.

In addition to back-office analytics, AI has made significant inroads into physical site operations through autonomous computer vision and edge computing. Unmanned Aerial Vehicles (UAVs) and fixed 360-degree cameras capture daily site conditions, which are then processed by convolutional neural networks (CNNs) to monitor project progress and verify structural tolerances against the underlying BIM model (Han et al. 2015, Ning et al. 2020). Furthermore, these real-world data pipelines are actively coupled with automated safety compliance systems. AI models process real-time video streams to identify when personnel are missing mandatory personal protective equipment (PPE), detect hazardous scaffolding configurations, or flag close-proximity interactions between laborers and heavy earthmoving equipment. This automated site oversight creates dense, real-time data streams that can feed back into the project's estimating and scheduling models, closing the loop between planning theory and field realities.

Project-Based Learning (PBL) is widely recognized as an effective pedagogical approach in construction education (Ruiz Viruel et al. 2025, Sadikoglu and Demirkesen 2025). AI enhances PBL by enabling students to work with real-world datasets, simulate project conditions, and analyze complex interactions between cost, schedule, and resources (Rabbi et al. 2024, Sadikoglu et al. 2025). Studies show that AI-supported PBL improves critical thinking, problem-solving, and decision-making capabilities among construction management students.

Despite profound advancements in industrial technology, the academic literature regarding construction and engineering education reveals a clear systemic delay in adopting these tools. Scholars in engineering education note that while modern students excel at using basic digital tools, they frequently struggle with data literacy and algorithmic thinking. While PBL models have long been recognized as highly effective for construction management students because they simulate real-world team interactions and unstructured problem-solving, integrating AI applications directly into project-based learning models forces students to transition from low-level data-entry clerks to high-level systems analysts who can interpret, validate, and troubleshoot algorithmic recommendations.

3. Methods

To ground the curriculum design in objective empirical data, this research utilized a multi-stage bibliometric and text-mining workflow targeting peer-reviewed academic literature, selected because it is a generic process of domain analysis and visualization (Baduge et al. 2022, Makabate et al. 2022). The overarching objective was to map out the international research front at the intersection of artificial intelligence, project management controls, and construction education. This systematic approach ensures that the resulting educational modules focus on established, high-impact industrial technologies rather than short-lived software trends. The methodology consists of three distinct phases: data collection and index extraction, text-mining filtration, and VOSviewer bibliometric cluster mapping.

3.1 Research Design

This study uses a mixed-methods research design combining scientometric analysis with qualitative synthesis. The goal is to identify AI integration trends, gaps, and opportunities for construction estimating and scheduling education.

3.2 Data Collection

A structured search was conducted in Web of Science using keywords including Topic Search (TS) = (Artificial Intelligence) AND TS = (estimating) and TS = (construction education) AND TS = (Engineering technology). The scope was restricted to Document Type (DT) peer-reviewed journal articles and fully indexed conference proceedings in English Language (LA), published year (PY) between January 2000 and June 2026. The initial query returned a raw dataset of 101 peer-reviewed articles published between 2000 and 2026. After applying database filters to exclude out-of-scope subject categories, articles were screened for relevance to Engineering Civil OR Construction Building Technology OR Engineering Multidisciplinary OR Engineering Industrial. The refined analytical dataset contained 67 high-quality publications.

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3.3 VOSviewer Analysis

Next, the comprehensive bibliometric metadata file, containing titles, abstracts, authors, sources, author keywords, and other factors, was exported directly to VOSviewer (Version 1.6.20). A fractional counting approach was used to construct a co-occurrence network based on author keywords. To focus the visualization on the most meaningful concepts, the minimum keyword threshold was set to 2 occurrences, which reduced the total pool to 77 key terms. Spurious general terms such as "system," "crack detection," "worker," "classification," "critical review," and "damage detection" were removed using a customized thesaurus file, ensuring that the final map focused purely on actionable technical and pedagogical concepts.

VOSviewer applies a specialized unified mapping and clustering layout technique. The spatial distance between individual nodes indicates their relative strength of association; keywords that are frequently co-cited or appear together in the same abstracts are mapped closely together. The system determines clusters automatically by optimizing a modularity-based objective function, grouping strongly related nodes together under distinct color banners. This analysis revealed a highly interconnected network architecture comprising 51 nodes, 331 distinct relational links, and a total link strength of 428. The structural network visualization properties of the resulting network map are shown in Figure 1.

