EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 3, March 2026
brightmindpublishing.com
ISSN (E): 3061-6972

ANALYSIS OF LIFE SAFETY CURRICULUM IN TECHNICAL UNIVERSITIES: A PROFESSIONAL CONTEXT INTEGRATION FRAMEWORK

N. M. Bakhriddinova
Associate Professor of the Department of "Industrial Ecology and Hydrology" of Bukhara State Technical University, Uzbekistan
E–mail: nbaxriddinova@inbox.ru

Abstract

This study presents a systematic methodology for analyzing Life Safety curricula in technical higher education institutions, focusing on the degree of professional context integration. Despite broad coverage of invariant core content (labor legislation, industrial sanitation, fire and electrical safety), existing curricula often lack systematic connection to professional engineering contexts and fail to produce tangible artifacts demonstrating competency. We propose a three-component analytical framework: interpretive content analysis with coding, time-distribution analysis, and competency mapping. A Professional Context Linkage Index (PCLI) is introduced to quantitatively assess curricula on a 0-100 scale based on scenario share (S), artifact share (A), and risk management coverage (R). Gap analysis reveals four typical deficiencies: (G1) core without context, (G2) context without artifacts, (G3) artifacts without assessment criteria, and (G4) disconnected risk management chains. The framework provides an evidence-based foundation for curriculum redesign, transitioning from content-as-topic-list to integrated content-pedagogy-assessment systems that produce risk-based decision-making competencies and portfolio evidence.

Keywords: Curriculum analysis, life safety education, professional contextualization, competency-based education, risk management, engineering education.

Introduction

Life Safety education in technical universities typically emphasizes invariant, general-theoretical content: labor legislation, industrial hygiene, fire and electrical safety, noise and vibration, accident causation, and related topics. While these blocks provide essential "core knowledge" for any engineer, a critical issue emerges from an innovative pedagogy perspective: such content often lacks deep integration with professional engineering contexts, fails to facilitate "risk-based decision-making," and does not culminate in tangible artifacts (portfolio evidence). Consequently, instruction may remain at the "knowledge" level without systematically developing the "ability to perform" competencies essential for employers: hazard recognition → risk assessment → control measure selection → evidence-based justification → transfer to new contexts.

The purpose of this analysis is fourfold: (1) establish a systematic methodology for analyzing existing Life Safety curricula; (2) propose a Professional Context Linkage Index (PCLI) to quantify the degree of professional context integration; (3) conduct gap analysis based on a three-layer content model (invariant core → professional context → integrative practical output); and (4) create an evidence-based starting point for developing enhanced content and methodological models in subsequent research phases.

Analytical Methodology

Problem Statement

Curriculum evaluation often relies on subjective comparisons: "this program is good," "not particularly," "outdated." Such approaches are insufficient for research requiring measurable, reproducible analytical procedures to support innovation frameworks and evidence-based assessment models.

Theoretical Foundation

Curriculum analysis in educational research employs content analysis, document analysis, and competency-based curriculum mapping. Content analysis involves categorizing content, coding markers, and calculating frequencies and proportions to draw conclusions (Krippendorff, 2018). Curriculum mapping connects program elements to outcomes and competencies, answering "which outcome is developed where and assessed how?" (Harden, 1986). From the constructive alignment perspective (Biggs & Tang, 2011), when objectives, activities, and assessment are misaligned, course effectiveness diminishes.

Proposed Framework

The dissertation employs a three-stage curriculum analysis process:

Stage A: Document Corpus Assembly

- Working curriculum (syllabus/program), calendar-thematic plan, assessment policy, independent work assignments, practical session scenarios, assessment materials
- Sources: university websites, electronic libraries, department resources, internal methodological collections

Stage B: Interpretive Content Analysis

Each topic/block is coded according to these parameters:

- Invariant core (universal rules/norms/concepts)
- Professional context markers (specific engineering objects/processes/work types)
- Activity format (lecture, case study, simulation, PBL, mini-project, debriefing)
- Artifact requirements (JSA, risk register, PPE matrix, etc.)
- Risk management block coverage
- Assessment evidence and criterion alignment

