

Bridging Academia and Industry in Asia's Booming Bioindustry: Scalable Innovations from Hong Kong's Flipped Learning and Mini-Hackathon Model

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Research Overview

This study evaluates an industry-integrated active learning model in the undergraduate course “Introduction to Bioindustries” at HKUST. Guest lectures, flipped preparation with current bioindustry case studies, and mini-hackathons enhanced engagement, skill confidence, and industry alignment, offering a scalable approach for Asia's expanding biotech sector to address workforce gaps and co-create knowledge.

Purpose of Study

Undergraduate bioindustry education often encounters an academia-industry divide: curricula emphasize foundational science while roles in drug development, regulation, medical technologies, and biomanufacturing require practical skills and sector awareness. This gap is acute in fast-growing Asian biotech regions, where expansion (Asia-Pacific CAGR ~14–18%) outpaces talent readiness.

This study addresses the gap via innovative pedagogy in HKUST’s “Introduction to Bioindustries.” It uses industry-informed active learning—guest lectures, flipped case-study preparation, and mini-hackathons—to boost engagement, critical thinking on real issues, and collaborative competencies for bioindustry careers.

Objectives include: • Strengthening analysis of complex topics. • Building communication and teamwork skills. • Creating low-resource tools (e.g., case frameworks, hackathon protocols) for adaptation elsewhere.

This work highlights the model's low-infrastructure requirements—relying primarily on university learning management systems (e.g., Canvas) and free collaboration platforms (e.g., Google Docs and Microsoft Teams), curated open-access materials, and existing faculty expertise without needing specialized facilities or high budgets. This design enables easy adaptation across diverse contexts worldwide, where bioeconomy growth varies in infrastructure availability. By aligning with Kolb’s experiential learning cycle and differentiating from traditional hackathons (e.g., no external sponsorship such as cash prizes, venue, or hardware from companies; guest

speakers are volunteer practitioners providing talks and feedback), the model promotes transferability, allowing educators in different places to customize it for local bioindustry challenges like commercialization strategies or ecosystem development.

This work aligns with global experiential education trends and the conference theme, showing how Hong Kong's local innovation can bridge institutional and sectoral boundaries, promote cross-border knowledge co-creation, and support equitable education in markets with similar alignment needs.

Research Methods

A convergent parallel mixed-methods design was utilized to evaluate the active learning model comprehensively. The study took place during the Fall 2025 semester with 64 enrolled undergraduate students from life sciences and related disciplines.

Quantitative data were gathered through pre- and post-course surveys employing 5-point Likert scales (Strongly Disagree to Strongly Agree) to track shifts in confidence domains (career navigation, presenting ideas, teamwork and collaboration with diverse views), perceived content relevance, engagement, and preference for active over traditional learning formats. Surveys were voluntary and anonymous; matched pre/post responses were obtained from 44 students (69% of enrollment), with 51 total post-survey submissions (80% response rate). Analysis focused on descriptive statistics, particularly percentages of Agree/Strongly Agree responses, with straightforward pre-post comparisons.

Qualitative components comprised open-ended survey questions (e.g., career interests, most valuable course elements, suggested improvements) and semi-structured focus groups (two groups, 20–30 minutes each, 4–6 participants per group). Probing questions targeted experiences with flipped preparation, hackathon dynamics, and workload perceptions. Qualitative data were analyzed thematically.

Key elements of the course included: • Flipped preparation using provided case studies and overviews of current bioindustry trends. • 9 guest lectures delivered by industry practitioners. • Phased weekly group tasks involving discussion and synthesis. • A team-based mini-hackathon focused on addressing authentic bioindustry challenges, incorporating peer feedback.

All activities adhered to institutional ethical standards, including informed consent and full anonymization of data. Combining survey numbers with students' open comments and focus group insights strengthened the reliability and richness of the findings.

Results and Discussion

Preliminary findings from the post-survey (n=51) showed robust support for the course design: over 92% of respondents rated the covered topics as comprehensive and relevant to contemporary bioindustry trends. Matched pre/post data (n=44) revealed clear improvements in confidence (Agree/Strongly Agree responses): career navigation rose from 55% to 75% (a 20 percentage point increase), presenting ideas from 57% to 82% (25 points), and teamwork/collaboration from 77% to 82% (5 points). These gains indicate the model's capacity to build practical, career-oriented competencies.

Qualitative insights further supported these outcomes. Students frequently highlighted inspiration from guest lectures and the mini-hackathon for clarifying diverse career pathways, with strong interest in pharmaceutical and drug discovery areas (~50% of career-related mentions), medical affairs, and regulatory functions. Group brainstorming, peer feedback during the hackathon, and exposure to practitioner perspectives were commonly cited as key enhancers of sector understanding and communication skills, e.g. pharmaceutical industry versus medical devices industry.

Post-course feedback suggested adding flexibility in weekly tasks (e.g., optional components) to reduce repetition or intensity. The phased, low-burden design mitigated these perceptions, sustaining strong outcomes and student satisfaction. Though limited to one cohort with moderate responses and self-reports, the model shows strong scalability with minimal infrastructure (digital tools, curated materials) across global contexts. This low-infrastructure approach—avoiding high-cost elements like external sponsorships and emphasizing reusable resources—facilitates adaptation in varied settings, from urban hubs like Hong Kong to emerging markets around the world, fostering inclusive bioeducation and addressing worldwide workforce gaps.

This exemplifies the conference theme: bridging cultures, co-creating knowledge, and advancing inclusive education to prepare graduates for global bioindustry challenges.

Keywords

Bioindustry education, flipped learning, mini-hackathons, academia-industry collaboration, experiential learning