The bibliometric text-mining analysis generated in VOSviewer reveals a multi-layered, interconnected network of knowledge that maps the integration of AI within the AEC industry. The macroscale structural topology of the keyword co-occurrence network is shown in Figure 1, while subnetwork extraction will be illustrated in subsequent figures to highlight specific structural paths. Rather than displaying disconnected computational or pedagogical bubbles, the co-occurrence pathways map exactly how innovative applications are mapped into the construction and engineering education framework. As illustrated in Figure 1, the red cluster serves as a vital structural gateway that bridges back-end algorithms and physical field execution. The pattern demonstrates that the research front is heavily focused on the construction and engineering industries, moving beyond static project coordination to predictive and innovative field controls (Abioye et al. 2021).

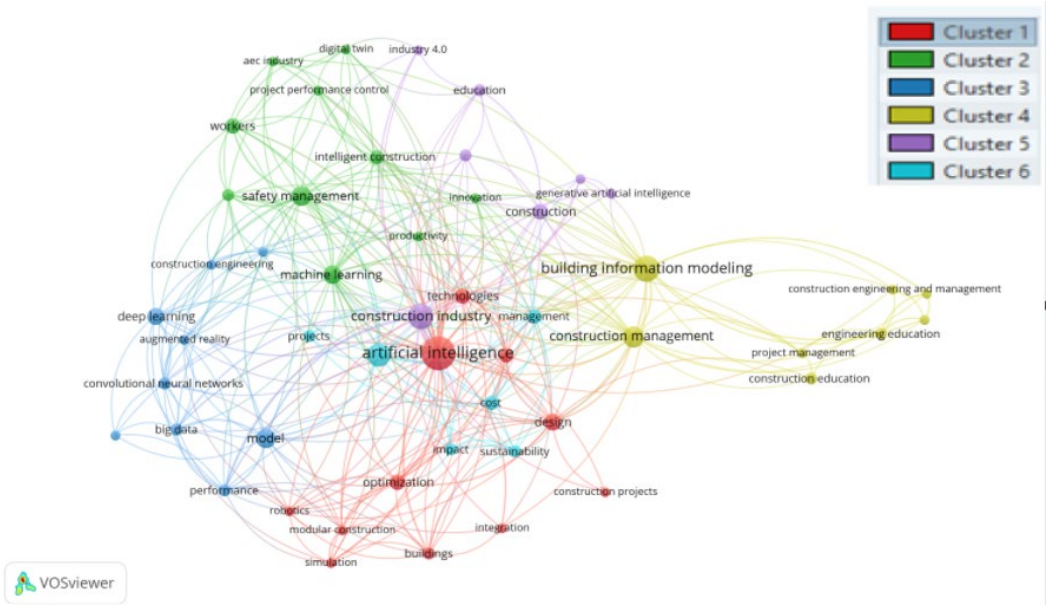


Figure 1. Main research interest cluster using the co-occurrence network of keywords

The resulting configuration generated by VOSviewer presents a clear layout of the current research landscape. The mathematical calculation of node density and network distance allows for the identification of each cluster. Below is a representation of the six core research clusters identified through this process, organized by structural properties, which yields the network maps summarized in Table 1.

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Table 1. Structural bibliometric network metrics per VOSviewer Cluster

Cluster ID	Thematic Core Label	Node Count	High-Frequency Keyword
Cluster 1	Intelligent Integration and Modular Construction Systems	11	Artificial Intelligence, Automation, Buildings, Construction Projects, Design, Integration, Modular Construction
Cluster 2	Digital Twin Architectures and Intelligent Field Management	10	AEC Industry, Automated Detection, Digital Twins, Innovation, Intelligent Construction, Machine Learning
Cluster 3	Advanced Deep Learning Methods and Immersive Visualization	9	Augmented Reality, Big Data, Construction Engineering, Convolutional Neural Networks, Deep Learning, Digital Transformation
Cluster 4	Core Framework and Pedagogy Methods in AEC	8	Building Information Modeling, Construction Education, Construction Engineering and Management, Construction Management, Engineering Education, Information Technologies
Cluster 5	Industrial Evolution and Emergent Technologies	7	Architecture, Construction, Construction Industry, Education, Generative Artificial Intelligence, Industry 4.0
Cluster 6	Predictive Modeling for Sustainable Controls	6	Artificial Neural Network, Cost, Impact, Management, Projects, Sustainability