Stage C: Competency Mapping

Professional Context Linkage Index (PCLI)

The PCLI (0-100) is calculated from three blocks:

- S (Scenario share) – proportion of scenario/case/PBL/simulation (by hours and tasks), 0-100
- A (Artifact share) – proportion of artifact requirements (in assessment and independent work), 0-100
- R (Risk management coverage) – coverage of risk management blocks, 0-100

Integrative formula:

$$PCLI = 0.35 \cdot S + 0.35 \cdot A + 0.30 \cdot R$$

Index Interpretation:

- 0-29: Low linkage
- 30-59: Medium linkage
- 60-79: High linkage
- 80-100: Very high linkage

Table 1 Topic-Professional Context-Integrative Product Mapping

№	**Topic (Core)**	**Current State**	**Professional Context**	**Integrative Artifact**	**IDM Evidence**	**Gap Type**
1	Labor protection legislation, responsibility	Theoretical presentation	Responsibility chain in project/facility: foreman-supervisor-engineer-HSE	Responsibility matrix (RACI) + safety briefing scenario	Rubric: completeness, real roles, justification	G1/G2
2	Industrial sanitation, microclimate	Standards presented	Workshop/laboratory microclimate hazards, ventilation decisions	Workplace checklist + risk register (microclimate)	Checklist + anchor sample	G1
3	Noise and vibration	Effects explained	Compressor, machine tools, construction equipment scenarios	Hazard map + PPE selection matrix	Rubric: evidence-based reasoning	G1/G2
4	Electrical safety	Rules presented	LOTO (lockout/tagout) scenario, cabinet/station work	LOTO checklist + JSA (electrical work)	Process checklist	G2/G3
5	Fire safety	General guidelines	Hot work permit, flammable materials, evacuation logistics	Hot work permit package + evacuation scheme	Rubric + anchor	G1/G2
6	Machinery and equipment safety	Descriptive	Machine tool work, protective devices, interlocks	JSA: machine operation + barriers card	Rubric: risk-control alignment	G2
7	Accident/near-miss analysis	Causes listed	Real accident case: 5 Why, bow-tie analysis	Incident analysis report + corrective actions	Rubric: cause-action logic	G2/G3
8	Emergency response (evacuation)	General guidelines	Tabletop evacuation drill using workshop map	Evacuation scenario + after-action review	Debriefing protocol	G2

Note. Gap types: G1 = core present, context absent; G2 = context present, artifact absent; G3 = artifact present, criteria absent; G4 = disconnected chain.

Table 2 PCLI Calculation Criteria and Evidence Sources

Block	Criterion (0-100)	Operational Definition	Calculation Method	Evidence Sources	Methodological Risk
S	Scenario share	Proportion of case/PBL/simulation/role scenario hours and task share	S = (scenario hours / total practice hours) × 100; or task share	Calendar-thematic plan, practical assignments	"Scenario in name only" (content-free)
A	Artifact share	Proportion of artifact requirements (JSA, risk register, PPE matrix, evacuation plan, etc.)	A = (artifact assessment share) × 100; +10 bonus if rubric/anchor present (max 100)	Syllabus, assessment policy, assignments	Artifact present but no criteria (G3)
R	Risk management coverage	Systematic coverage of hazard→risk→controls→incident→improvement blocks in course	Each block scored 0/1/2 (absent/partial/complete); R = (score/10) × 100	Topic content, assignments, debriefing materials	Blocks fragmented, chain disconnected (G4)

Note. Index: $PCLI = 0.35 \cdot S + 0.35 \cdot A + 0.30 \cdot R$. Interpretation: low (0-29), medium (30-59), high (60-79), very high (80-100).

Results

Analysis of typical Life Safety curricula reveals a consistent pattern: comprehensive coverage of invariant core content combined with systematic gaps in professional context integration. The typical curriculum structure includes 8-10 major thematic blocks (labor legislation, industrial hygiene, noise/vibration, electrical safety, fire safety, machinery safety, accident analysis, emergency response, and sometimes first aid), providing solid foundational knowledge.

