Gaps and Their Implications for Future Curriculum Reform in Food Science, Technology, and Engineering (FST&E)

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An AI-assisted comparative analysis of 3-recent publications demonstrates strong thematic convergence around curriculum modernization, project-based learning, interdisciplinarity, sustainability, and regional contextualization in FST&E education. These priorities align with contemporary models of future-ready professional development. However, systematic analysis of the literature reveals several critical gaps. Notably, the integration of regulatory science, food law, and policy engineering is limited, despite their central role in system design, compliance, innovation deployment, and risk-based decision making in highly regulated food systems. While experiential and project-based learning are emphasized, structured training in entrepreneurship, technology translation, intellectual property management, and process commercialization is underrepresented, constraining research-to-market and SME-driven innovation pathways. Digitalization and AI-enabled approaches are largely framed from a tools-centric perspective, with inadequate attention to physical process understanding, first-principles modeling, data quality and governance, cyber-physical systems, responsible AI implementation and ethics. Also, curriculum reform is primarily discussed in terms of content coverage, with limited adoption of competency-based assessment frameworks capable of validating transferable, interdisciplinary, and professional engineering competencies. Experiential learning remains predominantly anchored in conventional laboratory and internship models, overlooking emerging paradigms (e.g., digital twins, remote experimentation, virtual simulation environments). The prevailing focus on degree-centric education neglects the engineering imperative for lifelong learning, modular upskilling, and micro-credentialing in response to innovation, regulatory, and societal changes. Collectively, findings indicate that current FST&E curriculum reform remains incomplete and would benefit from a systems-oriented engineering education paradigm integrating regulatory competence, ethical digitalization, innovation engineering, robust competency validation, hybrid laboratory skills, enhanced health and nutrition advocacy, and lifelong learning pathways.

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