4. Results and Discussion

4.1 Construction Education Keyword Cluster

The results of the keyword co-occurrence network for construction education (Figure 2) reveal a structural intellectual landscape centered on the integration of BIM and design as privileged tools in construction education. The node size indicates the frequency of occurrence in the analyzed literature, while proximity and link strength reflect conceptual relationships. The strong linkage with BIM shows that it remains the primary digital platform through which AI concepts can enter construction curricula. Connections to construction management and project management suggest that AI integration in this area could be framed around improving analytical, planning, and decision-support skills. The ties to engineering education and design highlight the interdisciplinary nature of AI adoption, bridging computational methods with constructability and coordination learning. Generally, this network demonstrates that construction education serves as the hub for digital transformation, guiding how emerging AI-driven tools reshape teaching, learning, and project-based skill development.

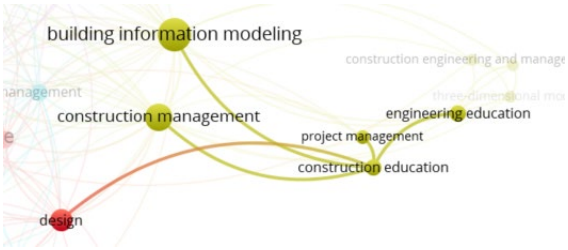


Figure 2. Construction education co-occurrence network of keywords

4.2 Engineering Education Keyword Cluster

The bibliometric network positions engineering education (see Figure 3) as the central integrative theme linking digital technologies, managerial practices, and modeling innovations across the AEC research landscape. Its strong

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connection to BIM suggests that BIM is the primary digital platform through which engineering students engage with emerging AI-enabled workflows. The close ties to construction management and project management show that engineering education increasingly incorporates managerial and analytical competencies supported by intelligent systems. Connections with information technologies and three-dimensional models highlight the growing emphasis on computational literacy, immersive visualization, and data-driven problem-solving within engineering curricula. The network demonstrates that engineering education serves as the hub through which digital transformation and AI integration diffuse across engineering disciplines, shaping how future professionals learn, collaborate, and innovate.

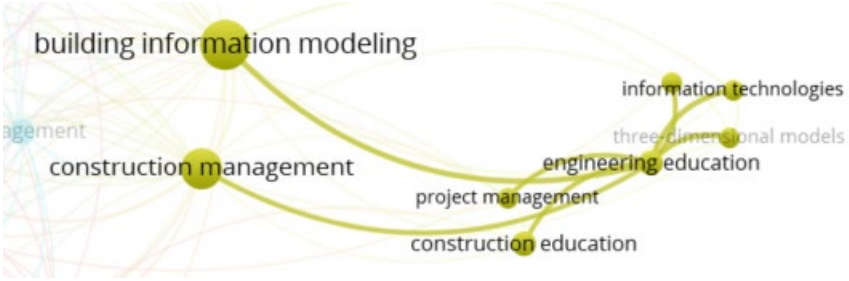


Figure 3. Engineering education co-occurrence network of keywords

4.3 Construction Engineering and Management Keyword Cluster

The network, as seen in Figure 4, positions construction engineering and management (CEM) as the central domain through which AI is reshaping educational and professional practices for the AEC sector. The strongest and earliest linkage is to artificial intelligence, indicating that AI serves as the foundational driver of innovation in CEM by enabling intelligent automation, predictive analytics, and data-centric decision-making. The network also shows a direct connection between CEM and information technologies, highlighting those advancements in digital infrastructure, computational tools, and data-processing systems form the technological backbone that supports AI integration in construction curricula. From this foundation, CEM extends outward to BIM, construction management, and project management, demonstrating how AI-enabled workflows enhance coordination, planning accuracy, and strategic project control. The map illustrates that CEM functions as the hub through which AI, information technologies, and digital modeling tools converge, shaping how future professionals are trained to manage complex, data-rich construction environments.