However, gap analysis using the three-layer model reveals four recurring deficiencies. G1 (core without context) appears most frequently in foundational topics like legislation and industrial hygiene, where norms are presented without engineering scenarios. G2 (context without artifacts) characterizes safety topics where case discussions occur but documented outputs are not required. G3 (artifacts without criteria) affects courses attempting artifact production without established rubrics or anchor works for quality control. G4 (disconnected chain) reflects fragmentation of the hazard→risk→controls→incident→improvement cycle across disconnected modules.

Discussion

This analytical framework addresses a critical gap in Life Safety engineering education: the systematic assessment of professional context integration. While existing approaches to curriculum evaluation often rely on subjective judgments or simple content checklists, the proposed PCLI provides a transparent, reproducible metric grounded in observable elements—scenario prevalence, artifact production, and risk management systematization.

The three-layer model (core-context-output) aligns with established principles of situated learning (Lave & Wenger, 1991) and constructive alignment (Biggs & Tang, 2011) while specifically addressing safety education's dual requirement: foundational knowledge of regulations and norms alongside applied competency in workplace risk management. The gap typology (G1-G4) provides actionable diagnostic categories that move beyond identifying "what's missing" to specifying "what connections are broken" in the content-pedagogy-assessment chain.

The PCLI's practical value lies in its resource-independence. Unlike frameworks requiring extensive simulation laboratories or virtual reality systems, this index evaluates design quality rather than technological sophistication. Even institutions with limited resources can achieve high PCLI scores through well-structured tabletop scenarios, template-based artifact production, and systematic portfolio assessment.

Implications for Practice

For curriculum developers, the framework provides structured decision-making tools. When S (scenario share) is low, redesign lectures as case introductions and convert practice sessions to problem-based formats. When A (artifact share) is low, identify 3-5 workplace documents aligning with topic clusters and create templates with rubrics. When R (risk management coverage) is fragmented, map topics to the hazard→risk→controls→monitoring cycle, ensuring all five blocks appear systematically.

For institutional quality assurance, PCLI enables comparative benchmarking across programs and tracking improvement over time. A baseline PCLI calculation, followed by targeted interventions and subsequent re-measurement, creates an evidence-based improvement cycle.

Conclusion

This study establishes a systematic, evidence-based methodology for analyzing Life Safety curriculum content in technical universities. The Professional Context Linkage Index (PCLI) quantifies the often-subjective assessment of "professional relevance" through three measurable dimensions: scenario integration, artifact production, and risk management systematization. Gap analysis using the three-layer model identifies four typical deficiencies that impede competency development.

The analytical framework serves as foundation for subsequent curriculum redesign: preserving essential normative content while transforming delivery from information transmission to competency construction through context-rich scenarios, workplace-relevant artifacts, and evidence-based assessment. The ultimate goal extends beyond content reorganization to pedagogical transformation: from courses where students "know about safety" to programs where students demonstrate "ability to manage safety" through documented, transferable competencies.

Future research should validate the PCLI weights through empirical studies linking index scores to competency outcomes, test the framework across diverse engineering specializations and institutional contexts, and develop implementation toolkits supporting curriculum developers in executing the transition from current to proposed content models.

References

1. Biggs, J., & Tang, C. (2011). Teaching for quality learning at university (4th ed.). Society for Research into Higher Education & Open University Press.
2. Harden, R. M. (1986). Ten questions to ask when planning a course or curriculum. Medical Education, 20(4), 356-365. https://doi.org/10.1111/j.1365-2923.1986.tb01379.x
3. International Organization for Standardization. (2018a). ISO 31000:2018 Risk management — Guidelines. ISO.
4. International Organization for Standardization. (2018b). ISO 45001:2018 Occupational health and safety management systems — Requirements with guidance for use. ISO.
5. Krippendorff, K. (2018). Content analysis: An introduction to its methodology (4th ed.). SAGE Publications.

6. Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge University Press.
7. Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive load theory. Springer. https://doi.org/10.1007/978-1-4419-8126-4