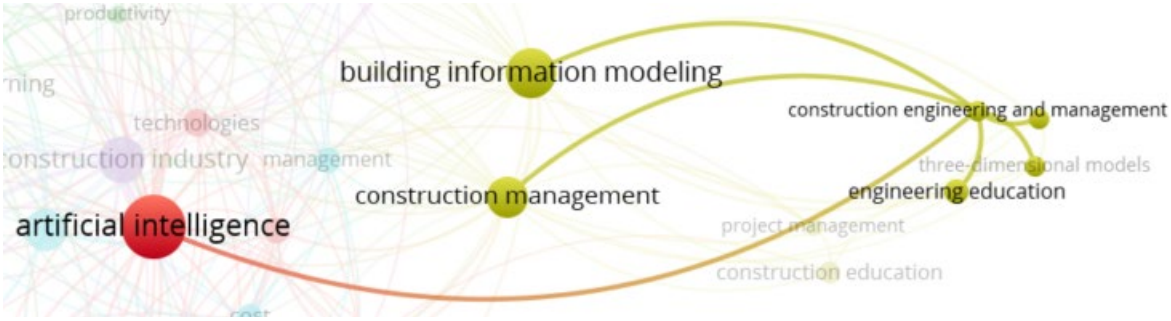


Figure 4. Construction engineering and management co-occurrence network of keywords

4.4 Architecture, Engineering, and Construction Industry Keyword Cluster

As depicted in Figure 5, the bibliometric network of the AEC industry shows that the strongest linkage is with artificial intelligence, indicating that AI is the primary driver of innovation across the AEC sector by enabling intelligent automation, predictive analytics, and data-driven decision-making. Closely connected is BIM, which serves as the dominant digital ecosystem in which AI applications such as automated clash detection, model-based quantity takeoff, and intelligent coordination are operationalized within industry workflows. Additional connections to machine learning, digital twin, and intelligent construction highlight the increasing reliance on computational methods, real-time sensing, and virtual-physical integration to enhance project performance control and safety management. At the smallest node level, themes such as workers, safety management, and project performance control demonstrate how AI-enabled tools ultimately influence human-centric outcomes, reinforcing the notion that the AEC industry is

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evolving toward a technologically augmented environment in which digital intelligence supports both operational efficiency and workforce well-being.

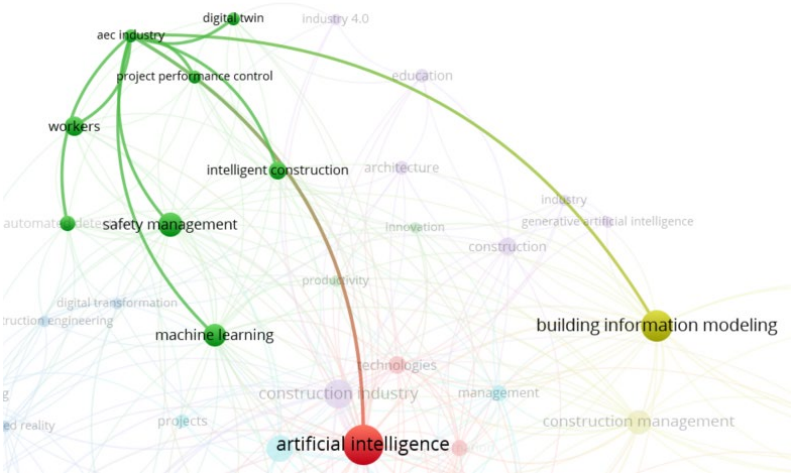


Figure 5. AEC industry co-occurrence network of keywords

4.5 Education Keyword Cluster

The education bibliometric network is increasingly shaped by emerging digital concepts such as digital twin and Industry 4.0, which appear as smaller nodes but signal early-stage adoption of advanced technologies in teaching and learning environments (see Figure 6). These smaller nodes demonstrate how educational frameworks are beginning to incorporate real-time simulation, cyber-physical systems, and intelligent automation as foundational components of modern instruction. As the network expands, education connects to mid-sized nodes such as construction and architecture, suggesting that pedagogical innovation could be driven by broader trends in industrial digitalization and the need to prepare students for technologically complex workplaces. The linkage to technologies highlights the growing emphasis on computational literacy, data analytics, and proficiency with digital tools as essential learning outcomes for future AEC professionals. Moving toward larger nodes, education is strongly connected to BIM, which serves as a dominant instructional ecosystem where students learn model-based coordination, visualization, and integrated project delivery. At the highest level, education is directly linked to AI, the largest and most influential node, showing that AI is becoming the primary catalyst for curricular transformation through intelligent automation, predictive modeling, and advanced decision-support systems. The network illustrates that education functions as the foundational hub through which emerging technologies, from small conceptual innovations to major digital ecosystems, are integrated, shaping how future AEC professionals learn, adapt, and innovate in an increasingly data-driven industry.

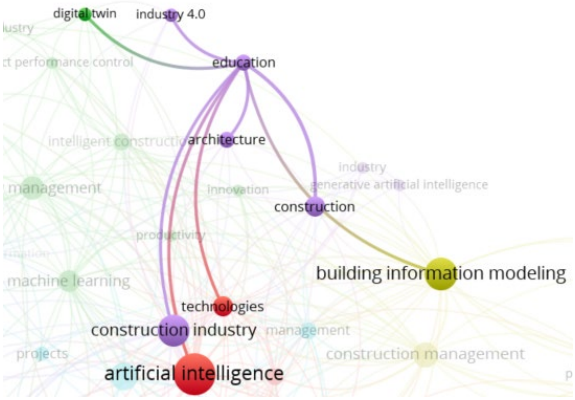


Figure 6. Education co-occurrence network of keywords

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4.6 Discussion

Across all five VOSviewer visualizations, a clear thematic progression emerges showing how AI, digital technologies, and educational frameworks intersect within the Architecture, Engineering, and Construction (AEC) knowledge domain. Construction education positions BIM as the dominant node linking construction management, project management, engineering education, and construction education. This reflects long-standing findings that BIM serves as the foundational digital ecosystem through which students first encounter model-based coordination and data-driven decision-making (Regona et al. 2022, Sacks et al. 2020). The strong ties between BIM and educational nodes indicate that construction and engineering programs continue to rely on BIM as the primary gateway for introducing digital literacy, even before more advanced AI concepts are integrated. The focus on engineering education shows how it connects outward to BIM, construction management, project management, and information technologies. This configuration suggests that engineering education is increasingly functioning as an interdisciplinary bridge, preparing students to navigate computational tools, digital modeling, and managerial workflows simultaneously. Studies have shown that engineering curricula are evolving to incorporate machine learning, optimization, and simulation-based methods, which naturally complement BIM-centric instruction (Boje et al. 2020, Pour Rahimian et al. 2020). The network reinforces that engineering education is not isolated but embedded within a broader digital transformation of AEC learning environments.

CEM at the center has strong ties to artificial intelligence, information technology, BIM, and construction management. This reflects a growing trend in the literature, in which CEM is becoming the primary domain through which AI-enabled tools such as predictive analytics, automated scheduling, and intelligent risk modeling are introduced (Razi et al. 2026). The presence of information technologies as a major connecting node underscores that CEM education increasingly requires computational proficiency, data-processing skills, and familiarity with digital infrastructures that support AI adoption. The AEC industry keyword co-occurrence expands the network further by showing AI as the largest node connected to machine learning, digital twin, intelligent construction, project performance control, and safety management. This visualization reflects the rapid growth of AI-driven research in construction, particularly in areas such as automated progress monitoring (Baduge et al. 2022, Han et al. 2015), predictive safety analytics (Poh et al. 2018), and digital-twin-based project control (Pan et al. 2021a). The inclusion of “workers” and “safety management” as smaller nodes indicates that AI’s influence extends beyond technical modeling into human-centric outcomes, reinforcing the need for educational programs to prepare students for ethical, safe, and socially responsible AI deployment. It further introduces a broader industrial perspective, showing how AI connects to BIM, the construction industry, architecture, digital twin, Industry 4.0, and technologies. This network demonstrates that AI is not just another tool but a structural driver of Industry 4.0 transformation across the AEC sector (Baduge et al. 2022, Regona et al. 2022).

5. Conclusion

The rapid advancement of artificial intelligence (AI) is transforming the Architecture, Engineering, and Construction (AEC) industry, creating an urgent need to modernize construction education to prepare graduates with the digital competencies required by the industry. This study employed a scientometric and bibliometric approach to systematically map the global research landscape on AI integration in construction education, construction engineering and management, and the broader AEC industry. By analyzing 67 high-quality publications from the Web of Science database using VOSviewer, the study identified six major research clusters representing the dominant themes driving AI adoption, including intelligent construction systems, digital twins, deep learning, Building Information Modeling (BIM), Industry 4.0 technologies, and predictive modeling for sustainable project controls. The findings demonstrate that BIM remains the principal digital platform through which AI concepts are introduced into construction education, while emerging technologies such as digital twins, machine learning, generative AI, immersive visualization, and predictive analytics are increasingly shaping both educational practice and industry operations. The bibliometric networks further reveal that construction education, engineering education, and construction engineering and management function as interconnected domains through which AI-enabled decision-making, intelligent automation, and data-driven project controls are disseminated across the AEC sector.

While this study provides valuable insights into the evolving AI research landscape, it is limited to publications indexed in the Web of Science database and English-language literature. Future research should expand the analysis to additional bibliographic databases, examine curriculum implementation through case studies and industry partnerships, and evaluate the effectiveness of AI-integrated educational modules on student learning outcomes and workforce readiness. Such efforts will further strengthen the integration of AI into construction education and support

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the development of a digitally competent construction workforce capable of leading the next generation of intelligent project delivery.

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Biographies

Olugbenro Ogunrinde is an Assistant Professor of Construction Science and Management in the Department of Engineering Technology. He holds a Ph.D. in Civil Engineering (Construction Engineering and Management concentration) from The University of Alabama, alongside an M.Sc. in Construction Management, a B.Sc. in Quantity Surveying, and an Executive Master's in Project Management. With over a decade of academic and industry experience, Dr. Ogunrinde specializes in integrating automation, Building Information Modeling (BIM), Digital Twins, and emerging technologies into the built environment to enhance quality management and infrastructure resilience. He has secured over $54,000 in grant funding and authored more than 20 peer-reviewed publications in prestigious venues, including the *Journal of Construction Engineering and Management* and *Journal of Infrastructure Systems*. His scholarship is backed by robust field experience as a Project Lead Quantity Surveyor and Planner on multi-million-dollar projects valued up to $123 million. Dr. Ogunrinde leverages this expertise in his teaching philosophy, employing project-based learning to prepare the future workforce. He is an active member of ASCE and the Golden Key International Honor Society, serves as an ASCE journal reviewer, and supports ACCE and ABET accreditation initiatives.

Dr. Adedeji Afolabi is an assistant professor in the construction science and management program in the Department of Engineering Technology. Dr. Afolabi has over 100 research articles focused on workforce sustainability (current and future workforce) using data analytics, exoskeletons, robotics, and reality and sensing technologies. He also has expertise in using physiological sensing technologies to monitor workers' health and safety and in developing frameworks for AI-driven automated systems.

Dr. Billy Gray is a tenured associate professor in Engineering Technology at Tarleton State University. Dr. Gray holds a Ph.D. in Industrial Engineering and has extensive experience in systems engineering, manufacturing systems, cost analysis, and lifecycle evaluation, including research on sensor integration, RFID technologies, and operational performance metrics. In his industry roles, he led engineering and operations teams responsible for product design, manufacturing, process improvement initiatives, quality management systems, and cost control. He also holds professional certifications in Lean Six Sigma and RFID technologies.

Dr. Tulio Sulbaran is a tenured professor in the School of Civil and Environmental Engineering and Construction Management at The University of Texas at San Antonio (UTSA). With over 23 years of experience, he was also the founder and director of the Center for Logistics, Trade, and Transportation (CLTT) at the University of Southern Mississippi. An accomplished researcher, Dr. Sulbaran has submitted over 170 proposals and secured more than 70 externally funded projects totaling millions of dollars as PI/Co-PI. His research primarily focuses on transportation innovation assessment, decision support, multimodal freight networks, and workforce development. He has received extensive funding from prominent organizations, including the National Science Foundation (NSF), the U.S. Department of Transportation (DOT), the U.S. Department of Defense (DoD), the U.S. Department of Homeland Security (DHS), various state DOTs, the Transportation Research Board (TRB), and Northrop Grumman. A widely published academic, Dr. Sulbaran has authored over 130 peer-reviewed publications, written several books, and delivered more than 280 professional presentations. His work appears in top-tier journals such as the International Journal of Virtual Reality, IEEE, and American Society of Engineering Education Proceedings.

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